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Keynote Address

INNOVATIVE COMMUNITY-BASED COMPUTING FOR ENTREPRENEURSHIP

Ahmad Zaki Abu Bakar

INNOVATIVE COMMUNITY-BASED COMPUTING FOR ENTREPRENEURSHIP

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ABSTRACT. There are many reasons why people all over the world venture out to become entrepreneurs each year but many failed. One of the main reasons for failure is due to uninformed and lack of advice decisions and actions made by the inexperienced entrepreneurs. To support their inexperience, education, decision support systems and a virtual intelligence network could be established but these strategies have limitations. This paper discusses the possibility of using community-based computing to support entrepreneurship and how entrepreneurs could benefit from the collaboration.

Keywords: virtual intelligence, community informatics, entrepreneurship

INTRODUCTION

There are many reasons why people around the world want to become an entrepreneur. It could be for financial reasons stemming from a necessity or an opportunity that spur them to create wealth that will be impossible to amass if they are working for somebody and earning a meager salary. It could be for career independence because they hate their boss and do not want their principles and life style to be dictated by someone else or the organization rules and regulations. It could be due to job scarcity or career satisfaction. It could also be for the challenge or the inspiration by the success of many other entrepreneurs.

Whatever the reasons, many hopefuls venture into business every year. According to the Global Entrepreneurship Monitor 2010 report (Kelly et al, 2011), 110 million people between the ages of 18–64 years old are actively engaged in starting a business while another 140 million are running new businesses they started less than 3 ½ years earlier. However, becoming an entrepreneur does not mean the need to own a business. *Entrepreneur* is an old French word meaning "one who undertakes an endeavor". Entrepreneurship is thus the act of being an entrepreneur. So who ever takes initiatives to create changes and innovation that causes a positive impact on an industry can be called an entrepreneur. This concept is actually used in the computer industry. In 1982, on the occasion of its thirtieth anniversary, the IEEE Computer Society established the Computer Entrepreneur Award to recognize and honor individuals whose entrepreneurial leadership is responsible for the growth of some segment of the computer industry. However, an entrepreneur is more precisely defined as an innovator and risk taker who strives to create products that will profitably satisfy the needs and wants of a particular segment of a market.

The computer or Information Communication Technology (ICT) sector certainly has many entrepreneurs. The Global Entrepreneurship Monitor states, "most policymakers and academics agree that entrepreneurship is critical to the development and well being of society. Entrepreneurs create jobs. They drive and shape innovation, speeding up structural changes in

the economy. By introducing new competition, they contribute indirectly to productivity. Entrepreneurship is thus a catalyst for economic growth and national competitiveness" (Kelly et al, 2011).

For such an important contributor to economy then the tools for entrepreneurship is expected to be well established. Unfortunately this is not the case and every year many entrepreneurs fail before being able to achieve their goals especially in the early formative years. Poor decisions making is one of the highest reasons of failure. The impact that each decision an entrepreneur makes may have on the ultimate survival of the business and how easily a new business can fail (Kampschroeder et al 2008). The issue at hand is how entrepreneurial decisions making be improved?

IMPROVING ENTREPRENEURIAL DECISION MAKING

If you are an entrepreneur just starting to venture out then you will find yourself swarmed by many hard and pressing issues requiring quick and right decisions. The issues could relate to financial, procurement, human resource, technology, production, marketing, revenue generation and one million other things that you have no prior knowledge or experience to rely on. If you have been working in an organization before then these decisions were made collectively by the Decision Making Unit or by the higher authorities. Even if you used to be part of the decision making process it was a collective decision. Now, your decision to have freedom as an entrepreneur also means taking sole responsibility for your business decisions. The mistakes you make in a big organization does not have much effect due to its organizational strength but for a small startup it is disastrous and may lead to certain death. So throughout the ages, many attempts have been made to improve this decision making process.

For educational institutions around the world including Universiti Teknologi Malaysia (UTM), subjects and special programs on entrepreneurship are run to create more entrepreneurs or technology entrepreneurs (technopreneurs) in the belief that entrepreneurs can be bred versus the notion that entrepreneurs are born. ICT schools and faculties inspired by the success of well known ICT entrepreneurs like Kenneth Olsen, Steve Jobs, Bill Gates and Michael Dell have ICT Technopreneur or Cyberpreneur programs to create future Bill Gates and Steve Jobs. The idea here is to educate and expose the potential technopreneurs to the ICT business industry and for them to develop hardware and software prototype products for real markets but in sheltered and well supported incubators. When they graduated they are more equipped to face the challenges and harsh reality of the ICT business industry compared to those that took the brave but naïve step of jumping straight into business. Even with the extensive preparation, the technopreneur graduates were found to not able to handle the harsh realties. Many blunder through many decisions with disastrous consequences.

For many academics, researchers and ICT companies, if the educational track is not effective then technology seemed to be the most appropriate answer to the decision making issue. Decision Support Systems (DSS) with Artificial Intelligence engines have been developed in the past to assist in the decision making process in many organizations. So the assumption here is it should be relatively easy to port the DSS for big corporate organizations to small startups. Combined with several business productivity tools, we should be able to create a Small Office Home Office (SOHO) for entrepreneurs. But it was not the case. Compared to big and matured organizations where the decision making process are more defined and well understood as well as supported by the abundance of policy and regulations, small entrepreneurial organizations are not well understood. The issues confronted in small startups are normally complex, unstructured and in most cases totally new depending on the areas the venture is exploring. The decisions require creativity and innovation as well as very much dependant on the leading entrepreneur thinking style. Policies and regulations have not been setup and in most cases are regarded as not important in the early stage of the organization life cycle. All these undermines the basis of a rule-based DSS.

No doubt, DSS SOHO certainly has a promising future in the business startup market. Unfortunately it is still not available for the entrepreneur. Research and development efforts should be undertaken to create and develop robust and intelligent DSS to support entrepreneurship. Since entrepreneurship is a mystery for many ICT developers then a good start is to understand the entrepreneur self.

In my own professorial inaugural lecture on 24 May 2003 at UTM, I propose the concept of the Human Virtual Intelligence Framework (Abu Bakar, 2003). In this concept, I propose a framework for a leader to utilize his or her five intelligences. Humans throughout the ages have always stressed on the importance of the Intellectual Intelligence qualities to signify the cognitive capability of a person. We measure a person's intelligence through his or her Intelligence Quotient or IQ. Only recently, the concepts of Emotional Intelligence (Goldman, D., 1996, 1998, 2001, 2006, 2009) and Spiritual Intelligence (Zohar, D, 2000) have been identified to be as equally important to a person's cognitive capability. You too can measure a person's Emotional Intelligence by an Emotional Quotient (EQ) or Spritual Intelligence by a Spritual Quotient (SQ).

To support the inadequacies and limitations of his intelligences, human has resorted to providing Artificial Intelligence to machines or computers. There are many successes to this fourth intelligence endeavor and many intelligent systems with machine intelligence are already being used in our daily lives. Our discussion on the use of a DSS is inline with this belief. Even so, humans actually have a bigger and more powerful fifth intelligence at his disposal called Human Virtual Intelligence (HVI). This HVI has not been fuly understood and as such has not been fully unleashed and used as a crucial competitive cognitive advantage.

HVI is based on the concept of collaboration by knowledge agents in an intelligent learning organization and transcends virtual corporations. Knowledge agents are the human capital or community surrounding the human. They are family members, relatives, friends, business partners, consultants, employees, bankers, venture capitalist, legak advisors, suppliers, customers and even competitors. Each knowledge agent by themselves has HVIs. If this community of human agents can be networked virtually through face-to-face meetings, correspondence and ICT then an extensive collaborative network of human wth HVI is created. Imagine the possibility of this collective brain.

As its name implies, this intelligence does not physically exist but only exist virtually. If used wisely, the human or entrepreneur has this powerful virtual intelligence at his or her disposal to assist in business decision making and getting things done. The entrepreneur still has to make the final decision and take actions but they are now more informed and calculated risks. The probability of failure or a wrong choice is still there but it is better than jumping over a cliff with your eyes close. Recovery processes could quickly be initiated to minimize losses.

In the HVI, the knowledge agents in most cases are willing to assist the entrepreneur because of their personal relationship. The knowledge agents such as family members, relatives and close friends will assist the entrepreneur based on their love and close personal relationship. In a sense, they are motivated to support the entrepreneur based on their emotional intelligence. The non-personal knowledge agents on the other hand, are motivated by their intellectual intelligence to assist the entrepreneur. This could be due to their close business working relationship and experience so long as it is in line with their own business or personal agenda.

To ensure this virtual intelligence is strong and operational, the entrepreneur must take a lot of efforts to maintain and service this network. This could be done by socializing and even by giving financial incentives. People are motivated differently and it is the task of the entrepreneur to understand each knowledge agent and know what their needs, requirements and wishes are, so that he can act accordingly.

Unfortunately, after a lot of effort, the size of the virtual network is very limited and confined to the entrepreneur socializing capabilities, motivational skills and incentives. The quality of the decisions made too depends on the quality of advice or information given by the knowledge agents in this personal virtual network. Quality and well-informed advices come from quality agents and this is a big issue for budding entrepreneurs who does not have the time, contacts, finance and other resources to get quality knowledge agents like business, lega and technology advisots or consultants to work for them. Interestingly, development in mass collaboration, Wikinomics and the rise of the social media could solve this issue.

WIKINOMICS CROWD SOURCING

Mass collaboration was proposed by Don Tapscott and Anthony D. Williams in their book titled, *Wikinomics: How Mass Collaboration Changes Everything*, published in December 2006 (Tapscott and Williams, 2007). The title of the book, Wikinomics derives from the concept of a wiki or Hawaiian word for 'quick' in which individuals participate to co-create a product. Wikinomics explores how some companies in the early 21st century have used mass collaboration or peer production and open-source technology or wikis, to be successful. The most notable example of a wiki is the Wikipedia where more than eight million writers around the world participated in creating the biggest online encyclopedia. The four principles of Wikinomics are openness, peering, sharing and acting globally. Tapscott and Williams have recently released a follow-up book to Wikinomics, entitled *Macrowikinomics: Rebooting Business and the World*, which was released on September 28, 2010 (Tapscott and Williams, 2010). .

One of the strong elements advocated in Wikinomics is the concept of mass collaboration that includes crowdsourcing. Crowdsourcing is the act of outsourcing tasks, traditionally performed by an employee or contractor, to an undefined, large group of people or community (a crowd), through an open call over social media. The use of the term has spread to include models where discrete work is distributed to individuals within the crowd. Social media are media for social interaction, using highly accessible and scalable web-based and mobile technologies to turn communication into interactive dialogue.

Jeff Howe (2006), one of the first authors to employ the term, established that the concept of crowdsourcing depends essentially on the fact that because it is an open call to an undefined group of people, it gathers those who are most fit to perform tasks, solve complex problems and contribute with the most relevant and fresh ideas. There are several perceived benefits of crowdsourcing. With crowdsourcing, problems can be explored at comparatively little cost, and often very quickly. Financial incentives or rewards are by competition or results. In most cases there are no financial returns promised. By crowdsourcing, the organization has access to a wider range of talent and ideas that are beyond the confines of the organization and even country. Crowdsourcing gives opportunity to get views from the public and customers needs that can be used in marketing. Crowdsourcing are also good for building and fostering brand names and loyalty.

There were of course many skeptics. How could this phenomena be happening? Can a crowd of unconnected people from various locations in the world produce great works that could not be solved by a dedicated team? James Surowiecki (2004), in his book *The Wisdom of Crowds*, examines several cases of crowd wisdom at work, where the very success of a solution is dependent on its emergence from a large body of solvers. So the phenomena is real and we are actually experiencing it every time we surf the Internet. If you see a request for a poll then that is crowdsourcing in action.

ENTREPRENEURIAL CROWDSOURCING

Back to the issue of finding quality knowledge agents for entrepreneurship, the answers seemed to lay in utilizing social media for crowdsourcing entrepreneurial decisions. To enhance the personal and closed human virtual intelligence of the entrepreneur and get creative and quality solutions to a difficult business issue, an open appeal can be made through the popular social media like Facebook, Linkedit, etc. The call is to entice anyone in cyberspace to contribute in providing advice, recommendation and even solutions faced by the entrepreneur. You will be surprised by the response. It seems that there are many people out there that care. The interesting thing about this strategy is that the knowledge agents from this process could come from anywhere in the world and normally without any cost to the entrepreneur.

A smaller community of avid contributors will eventually emerge from the crowd after several appeals. This small community could then be utilized discretely for more specific tasks with of course some financial incentives. From this exercise, different communities could be identified and utilized for different issues and tasks. In essence the size and nature of the virtual intelligence network will fluctuates with time and tasks. Basically the problem of getting quality advice for the entrepreneur is hence solved. All you need to have is access to a social media site and be part of the community.

CHALLENGES OF CROWDSOURCING

If you think everything is fine then please reconsider because there are actually many issues related to crowdsourcing. Crowdsourcing like other strategies has its own weaknesses. Eric Schonfield in his article in TechCrunch (Schonfield E., 2008) said, “Crowdsourcing sounds good in theory—pull together a bunch of smart, motivated individuals from across the Web to create a new product or business—but in practice it is not so easy to pull off”. His article described a crowdsourcing company in Canada that failed because the output from the outsourcing initiative relied heavily on a few community members and this made them very diffused.

They are certainly many issues and challenges. Let me list ten. One, many crowdsourcing initiators assume that their community or the crowd will automatically care about their cause and willingly assist their plight. While there is some interest in the problem, in most cases there have to be more substance, compelling reason or urgency for a community to want to act on the issue. Two, the problem must be clearly defined, focused or trivial for the crowd to effectively respond. Crowd mentality is simple with a short attention span. Three, difficult or complex problems require many hours of hard work and dedicated resources that the crowd is not willing to commit unless there is a clear tangible reward. With no clear incentives, the crowd can quickly sense a cheap attempt to exploit them. Four, how do you know whether the idea given by the crowd is good? The quality of the solution is dependant on the quality of the problem solvers. In crowdsourcing, you do not know the real identity and credentials of the crowd because it is common practice to have pseudo identities or avatars to represent yourself in cyberspace. Five, the crowd might not have the correct technical background or subject matter expertise to solve the problem effectively. Six, there is also a possibility of a group think phenomena in action and they falling to the Condorcet's jury theorem. This is a political science theorem about the relative probability of a given group of individuals arriving at a correct decision. Seven, how do you maintain secrecy or control of your idea over a public or open network? Your business competitor might be on of the crowd. Eight, crowdsourcing like all trends or fads will fade when the novelty wears off. So creativity and innovation has to be employed to maintain the crowd’s interest. Stale ideas or already solved problems will put many people off. But what is the crowd current interest? Nine, there are too many sites employing crowdsourcing that made the crowd diffused and extremely picky. Ten, building trust and a strong community require time, patience and innovative strategies that many

entrepreneurs do not have.

So are we back at square one? Certainly not, one realization of working on enhancing the virtual intelligence is that the entrepreneurs should not be working alone but must work as a community. Hence, community entrepreneurship should be the norm. Since ICT is a necessary tool for the success of the entrepreneurship then Community Informatics too is an area to be explored.

ENTREPRENEURIAL COMMUNITY INFORMATICS

Responding to the nature of communities in the innovation era, a new knowledge discipline has emerged. According to its journal, "Community Informatics (CI), also known as community networking, electronic community networking, community-based technologies or community technology refers to an emerging field of investigation and practice concerned with principles and norms related to information and communication technology (ICT) with a focus on the personal, social, cultural or economic development of, within and by communities. It is formally located as an academic discipline within a variety of academic faculties including Information Science, Information Systems, Computer Science, Planning, Development Studies, and Library Science among others and draws on insights on community development from a range of social sciences disciplines. It is a cross- or interdisciplinary approach interested in the utilization of ICTs for different forms of community action, as distinct from pure academic study or research about ICT effects" Gurstein, M. (2007).

I believe Community Informatics research will provide more solutions to answer the issues in implementing a computing system for a virtual intelligence for entrepreneurship. In this field the various aspects of the virtual and physical communities are studied in depth to provide insights into the nature of the communities. We need to understand more about community dynamics before we can make effective systems for them and the future is certainly more towards working in communities.

DREAM SYSTEM

I have a vision for an intelligent DSS SOHO community-based computing system for entrepreneurship. The computing system should have connectivity to traditional and social media sites. With business productivity tools, the entrepreneur can get work such as sending quotations and invoices to be done in a short span of time. When in need of quick advice, the entrepreneur can directly call or e-mail his personal virtual intelligence community. For harder issues, the crowdsourcing method will be used. However, crowdsourcing appeals could only be made after a through search has been done by a data mining system to find and ensure that the problem has not been answered before.

Problems, answers, actions and experiences should be stored and managed by a knowledge management system. The problem too should be defined more clearly by a problem composition system. The draft problem can then be sent to a smaller community identified by the system for advice and recommendations. The final appeal would then be sent to a social media site indentified by the system based on certain criteria. This will ensure a higher response from the knowledge agents from the crowdsourcing exercise.

The knowledge management system component will have profiles of knowledge agents and classify them into various categories. The system will remind the entrepreneur on his responsibility and actions to maintain and motivate his knowledge agents. In essence this could be functioning similarly to what is happening in a multilevel marketing system where finally a personal touch is needed. With such as system at his disposal, the entrepreneur could then focus on his or her business and make more intelligent decisions. Imagine the possibilities.

CONCLUSION

Entrepreneurship is an important element in the growth of an economy but does not have many support systems. In this paper the idea of an innovative community-based computing system for entrepreneurship is proposed utilizing works and ideas the author has personally been involved. It is up to the reader to ponder on the idea and maybe attempt to develop such a system. It won't be easy but the possibilities are enormous.

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COMBINED NEAREST MEAN CLASSIFIERS FOR MULTIPLE FEATURE CLASSIFICATION

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ABSTRACT. Pattern classification is an important stage in many image processing applications. This paper proposes a technique that is based on nearest mean classifier for classification. The proposed technique integrates three classifiers and uses colour and shape features. Experiment on small training samples has been conducted to evaluate the performance of the proposed combined nearest mean classifiers and results obtained showed that the technique was able to provide good accuracy.

Keywords: classification, multiple classifier combination, nearest mean classifier, multiple features.

INTRODUCTION

Selection of appropriate classifier is important because it can significantly affect the success of classification process (Lu & Weng, 2007). There are many classifier that has been developed for classification such as artificial neural network (Zhang, 2000), support vector machine (Vapnik, 1998), decision tree classifier (Larose, 2005), Naïve Bayes (Csurka et al., 2004) and k nearest neighbour (Hardin, 1994). Individual classifier can achieve different degrees of success for a particular application problem, but none of them are perfect (Xu et al., 1992). Individual classifier has its strengths and weaknesses. Hence combining multiple classifiers is considered as a new direction for pattern classification. Combination of multiple classifiers may outperform all individual classifier by integrating the benefits of various classifier (Du et al., 2009). Effective use of multiple features can significantly affect the success of classification (Lu & Weng, 2007).

According to Woo and Mirisae (2009) the classification of objects based on colour alone is not sufficient to identify and distinguish the objects because different objects may have the same colour. Furthermore, different objects may have the same colour and shape thus the use of colour and shape are also not adequate to identify and distinguish the objects. Therefore, multiple features are required to improve the classification accuracy.

The nearest mean classifier (NMC) was introduced by Fukunaga (1990) as a classifier which provides good performance for small sample problem (Veenman & Tax, 2005). Small sample problems are problems with number of samples smaller than the number of features (Jain & Chandrasekaran, 1982). NMC uses the similarity between patterns to determine the classification. For each class, NMC computes the class means (or centroid) of the training patterns and classifies each test patterns (or unknown objects) to the class whose class mean is closest to this test pattern. This classifier has been successfully applied to many classification problems and has shown good performances and very robust (Huang et al., 2002; Shin & Kim, 2009).

For applications with large number of features the training sample size should be large enough (Raudys & Jain, 1991). However, small sample problems were often encountered in the pattern recognition problems (Huang et al., 2002). Although NMC can provide good performance for small samples but the use of single NMC for large number of multiple features will not give good results. Generally, the use of single classifier for a large number of features is not possible to give good results because of the curse of dimensionality (Du et al., 2009). The curse of dimensionality (also known as the effect of Hughes or Hughes phenomenon) is the problem caused by the exponential increase in volume associated with adding extra dimensions to a space. Classifier combination method allows high-dimensional vector to be split into several vectors with lower dimension, thus the classifier can process the feature vector with lower dimension simultaneously (Xu et al., 1992).

PROPOSED TECHNIQUE

Object recognition and classification in the image are usually based on several features which characterize the object in the image. Features are important attributes of objects and the most common used features are colour, shape, and texture. In this study only the colour feature and shape feature are used. The proposed multiple classifiers technique consists of three phases namely image preprocessing, feature extraction and classifier combination as depicted in Figure 1.

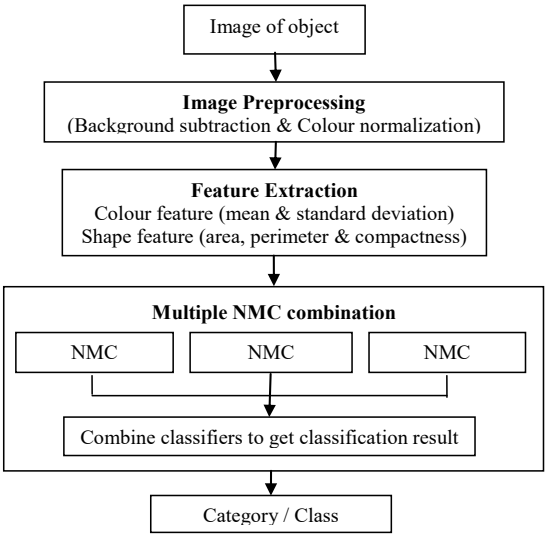

Figure 1. Multiple nearest mean combination technique

Image Preprocessing

The image will be preprocessed to obtain the feature of the object. Operations such as background subtraction and the normalization of color will be performed on the image. The background subtraction is performed with the aim to separate the object from its background. This is implemented by doing pixel subtraction (Fischer et al., 2003). Object (Q) is detected through the use of the following equation.

$$Q(i,j) = \left| P_1(i,j) - P_2(i,j) \right| \quad (1)$$

where P_1 is the image of object plus its background, P_2 is the background image and *i, j* are the position of the pixel on the image. In other words, *Q* is the absolute subtraction value of the object from its background. The threshold value of red (*R*), green (*G*) and blue (*B*) intensity is set to 75. This is considered ideal after several conducting experiments investigating the value.

Colour normalization operation is then performed to eliminate the influence of different lighting (Gonzalez & Woods, 1992). The equation used to normalize the colour at each pixel *Q* with the intensity of each colour on red component is

$$r(Q) = \frac{R(Q)}{R(Q) + G(Q) + B(Q)} \tag{2}$$

The same treatment is applied to green and blue component.

Feature Extraction

Features found in the image are extracted and placed in feature vectors. Feature vectors can be divided into three groups, i.e feature vector of mean and standard deviation on each channel of RGB and shape feature vector which consists of the area, perimeter and compactness. If the number of pixels of object image is *N* then the mean value (*x*) for each colour can be obtained as follows.

$$x = \left(r_{avg}, g_{avg}, b_{avg}\right)^T \tag{3}$$

where $r_{avg} = \frac{\sum_1^N r(Q)}{N}$, $g_{avg} = \frac{\sum_1^N g(Q)}{N}$ and $b_{avg} = \frac{\sum_1^N b(Q)}{N}$.

The feature vector of standard deviation value (y) of colour for the same number of pixels can be obtained by

$$y = (r_{std}, g_{std}, b_{std})^T \tag{4}$$

where $r_{std} = \sqrt{\frac{\sum_1^N \left(r(Q) - r_{avg}\right)^2}{N}}$, $g_{std} = \sqrt{\frac{\sum_1^N \left(g(Q) - g_{avg}\right)^2}{N}}$ and $b_{std} = \sqrt{\frac{\sum_1^N \left(b(Q) - b_{avg}\right)^2}{N}}$

The shape-based features are measured by area, perimeter and compactness. The area of an object reflects the actual object size or weight. This can be estimated by counting the total number of pixels that are enclosed by the detected object boundary. The perimeter of an object is defined as the area that covers the boundary, i.e. the sum of the boundary points. In this study, the boundary length, i.e. perimeter is expressed using eight (8) connected chain code (Freeman, 1961). The compactness of an object is defined by

$$c = \frac{4.\pi.a}{p^2} \tag{5}$$

The feature vector of shape for any object is represented by $z = (a, p, c)^T$ where *a* is area, *p* is perimeter, and *c* is compactness. A circular object usually has a compactness value of 1, while objects with more complex shapes have smaller values.

The Multiple Nearest Mean Classifier Combination

The proposed method is based on the concept of different feature space by Kuncheva and Whitaker (2001). The combination model consists of three nearest mean classifiers. The input to the first and second classifiers are the colour mean and colour standard deviation feature sets respectively while the input to the third classifier is the area, perimeter and compactness

feature set. Output from each classifier is the similarity value between feature of unknown object (or test pattern) and feature of samples (or training pattern). The similarity value is obtained by calculating the euclidean distance between feature vector (or pattern) of unknown object and feature vector of samples. Two vectors are close to each other will have many similarities. Feature vector of samples represented by feature vector of class mean. The class mean or centroid ($\bar{x}$) is calculated by

$$\bar{x} = \frac{1}{n_i} \sum_{j=1,n_i} x_{i,j} \tag{6}$$

where $x_{i,j}$ is the j^{th} sample feature vector from class *i*. If the colour mean of object is stated as x and the colour mean of centroid as $\bar{x}$, the Euclidean distance of two vectors is

$$d(x,\bar{x}) = \sqrt{(r_{avg} - \bar{r}_{avg})^2 + (g_{avg} - \bar{g}_{avg})^2 + (b_{avg} - \bar{b}_{avg})^2} \tag{7}$$

The same concept is applied in calculating the Euclidean distances of colour standard deviation and shape.

Values for distances provided by the classifiers will be normalized because different features will have different scale. Normalization is done by dividing the Euclidean distance between two feature vectors and the maximum Euclidean distance between any feature vector. The Same concept is applied in normalizing of each feature sets (colour mean, colour standard deviation and shape). The combined distance $(d(Q,\overline{Q}))$, can be calculated as

$$d(Q,\overline{Q}) = \frac{d(x,\bar{x})}{\max d(x,\bar{x})} + \frac{d(y,\bar{y})}{\max d(y,\bar{y})} + \frac{d(z,\bar{z})}{\max d(z,\bar{z})} \tag{8}$$

$Q = (x,y,z)^T$ is feature vector (or pattern) of unknown object which composed by three subvectors, $\overline{Q} = (\bar{x},\bar{y},\bar{z})^T$ is feature vector of samples which composed by three subvectors, $\max d(x,\bar{x})$, $\max d(y,\bar{y})$ and $\max d(z,\bar{z})$ are the maximum distance between any feature vector of colour mean, colour standard deviation and shape values respectively. The classification rule is performed as follows:

If feature vector (or pattern) of unknown object is $Q = (x,y,z)^T$ and $\overline{Q}_1$, $\overline{Q}_2$ are the class mean for classes ω_1 and ω_2 respectively then Q is classified to ω_1 if and only if $d(Q,\overline{Q}_1) < d(Q,\overline{Q}_2)$ else Q is classified to ω_2 if and only if $d(Q,\overline{Q}_2) < d(Q,\overline{Q}_1)$

If the value of $d(Q,\overline{Q}) < \varepsilon$ where ε = 0.75 then the unknown object will be classified, otherwise the unknown object will be rejected. The threshold (ε) value of 0.75, is empirically achieved.

DATA

A sample of 84 fruits images that correspond to 12 categories have been used to form the reference values for each category. The data were divided into training set (43%) and testing set (57%), with one to three training samples were used. All images were of 640 x 480 pixels with 24-bit true colour, 256 levels of gray and RGB colour model. The types of fruits that were used are limited to variants of apples, mangoes, oranges, pears and durian. Obtained feature values are shown in Table 1.

Table 1. Reference feature values

Type of fruit	Colour mean			Colour standard deviation			Shape		
	Red	Green	Blue	Red	Green	Blue	Area	Peri meter	Compact ness
Fuji Apple	193.93	136.28	83.73	38.71	50.96	30.03	15911	438	1.04
Manalagi Apple	167.41	180.51	66.67	33.88	34.28	25.70	12581	385	1.07
Washington Apple	184.34	75.75	64.24	37.20	39.23	30.05	16455	623	0.53
Arum Manis A Mangoe	131.89	143.69	51.07	27.20	26.35	14.91	31211	1449	0.19
Arum Manis B Mangoe	112.97	132.85	47.52	17.84	20.79	16.66	17083	920	0.25
Golek Mangoe	147.24	150.16	36.51	31.02	28.58	27.73	27439	1042	0.32
Honey Mangoe	105.27	138.55	77.66	22.91	24.81	27.03	20703	1588	0.10
Podang Mangoe	203.74	143.30	48.70	34.63	34.37	30.31	16436	455	1.00
Sunkist Orange	206.37	114.51	8.17	38.68	37.96	26.97	20846	618	0.69
Siam Orange	176.46	135.07	20.09	36.46	34.53	33.22	14469	498	0.73
Peer	211.77	191.14	122.68	35.30	41.74	41.80	18324	515	0.87
Durian	117.28	123.81	50.23	19.27	20.72	25.17	72276	10769	0.01

EXPERIMENTAL RESULT

In evaluating the performance of the proposed technique, forty eight (48) new fruits images were used as the testing images. Each class has 4 new fruit images. Small number of image were used in the training process. Three categories of training images were employed. The sizes of the three categories were 12, 24 and 36 respectively. The results are shown in Table 2.

Table 2. Fruit image test result

Number of training image	Number of testing image	Classification		Success rate (%)
		True	False	
One image per class	12	12	0	100
	24	24	0	100
	36	36	0	100
	48	46	1	95.83
Two images per class	12	12	0	100
	24	24	0	100
	36	36	0	100
	48	45	2	95.83
Three images per class	12	12	0	100
	24	24	0	100
	36	36	0	100
	48	48	0	100

From the results, it can be seen that the proposed technique is able to recognize and classifying new fruit images with small training sample size. The success rate when 1 or 2 samples are used in each class is 95.83% and for the case of 3 samples, the rate reaches 100%.

CONCLUSION

Identification and classification of fruits using the proposed multiple nearest mean classifier technique has shown that the technique is capable in producing high accuracy with small sample size. Small sample size posed a problem to most classification technique as big sample size is required to produce results with acceptable accuracy. Future research could include more than two features and tested with small and big samples.

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ARTIFICIAL IMMUNE SYSTEM AGENT MODEL

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ABSTRACT. The Artificial Immune Systems (AIS) is a biologically inspired techniques that emulates a natural system, in particular the vertebrate immune system, in order to develop computational tools for solving engineering problems. Immunity-based technique emerge as a new branch of artificial intelligence (AI). The human biological immune system has become the source of inspiration for developing intelligent problem-solving techniques. The powerful information processing capabilities of the human system, such as feature extraction, pattern extraction, learning, memory and its distributive nature provide rich metaphors for its artificial counterpart. Hence, the goal of this study is to develop an Artificial Immune System (AIS) model using agent approach for incremental learning. The main issue handled was how to integrate a multiagent system into an AIS application. This model proposed was simulated using cases for the performance measurement. The step by step activities performed in developing the agent based AIS model can be a guideline in developing an AIS application. Besides that, the simulation of the AIS model can be further enhanced to be used for teaching and learning purposes.

Keywords: Artificial Immune System (AIS), Agent Technology

INTRODUCTION

The immune system (IS) is a complex of cells, molecules and organs that represent an identification mechanism capable of perceiving and combating dysfunction from our own cells (*infectious self*) and the action of exogenous infectious microorganisms (*infectious nonself*). The interaction among the IS and several other systems and organs allows the regulation of the body, guaranteeing its stable functioning (Janeway Jr., 1992). Without the immune system, death from infection would be inevitable. Its cells and molecules maintain constant surveillance for infecting organisms. They recognize an almost limitless variety of infectious foreign cells and substances, known as *nonself* elements, distinguishing them from those native noninfectious cells, known as *self molecules* (Janeway Jr., 1992; Mannie, 1999). When a *pathogen* (infectious foreign element) enters the body, it is detected and mobilized for elimination. The system is capable of "remembering" each infection, so that a second exposure to the same pathogen is dealt with more efficiently.

The immune system, however is a system with high complexity and is under active research (from the biological point of view). The current Artificial Immune System (AIS) works adopted only a few immune mechanisms. Specifically, three immunological principles are primarily used in a piecemeal in AIS methods. These include the immune network theory, the mechanisms of negative selection and the clonal selection principles. The system uses learning, memory, and associative retrieval to solve recognition and classification tasks. In particular, it learns to recognize relevant patterns, remember patterns that have been seen

previously, and use combinatorics to construct pattern detectors efficiently. Artificial Immune Systems are used in pattern recognition, fault detection, computer security, and a variety of other applications in science and engineering.

Some of the first work in applying immune system metaphors was undertaken in the area of fault diagnosis (Ishida, 1990). Later work applied immune system metaphors to the field of computer security and virus detection (Forrest *et al*, 1994), which seemed to act as a catalyst for further investigation of the immune system as a metaphor in many areas.

Using the immune system as inspiration has proved very useful when trying to address many computational problems. The immune system is a remarkable learning system. Through the use of B-cells and T-cells the immune system can launch an attack against invading antigens and remove them from the system. This is achieved through a process of B-cell stimulation followed by cloning and mutation of new antibodies. This diversity that is generated allows the immune system to be adaptive to new, slightly different infections. The immune system is able to retain information about antigens; so that next time the body is infected a quicker, secondary immune response can be triggered to eliminate the infection. A number of theories exist about how the immune system retains this information, in a type of memory: the most popular being the clonal selection theory, and the idea of memory cells, and the alternative immune network theory, with the idiotypic interactions on antibodies. The immune system is composed of an enormous set of cells, molecules and organs, which can be viewed as immune agents distributed all over our bodies. (Forest *et al.,* 1997; Dasgupta, 1999; De Castro *et al*., 2000, Acklien *et al*. 2002)

LITERATURE REVIEW

The backbone of the study involves imitating the human immune system in terms of features and functions in multi agent systems. The motivation for this research comes from the fact that artificial immune system has found solutions for several applications.

Table 2: Comparison of rule based, cased based and artificial immune system.

Type	RB	CBR	AIS
Data	Rule base	Case base	Rule and case base
Incremental Learning	Yes	Yes	Yes
Redundancy	High	High	Medium
Storage of memory	High	High	Medium
Knowledge Acquisition	Difficult	Easy	Easy

Table 2 shows that the redundancy data, storage memory and knowledge acquisition by using AIS is better that the rule based and case based reasoning. From that viewpoint, this study will explore the AIS model capability in order to solve that kind of problem. Based on previous discussion, there are various related issues that need to be solved in this study. Artificial Immune System model will be used as a central theme to demonstrate the naturalistic decision making process in emergency situation. Thus, the aims of the study are to explore the learning, recognition process and memory mechanism in the human immune system on extracting the knowledge from the case and the expert. The human immune system has a capability to control the complex system.

In the same context agent based solutions have als been developed in different application domains. An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through effectors. The characteristics of the agents

are autonomous, sociable, cooperative, proactive and reactive entity. The reason for developing the Multi Agent System (MAS*)* is due to the similarities observed between the immune system architecture and the architecture of the agents. This study will concentrate on agent and their characteristics in order to develop the model of Artificial Immune System by adopting intelligent agent approach. The distinct similarities between the agents and the immune system are:

- Both are distributed or decentralized systems
- Both have multiple autonomous entities
- Both have individual and global goals
- Both systems learn from their experience
- Both are adaptable
- Both sense the changes in the environment and act accordingly
- Both systems communicate and coordinate
- Both possess knowledge with which they make intelligent decisions.

In a recent work, Dasgupta (1999) proposed an agent-based system for intrusion/anomaly detection and response in networked computers. In his approach, the immunity-based agents roamed around the nodes and routers monitoring the situation of the network. The most appealing properties of this system were: mobility, adaptability and collaboration. The immune agents were able to interact freely and dynamically with the environment and each other. Figure 1 depicts the types of agents employed and their hierarchical coordination. The decision/action agents could assume the forms of *helper*, *killer* or *suppressor* agents, like in the case of T-cells. The communicating agents corresponded to *lymphokines*, secreted by T-cells to regulate the immune response. Some of the monitoring agents worked in the complement space for monitoring changes (*non-self*), while others had the knowledge of known intrusions.

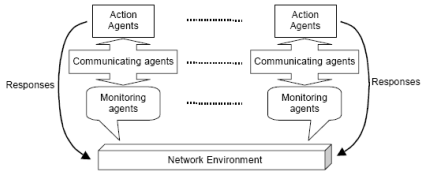

Figure 1. Conceptual view of the proposed multi-agent intrusion detection system.

Tung et al. (2004) proposed an Architecture Immune Dealing System (AIDS) as a system that uses the artificial immune algorithm that is implemented in the e-marketplace. It has similar architecture as the artificial immune system with agents acting to search for an appropriate match of buyer and seller. The AIDS represents the next generation of services in the e-marketplace, aiming to achieve an efficient and fair e-marketplace with less cost.. along with explosive growth rate. In this paper, Artificial Immune System is used as the E-marketplace's trading mechanism, which structure an Artificial Immune Dealing System(AIDS). The authors introduced a new Architecture of emarketplace, which uses artificial immune concept, named Artificial Immune Dealing System(AIDS). By the interaction of B lymphocytes, B memory lymphocytes and antigens provide all the functions of AIDS. The antigens act as a product's information catalog, which for antibodies to select. Antibodies act as a purchaser, which select product(antigen). The whole system works like a large intelligent multi-agent system. In this paper, it also introduced the algorithm that AIDS used and the advantage of AIDS.

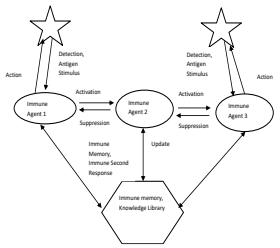

Figure 2. Multi-Immune Agent Schematic Network Model (Yunyuan & Wei, 2005)

Yunyuan and Wei (2005) propose an immune agent model combining the artificial immune system with the agent technology. In the model, a robot is regarded as an antibody and each environmental condition as an antigen respectively. Furthermore, based on the model, a new multi-robots cooperation algorithm is designed to build self-determination cooperation among robots even in a new environment. Inspired by pheromone from ants algorithm, a new pheromone as Inter- stimulus between robots in the model is introduced to the algorithm. By comparing the inter-stimulus value between antigen and antibody and among antibodies, the system will autonomously produce appropriate antibodies to kill the antigen. Finally, the model will be verified by simulation. This paper proposes an immune agent model by combining the artificial immune system and agent technology. Robots in this model perform self-determination cooperation in a new environment without awareness of the variety of the tasks. Simulation is performed to validate the effectiveness of the algorithm.

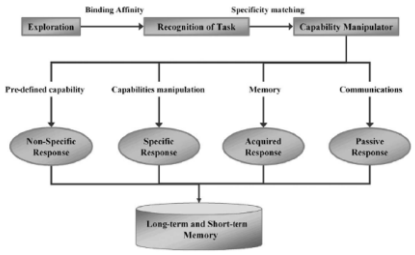

Figure 3. Architecture of the control framework for the individual AIS agent.

Hendry and Vicky (2006) present a formal mathematical model of an artificial immune system (AIS)-based control framework. The framework aims to provide an integrated solution to control and coordinate complex distributed systems with a large number of autonomous agents such as automated warehouses, distribution centers, and automated materialhandling systems. The control framework consists of a set of AIS agents working in response to the changing environment and the occurrence of tasks. The AIS agents manipulate their capabilities to derive appropriate responses to tackle different problems. A methodology describing the response-manipulation algorithm of the AIS agents and their ability to generate new capabilities is discussed in this paper. Through response manipulation and knowledge building, a self-organized and fully distributed system with agents that are able to adapt and

accommodate in a dynamic environment via distributed decision making and interagent communication is achieved. Figure 3 shows the architecture of the control framework proposed by the authors.

This study was conducted in four phases : study on current AIS framework; modeling AIS using agent approach; design the simulation for the AIS model and evaluate the system using selected test case.

CONCLUSION

This study will propose an AIS incremental learnirng model using intelligent agent approach. This model was simulated using real data for the performance measurement. The development activities involve can be used as a guideline for developing agent based AIS. .

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INTERACTED MULTIPLE ANT COLONIES OPTIMIZATION APPROACH FOR THE SINGLE MACHINE TOTAL WEIGHTED TARDINESS PROBLEM

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ABSTRACT. Single Machine Total Weighted Tardiness Problem (SMTWTP) is an important combinatorial optimization problem that considers the job scheduling for sequential processing on a single machine and the target is to minimize the total tardiness of all jobs. This is a crucial task in manufacturing and production planning. The framework of Interacted Multiple Ant Colonies Optimization (IMACO) is a recent proposition. It divides the ants' population into several colonies and employs certain techniques to organize the work of these colonies. This paper considers the tackling of SMTWTP using IMACO. It also proposes the idea of different ant colonies use different types of problem dependent heuristics. The performance of IMACO was demonstrated and compared with the best performing ant algorithms the Ant Colony System (ACS). The Computational results show the dominance of IMACO.

Keywords: Multiple Ant Colonies Optimization, Ant colony, optimization

INTRODUCTION

Machine scheduling problems, traveling salesman problem, quadratic assignment problem, vehicle routing problem, and network routing problem are some well known examples of Combinatorial Optimization Problems that have great importance in research and development. These problems have a discrete set of feasible solutions and the goal is to find the optimal solution (the best solution from the feasible solutions). These problems are theoretically proven as *NP* - hard problems. The only way to tackle these problems is to use approximate (heuristic) algorithms such as tabu search, evolutionary computation, simulated annealing, genetic algorithms and Ant Colony Optimization (ACO).

The recently proposed IMACO framework tries to improve the performance of ACO algorithms by utilizing several ant colonies with certain techniques to organize the work of these colonies. The proposed framework composes necessary techniques that encourage the controlled exploration of the search space in couple with a good exploitation of previously obtained good solutions. As exploration is the means of ants to search for new solution, this should be done under certain control to avoid exploring a very wide area from search space that might be far from the optimal solution. On the other hand a good exploitation of the search history is necessary to search the solution space in the neighborhood of previously good solution. However, very strong exploitation is not required because it increases the convergence speed of ants towards the same solution obtained in previous iterations (Aljanaby et al., 2010a, 2010b).

In this paper, the SMTWTP is first described. The explanation of the framework of IMACO and its incorporated techniques is then given. An experimental study of using IMACO with different problem dependent heuristics to solve all 375 available instances of SMTWTP is conducted and the results have been shown and compared with the results of other ACO algorithms.

THE SINGLE MACHINLE PROBLEM

SMTWTP can be stated as follows. Each of n jobs is to be processed without pre-emption on a single machine that can handle no more than one job at a time. The processing and set-up requirement of any job are independent of its position in the sequence. The release time of all jobs is zero. Thus, jobs j (j=1, …, n) becomes available at time zero, requires uninterrupted positive processing time p_j, which includes set-up and knock-down times on the machine, has a positive weight w_j, and has a due time d_j by which it should ideally be finished. For a given processing order of the jobs, the completion time c_j and the tardiness T_j=max{0, c_j-d_j} of job j can be computed. The problem is to find a processing order of the jobs with minimum total weighted tardiness $\sum_{j=1}^{n} W_j T_j$ (Besten, Stützle, & Dorigo, 2000, Baggio, Wainer, & Ellis, 2004).

The SMTWTP is an *NP*-hard scheduling problem for which instances with more than 50 jobs often can not be solved to optimality with state of the art branch and bound algorithms (Congram, Potts, & van de Velde, 2002). The total number of available instances is 125 for values of n=40, n=50 and n=100. Optimal values of solutions are available for 124 and 115 of 40 and 50 job problem instances respectively. The values for unsolved problems are the best known solution to Crauwells et al. (1998). These solutions appear to be optimal since they have not been enhanced for a long time. The best known solutions to date of the 100-job instances are available and most of them are according to Crauwells et al. (1998) and Congram et al. (2002).

Three types of problem specific heuristic are examined in this work. These problem specific heuristic are easily calculated and have been studied in the literature (Besten, Stuzle, & Dorigo, 2000) and are as follows.

- Earliest Due Date (EDD): this heuristic puts the jobs in non-decreasing order of the due dates d_j and given by:

$$H_{ij} = \frac{1}{d_j} \tag{1}$$

- Modified Due Date (MDD): this heuristic puts the jobs in non-decreasing order of the modified due dates mdd_j which given by mdd_j=max{C+p_j, d_j}, where C is the sum of the processing times of the already scheduled jobs. This heuristic is given by:

$$H_{ij} = \frac{1}{mdd_j} \tag{2}$$

- Apparent Urgency (AU): this heuristic puts the jobs in non-decreasing order of the apparent urgency which given by

$$au_j = \frac{w_j}{p_j} \exp(-\frac{\max\{d_j - C_j, 0\}}{k\overline{P}} \tag{3}$$

Where $\overline{P}$ is the average processing time of the remaining jobs, k is a scaling parameter which set to 2 (Besten, Stuzle, & Dorigo, 2000). The heuristic is given by:

$$H_{ij} = \frac{1}{au_j} \tag{4}$$

INTERACTED MULTIPLE ANT COLONIES OPTIMIZATION

IMACO framework is recently proposed in pervious work of the author (Aljanaby et al., 2010a, 2010b, 2010c, 2010d). In this framework there are two levels of interaction the first one is the colony level and the second one is the population level. The colony level interaction can be achieved through the pheromone depositing process within the same colony; the pheromone updating mechanism is responsible for the implementation of this kind of interaction. The population level interaction is achieved by evaluating the pheromones of different colonies using some evaluation function; the responsibility here is of the pheromone evaluating mechanism.

The work activities of a single colony in the proposed IMACO algorithm are based on ACS. Each colony has its own pheromone that is used as an interaction between the ants of the same colony. The interaction between ant colonies using pheromone can be organized in different terms. The IMACO algorithm is described as follows. M colonies of m ants each are working together to solve some combinatorial problem. The probabilistic decision of the ant k belongs to the colony v to move from node i to node j is defined as:

$$j = \begin{cases} \arg \max_{l \in N_i^k} \{ f(P_{il}) H_{il}^{\beta} \} & if \ \ q \le q_0 \\ S & \text{otherwise} \end{cases} \quad (5)$$

The random variable S is selected according to the following probabilistic rule:

$$S = \begin{cases} \dfrac{f(P_{ij}) H_{ij}^{\beta}}{\sum_{l \in N_i^k} f(P_{il}) H_{il}^{\beta}} & \text{if } j \in N_i^{kv} \\ 0 & \text{otherwise} \end{cases} \quad (6)$$

Where N_i^{kv} is the set of remaining nodes to be visited by the k^{th} ant of colony v located at node i and P_{ij}^{v} is the pheromone of colony v on the edge (i,j). $f(P_{ij})$ is the evaluation function of the pheromone on the edge (i, j) and will be discussed in next subsection.

Global and local pheromone updating are used in IMACO. Global pheromone updating includes that best ant of each colony deposits an amount of pheromone on its own path. The best ant refers to the ant that got the so far best (global) solution since the starting of the algorithm execution or the ant that got the best solution in the current iteration of the algorithm execution. In this work a combination of so far best and iteration best ants are allowed to update the pheromone.

After all ants of all colonies complete their tours (i.e., one algorithm iteration), the ant that finds the so far best solution in its colony is allowed to deposit an amount of the colony's pheromone on the edges of its tour according to the following global pheromone update:

$$P_{ij}^{v} = (1-\sigma) P_{ij}^{v} + \sigma \Delta p_{ij}^{v.bs} \quad (7)$$

Where σ is a pheromone evaporation parameter its value is in the range [0, 1] and $\Delta P_{ij}^{v.bs}$ is the pheromone quantity added to the connection (i, j) belonging to the best solution of the v^{th} colony $L^{v.bs}$ and is given by:

$$\Delta p_{ij}^{v.bs} = \begin{cases} 1/L^{v.bs} & if \ (i,j) \text{ belongs to} \\ & \text{the best tour of} \\ & \text{colony } v \\ 0 & \text{otherwise} \end{cases} \quad (8)$$

To create a search diversification IMACO uses iteration best solution once in the pheromone updating after each 50 times of using the global best solution. Local pheromone updating includes that each ants reduces the amount of pheromone on paths it uses in order to give a more chance to other paths to be chosen by the future generations. Local pheromone update is applied by each ant on the visited edges. It is very important rule as it is performed during the solution construction this helps to yield different pheromone evaluation values for the same edge in the same iteration at different solution construction steps and it is given by:

$$P_{ij}^{v} = (1-\gamma)P_{ij}^{v} + \gamma p_0 \tag{9}$$

where P_0 is the initial pheromone value and γ is another pheromone evaporation parameter with a value in the range [0, 1].

Evaluation Technique

The pheromone of different colonies has been evaluated using two mechanisms. The first mechanism evaluates the pheromone as an average of the pheromone values of all colonies on some edge. This means that an ant will make its decision to choose some edge based on the average of the available experiences of ants of all colonies that visited this edge in the past. This variant of IMACO is referred hereafter as IMACO-AVG.

Given that for each edge there are M pheromone values each belongs to a single colony. Average pheromone evaluation function evaluates the pheromone on any edge as an average of the available M values. The average pheromone evaluation function $f(P_{ij})$ on the edge (i, j) for IMACO-AVG will be defined as:

$$f(P_{ij}) = \frac{\sum_{v=1}^{M} P_{ij}^{v}}{M} \tag{10}$$

The second mechanism evaluates the pheromone as the maximum value of the pheromone values of all colonies on some edge. This mechanism, referred as IMACO-MAX, chooses the max value among the available M values. The pheromone evaluation function for IMACO-MAX is defined as:

$$f_2(P_{ij}) = \max_{v=1}^{M} P_{ij}^{v} \tag{11}$$

The above rule lets an ant's decision to choose some new edge be based on the best available experience of ants of all colonies that previously visited this edge. This kind of cooperation using max pheromone evaluation is trying to make an early exploitation of the history of the search by choosing the max (best) available pheromone value. The result of this max pheromone evaluation function lets an ant to follow the best available information about the goodness of particular edge. However, since best pheromone comes from different colonies, this will provide necessary diversification that helps ants' to avoid the attraction to a one good solution.

The above two mechanism are pure average and max evaluation that depends 100% on the average evaluation function. The following rule is a more general which evaluates the pheromone as a composition between the pheromone values of the ant own colony and the value of the pheromone evaluation function based on some pheromone evaluation rate. Consider that the composition rate is 0.5; an ant will build 50% of its decision based on its own colony's experience and the other 50% based on the experiences of other colonies. This new variant will be called IMACO-AVG E λ and IMACO-MAX E λ where λ is the pheromone evaluation rate; its value is in the range [0, 1]. The pheromone evaluation function is then defined as:

$$f'(P_{ij}) = \lambda P_{ij}^{s} + (1-\lambda)\ f(P_{ij}) \tag{12}$$

Where P_{ij}^{s} is the pheromone belongs to colony *s* on edge (*i*, *j*). Note that IMACO-AVG E0 and IMACO-MAX E0 represent the pure pheromone evaluation and IMACO-AVG and E1 IMACO-AVG represent no interaction between utilized ant colonies.

Exploration technique

Each ant makes a probabilistic decision when it needs to move to a new node. The probabilistic decision is based on heuristic information (cost) and pheromone information. Pheromone represents information about previous experiences of the ant's own colony and of the other colonies. While heuristic represent a priori information about the goodness of a solution. Exploration and exploitation is controlled by the parameter q_0 whose value is in [0, 1]. It is usually used in ant's probabilistic decision as trade-off between exploitation (choosing the edge with the higher value of the multiplication of pheromone and heuristic values) and exploration (choosing the edge randomly according to some probability distribution). Setting q_0 to zero means that the algorithm uses a pure exploration while pure exploitation is reached by setting q_0 to one. However, the value used for q_0 in many research papers usually between 0.5 and 0.9 (Dorigo & Stützle, 2002, 2004, Dorigo & Blumb, 2005). Most of the work done using ACS in solving different problems was with q_0 =0.9 which gives the algorithm a high chance of exploitation without loosing the chance of exploration.

IMACO considers the case where different ants' colonies have different values for the parameter q_0. The value 0.8 has been assigned to the centre colony whose number equal to *int* (no. of colonies / 2). This value is increased / decreased for the colonies after / before the centre colony by a changing factor called QCF. This technique enables the utilized ant colonies to work with different levels of exploration. Some will prefer high exploration of new areas of search space while other colonies will prefer high exploitation search history.

RESULT AND DISCUSSION

ACS, IMACO-AVG and IMACO-MAX for SMTWTP have been implemented using visual C++. Both versions of IMACO have been applied to all available 375 instances of SMTWTP. Based on past work the number of colonies utilized by IMACO-AVG and IMACO-MAX was 8 colonies, the evaluation rate was λ=0.4 and the exploration / exploitation control parameter was QCF=0.025 (Aljanaby et al., 2010c, 2010d). In addition to use IMACO with EDD, MDD and AU, this section is developing the idea of using IMACO with different combination of the three heuristics. For instance, using EDD-MDD means that half of the utilized ant colonies will use EDD while the other half of these colonies will use MDD.

The global pheromone updating is performed by according to rules **7** and **8**. The value of best solution (global-best or iteration-best) mentioned in rule **8** represents the total weighted tardiness of the jobs sequence of the best solution. Local pheromone updating is performed using rule **9** and P_0 the initial value of pheromone trials that usually assigned a small value computed as $P_0 = \frac{1}{nT_{EDD}}$ where *n* is the number of jobs and T_{EDD} is the total weighted tardiness of job sequence obtained by EDD.

Table 1 shows the results of experiments done on 125 instances of 40, 50 and 100 job SMTWTP. The results presented in these tables are the number the optimal solution found (out of 125). The results of ACS presented in Table 1 are of the implementation developed with this

research work. The reason is that the results of ACS presented in the literature usually with local search while all results presented here are without using local search. As explained in previous section all algorithms ran exactly the same number of computation steps.

Regarding the use of different combination of heuristics, EDD-MDD was the best combination as it always reaches the best results. EDD-MDD-AU heuristic was in the second rank and followed by MDD. This seems normal as previous studies (Besten et al., 2000, Congram et al., 2002) show the ranking of these heuristic according to the goodness of the results obtained was MDD, EDD and AU respectively. The results obtained from IMACO confirmed this getting the best results when using the best two heuristics, i.e., EDD-MDD combination. In fact, the use of a combination of heuristics increases the ability of different colonies to achieve high diversion in the search process and therefore increase the ability to improve the quality of the obtained solutions.

Table 1. Results for 40, 50 and 100 job instances

Algorithm	Heuristic	40-Job	50-job	100-Job
ACS	EDD	39	33	24
	MDD	44	37	27
	AU	36	30	21
IMACO-AVG	EDD	45	38	30
	MDD	53	45	37
	AU	41	34	26
	EDD-MDD	57	50	42
	EDD-AU	43	37	28
	MDD-AU	49	43	34
	EDD-MDD-AU	54	47	38
IMACO-MAX	EDD	43	37	30
	MDD	48	42	34
	AU	38	31	24
	EDD-MDD	53	46	39
	EDD-AU	43	36	30
	MDD-AU	47	40	32
	EDD-MDD-AU	49	43	34

CONCLUSION

It is obvious based on the results of Table 1 is that IMACO-AVG and IMACO-MAX outperform ACS in terms of the number of optimal solution found. IMACO-AVG was the best algorithm that found the best results all the way. It is the ability of IMACO to avoid the stagnation situation and improves its solutions with the time. This comes from the kind of interaction used between ant colonies and the type of information used by ants when making their decision. The proposed interaction plays on two directions which are cooperation and diversification. Pheromone evaluation mechanism plays the main role in cooperation. Pheromone evaluation was the mean to combine the pre-acquired information about the quality of the solutions represented as pheromone values. Average pheromone evaluation was the best technique that puts IMACO-AVG in front of other state-of -the-art ant algorithms. Pheromone evaluation needs a high support from other mechanisms. On the other hand, letting different colonies works with different q or different levels of exploration / exploitation was of great aid in achieving diversification. Some colonies prefer a higher exploration while others prefer a higher exploitation. This provides the whole search process with a wide range of good solution that ants of different colonies choose their best solution from.

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NANO-SATELLITE ATTITUDE CONTROL SYSTEM BASED ON ADAPTIVE NEURO-CONTROLLER

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ABSTRACT. The current research focuses on designing of an intelligent controller for attitude control system (ACS) of nano-satellite. The nano-satellite namely Innovative Satellite (InnoSAT) was organized by Agensi Angkasa Negara (ANGKASA) to attract the interest of Malaysian universities in satellite development. In this study, an intelligent controller based on Hybrid Multi Layered Perceptron (HMLP) network was developed. The network used model reference adaptive control (MRAC) system as a control scheme to control a time varying systems where the performance specifications are given in terms of a reference model. The Weighted Recursive Least Square (WRLS) algorithm will adjust the controller parameters to minimize error between the plant output and the model reference output. The objective of this paper is to analyze the tracking performance of ANC based on HMLP network and ANC based on standard MLP network for controlling a satellite attitude. The simulation results indicate that ANC based on HMLP network gave better performance than ANC based on standard MLP network.

Keywords: Intelligent controller, Hybrid Multi Layered Perceptron, nano-satellite

INTRODUCTION

Small satellites become more popular in the last few decades due to their relative simplicity resulting in an attractive short period of design and in low cost (Bushenkov, 2002 & Martinelli & Pena, 2005). Beginning in 1999, California Polytechnic State University and Stanford University developed the CubeSat specifications to help universities worldwide to perform space science and exploration. A CubeSat is a type of miniaturized satellite for space research that usually has the size of 10cm x10cm x10cm, volume of exactly 1 liter, weighs no more than 1 kilogram, and typically uses commercial, off-the-shelf electronics components (Gregory, 2004). InnoSAT consists of a few CubeSats stacked together, which carries a few payloads designed by Astronautic Technology Sdn. Bhd. (ATSB) and Malaysian Universities. Attitude Control System (ACS) is part of the attitude determination and control system payload. The ACS fully operates as a three-axis attitude stabilization control system. Attitude refers to the coordinate for satellite movement in space where the coordinate are the data for x, y and z axes. The data are the main information to evaluate the movement of the satellite (Yaakop *et al*., 2009). The usual ACS used in small or large satellites includes several kinds of sensors, actuators and an on-board computer that processes the data through a control algorithm (Martinelli & Pena, 2005).

In satellite attitude control system, a few approaches have been developed by using neural network (Krishnakumar *et al*., 1995; Hao *et al*., 2004; Talebi & Patel, 2005; & Sivaprakash & Shanmugam, 2005). A development of an intelligent real time control system based on neural network is possible for the satellite in space that is exposed to non-probabilistic uncertainties

such as sun flare and time dependant noises in measurement (Zak, 2003).A few comparisons performance have been done between adaptive neuro-controller based on HMLP network and other controllers. The results show that ANC based on HMLP network give significant improvement in the performance of controlling unstable system (Sharun *et al*., 2010a; Sharun *et al*., 2010b & Sharun *et al*., 2010c). In this current study, the advantages of HMLP network and the WRLS algorithm are combined to improve the performance of tracking control technique in varying operating conditions such as noise, varying gain and disturbance torques.

MODEL OF SATELLITE

Since InnoSAT model is dealing with second-order systems, some damping control must also be provided to improve stability. Thus the control torques will have to include a term that is dependent on the attitude rates to be measured or estimated. The control torques to be activated is always a function of the attitude errors. The simplest torque control law is based on Euler angle errors. For a satellite with a diagonal inertia matrix and small Euler angle rotations, the attitude dynamic equations can be approximated as (Sidi, 2001):

$$\left.\begin{aligned} T_{dx} + T_{cx} &= I_x\ddot{\emptyset} \\ T_{dy} + T_{cy} &= I_y\ddot{\theta} \\ T_{dz} + T_{cz} &= I_z\ddot{\varphi} \end{aligned}\right\} \quad (1)$$

The Euler angles $\emptyset$, θ and φ are defined as the rotational angles about the satellite body axes: $\emptyset$, about the X axis; θ, about the Y axis; and φ, about the Z axis. The term ω_o represents the orbital angular velocity of the satellite. $T_c's$, are control moments to be used for controlling the attitude motion of the satellite; and $T_d's$, are those moments due to different disturbing environmental phenomena. I_x, I_y and I_z are the moments of inertia for satellite body. These are second order linear differential equations of the Eulers angles. The Laplace Transform of the Roll, Pitch and Yaw axes from Eq. 1 are given by:

$$\left.\begin{aligned} s^2\emptyset_{(s)} - s\emptyset_{(0)} - \dot{\emptyset}_{(0)} &= \frac{T_{dx}}{I_x} + \frac{T_{cx}}{I_x} \\ s^2\theta_{(s)} - s\theta_{(0)} - \dot{\theta}_{(0)} &= \frac{T_{dy}}{I_y} + \frac{T_{cy}}{I_y} \\ s^2\varphi_{(s)} - s\varphi_{(0)} - \dot{\varphi}_{(0)} &= \frac{T_{dz}}{I_z} + \frac{T_{cz}}{I_z} \end{aligned}\right\} \quad (2)$$

The Euler angles and their derivatives with subscript 0 represent the initial conditions of the satellite attitude about its equilibrium position. For InnoSAT, the initial angles for all axes $(\emptyset_{(0)}, \theta_{(0)}, \varphi_{(0)})$ are assumed to be zero. Consequently, the transfer function of InnoSAT model for Roll, Pitch and Yaw axes equation are simplified as Eq. 3:

$$\left.\begin{aligned} \emptyset_{(s)} &= \left[\frac{T_{dx}}{I_x} + \frac{T_{cx}}{I_x} + \dot{\emptyset}_{(0)}\right]/s^2 \\ \theta_{(s)} &= \left[\frac{T_{dy}}{I_y} + \frac{T_{cy}}{I_y} + \dot{\theta}_{(0)}\right]/s^2 \\ \varphi_{(s)} &= \left[\frac{T_{dz}}{I_z} + \frac{T_{cz}}{I_z} + \dot{\varphi}_{(0)}\right]/s^2 \end{aligned}\right\} \quad (3)$$

DESIGN SCHEME OF ADAPTIVE NEURO-CONTROLLER

Model Reference Adaptive Control System

Mashor (2007) proposed the model reference adaptive control (MRAC) system as shown in Figure 1. In this MRAC, a reference model is chosen to generate the desired output trajectory and to ensure the output of the controlled system tracking the desired reference output. In order to achieve desired system performance in the sense of the closed-loop stability, adaptive laws are used to update the controller parameter.A stable linear continuous-time reference model is specified by the following differential equation (Mashor, 2007):

$$y_m(t) = a_{m_1}y_m(t-1) - a_{m_2}y_m(t-2) + b_{m_0}r(t-1) + b_{m_1}r(t-2) \quad (4)$$

where $r(t)$ is the reference input and $y_m(t)$ is the reference model output; $a\ and\ b$ are fixed

model parameters and their values are chosen for any desired stable response, which is the controlled system is expected to acquire. The model following error is defined by:

$$e(t) = y_m(t) - y_p(t) \quad (5)$$

where $y_p(t)$ is the output plant.

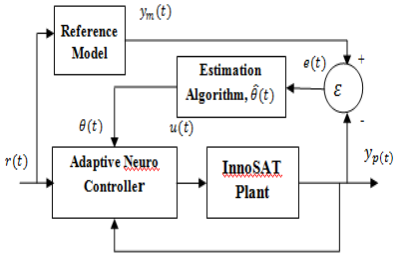


Figure 1. Block diagram of a model reference adaptive control (MRAC) system.

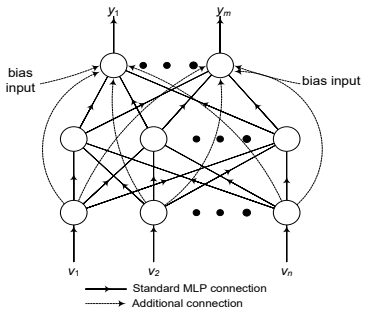


Figure 2. One_hidden_layer HMLP network

Hybrid Multi Layered Perceptron Network

Hybrid Multi Layered Perceptron (HMLP) network has been proposed by Mashor (2000). It has been selected as the basis for the ANC in this current study. A HMLP network with one hidden layer is shown in Figure 2.The network allows the network inputs to be connected directly to the output nodes with some weighted connections to form a linear system (dotted line connections) in parallel with the original nonlinear system from the standard MLP model (continuous line connection). These additional linear input connections do not significantly increase the complexity of the MLP network since the connections are linear. Simple RLS algorithm will be used to train the network since the parameters of the network appeared linearly within the network model. In this paper, both controllers used weighted recursive least square (WRLS) algorithm as a mechanism to adjust the controller parameters. Detail explanations about WRLS algorithm could be found in (Astrom, 1995).

The HMLP network with one hidden layer can be expressed by the following equation:

$$\hat{y}_k(t) = \sum_{j=1}^{n_h} w_{jk}^2 F\left(\sum_{i=1}^{n_i} w_{ij}^1 x_i^0(t) + b_j^1\right) + \sum_{i=0}^{n_i} w_{ik}^l x_i^0(t); \quad (6)$$

$$for\ 1 \le j \le n_h\ and\ 1 \le k \le m$$

where w_{ij}^1, w_{jk}^2 and w_{ik}^l denote the weights in the first layer, weights in the second layer and weights of extra linear connections between the input and output layer, respectively; b_j^1 and x_i^0 denote the thresholds in the hidden nodes and inputs that are supplied to the input layer respectively. The number of output node, inputs nodes and hidden nodes are represented by m, n_i and n_h respectively. $F(\cdot)$ is an activation function that is normally selected as a sigmoid function:

$$F\big(v(t)\big) = \frac{1}{1+e^{-v(t)}} \quad (7)$$

The weight w_{ij}^1, w_{jk}^2 and w_{ik}^l and threshold, b_j^1 are unknowns and should be selected to minimize the prediction error, define as:

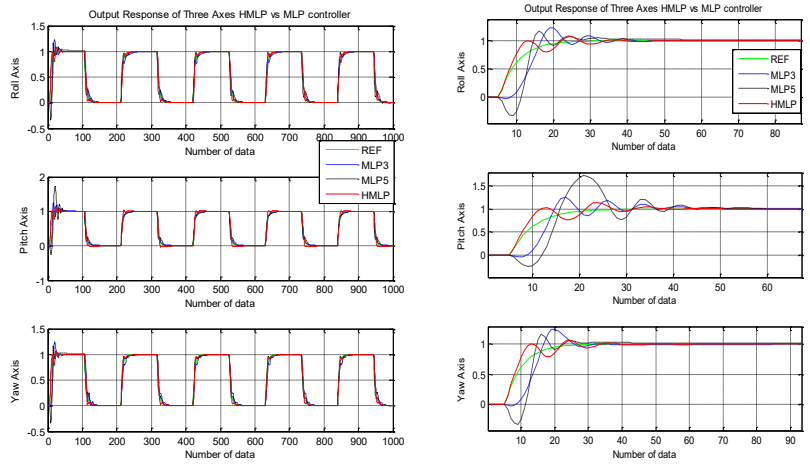
$$\varepsilon_k(t) = y_k(t) - \hat{y}_k(t) \quad (8)$$

where $y_k(t)$ and $\hat{y}_k(t)$ are the actual and the network output.

RESULTS AND DISCUSSIONS

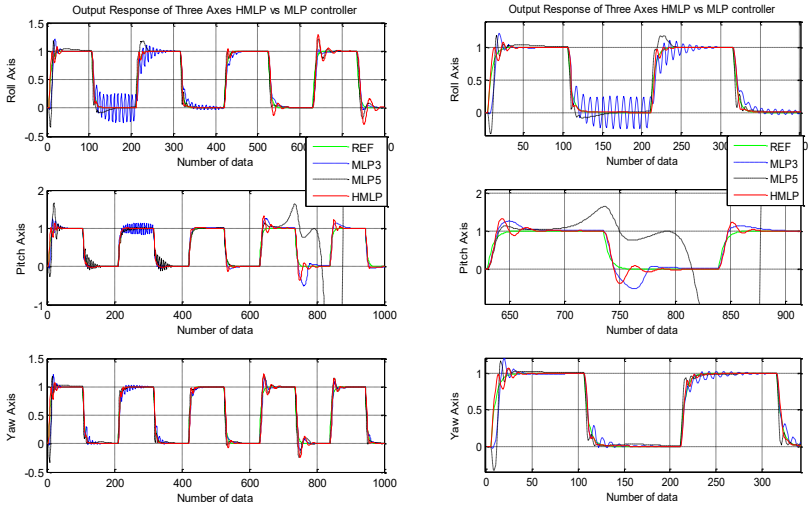
With the same number of input, hidden and output nodes, the HMLP network will have extra weights that are equal to the number of input nodes. Equation for calculating number of weight can be referred to Mashor (2000). To be fair for this ANCs comparison, the MLP network with extra hidden node is also considered. Therefore, HMLP network will be assigned to have 3 hidden nodes whereas MLP network with 5 hidden nodes is also considered for comparison. So that, HMLP network with 3 hidden nodes (HMLP) will have 35 weights, MLP network with 3 hidden nodes (MLP3) will have 27 weights and MLP with 5 hidden nodes (MLP5) will have 45 weights. Thus, in this ANCs comparison the MLP network with 5 hidden nodes will have extra weight over the HMLP network with 3 hidden nodes.

By referring to Figure 3(a), the output response at unity gain for all axes shows that the ANC controllers can track smoothly the model reference. However, MLP controllers possess delay time and undershoot which make it taking longer time to converge as shown in Figure 3(b). Figure 4(a) and (b) shows the output response of ANC controllers at varying gain where HMLP controller asymptotically follows the desired response at the high gain but degrades with small oscillations at the low gain. Meanwhile, output response of MLP controllers is even worst especially for Pitch axis where it has divergence output response. Figure 5 shows the response of the system when a step disturbance was introduced between 300s and 600s. Output response from HMLP controller for all axes is better than output response from the MLP controllers because it able to converge in a shorter time after disturbance. Meanwhile, MLP controllers have divergence output response for Roll and Yaw axes.



(a) **(b)**

Figure 3. (a) Output response of ANC's controller with unity gain. (b) After they have been zoomed.



(a) **(b)**

Figure 4. (a) Output response of ANC's controller with varying gain. (b) After they have been zoomed.

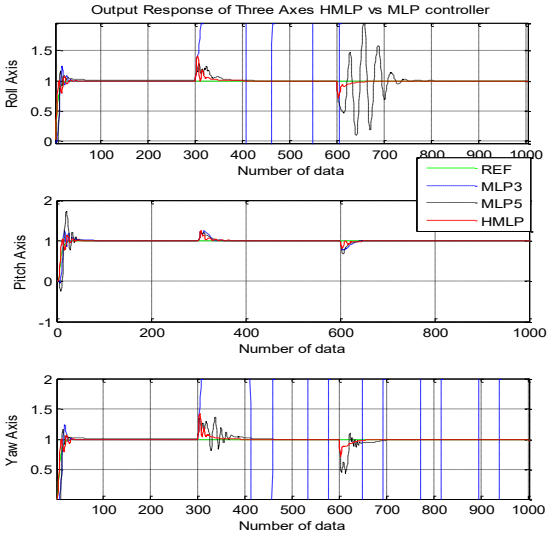


Figure 5. Output response of ANC's controller with step disturbance

CONCLUSIONS

On the above analyzing, simulation results of ANC based on HMLP network and ANC based on standard MLP network are compared for satellite attitude control of InnoSAT plant. The comparison is based on the capability of the controlled output tracking the model

reference. The simulated data were used for the comparison. From Figure 3 to 5, it is observed that performance of the HMLP controller was improved from both MLP controllers in terms of tracking the model reference output. The simulation results signify that the ANC based on HMLP network is sufficient to control the plants with unpredictable conditions and disturbances. It was observed that ANC based on HMLP network is controllable and more stable than standard MLP network with more hidden nodes.

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IMPROVED WEB PAGE RECOMMENDER SYSTEM BASED ON WEB USAGE MINING

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ABSTRACT. Web now becomes the backbone of the information. Today the major concerns are not the availability of information but rather obtaining the right information. Mining the web aims at discovering the hidden and useful knowledge from web hyperlinks, contents or usage logs. This paper focuses on improving the prediction of the next visited web pages and recommends them to the current anonymous user by assigning him to the best navigation profiles obtained by previous navigations of similar interested users. To represent the anonymous user's navigation history, we used a window sliding method with size *n* over his current navigation session. Using CTI dataset the experimental results show higher prediction accuracy for the next visited pages for anonymous users compared to previous recommendation system.

Keywords: web mining, web page recommender

INTRODUCTION

Web mining aims to discover useful information or knowledge from Web hyperlinks, page contents, and usage logs (Liu, 2007). Yet an important problem is how to mine complex data formats including Image, Multimedia, and Web data (Yang & Wu, 2006). Based on the primary kinds of data used in the mining process, Web mining tasks can be categorized into three main types: Web structure mining, Web content mining and Web usage mining (Liu, 2007). Web structure mining discovers knowledge from hyperlinks, which represent the structure of the Web. Web content mining extracts useful information/knowledge from Web page contents. Web usage mining (WUM) mines user access patterns from usage logs, which record clicks made by every user. Fig.1 shows the web usage mining recording process of the users' browsing activities either from direct client-server browsing or proxy-server browsing in terms of IP address, date, method, file required, protocol, browser types,… et which stored at the web server logs files. The output of the WUM is some patterns that may be the input to the Recommendation systems Engine which is one of the application areas of the Web usage gives the ability to predict the next visited page for a given user.

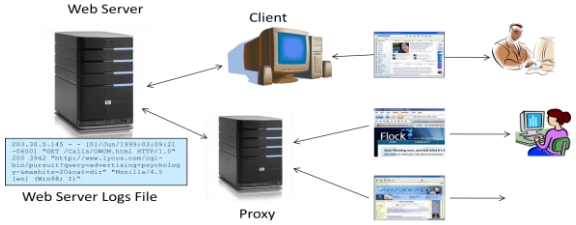

Figure 1. Web Usage Mining Recording Process of the users' browsing Activities

Related works

Recently, many researches tried to improve the prediction accuracy of the recommendation systems. (Mobasher, Cooley, & Srivastava, 2000; Nakagawa & Mobasher, 2003) , presented WebPersonalizer a system which provides dynamic recommendations, as a list of hypertext links, to users. (Mobasher, Dai, Luo, & Nakagawa, 2002) presented and experimentally evaluate two techniques, based on clustering of user transactions and clustering of pageviews, in order to discover overlapping aggregate profiles that can be effectively used by recommender systems for real-time Web personalization. (Zhou, Hui, & Chang, 2004) proposed an intelligent web recommender system known as SWARS (Sequential Web Access based Recommender System) that uses sequential access pattern mining. (Liu & Kešelj, 2007) proposed a novel approach to classifying user navigation patterns and predicting users' future requests based on the combined mining of Web server logs and the contents of the retrieved web pages. (Baraglia & Silvestri, 2004) (Baraglia & Silvestri, 2007) proposed a WUM system called SUGGEST, that provide useful information to make easier the web user navigation and to optimize the web server performance. (Cornelis, Lu, Guo, & Zhang, 2007) developed a conceptual framework for recommending one-and-only items. It uses fuzzy logic, which allows to reflect the graded/uncertain information in the domain, and to extend the CF paradigm, overcoming limitations of existing techniques. A possible application in the context of trade exhibition recommendation for e-government is discussed to illustrate the proposed conceptual framework. (Jalali, Mustapha, Sulaiman, & Mamat, 2010) Proposed WebPUM, a recommender system based on Common Sequences algorithm (LCS). (AlMurtadha, Sulaiman, mustapha, & Udzir, 2010) proposed a method for Learning and mining the web navigation profiles to provide an appropriate model to recommend to the anonymous user. (Castellano, Fanelli, & Torsello, 2011) presented NEWER as a usage-based Web recommendation system that exploits the potential of Computational Intelligence techniques to dynamically suggest interesting pages to users according to their preferences. (Almurtadha, Sulaiman, Mustapha, & Udzir, 2011) Presented iPACT an improved recommendation system using Profile Aggregation based on Clustering of Transactions

The Methodology

As shown in Fig.2, the proposed architecture consists of two main components, namely the offline and online. In the offline component tow three important processes are taken. First, preprocess the web server logs by allying data cleaning techniques and then partition the web navigations into sessions determined by the period of browsing. Second, partition the filtered sessionized page views into clusters of use's navigation patterns with similar pageviews browsing activities using K-mean algorithm. Finally, generate web navigation profiles based on the preformed clusters. The online component does the matching of the new anonymous user request (current active session) to the profile shares common interests to the user. The details will be discussed in the following sections.

This study used the clusters produced by the clustering step (previous step) to build the usage or the navigation profile with one profile for each cluster. The navigation profile contains only those web pages that passed certain confidence support and weights values. The confidence support determines the frequency occurrence on those pages in the cluster. These profiles don't consider specific users since this study don't take the users history in account during obtaining the profiles. To summarize we construct a navigation profile as a set of pageview-weight pairs:

$$profile = \{ p, weight(p) \mid p \in P, weight(p) \geq min\_weight \}.$$

where $P = \{p1, p2, \ldots, pn\}$, a set of n pageviews appearing in the transaction file with each pageview uniquely represented by its associated URL and the weight(p) is the (mean) value of the attribute's weights in the cluster. Fig.3 shows a navigation profile Database snapshot of

two profiles obtained for two clusters 1 and 2 where each profile contains related page views. For example, profile 1 represents the activity of a user interested in the courses and the programs offered while profile 2 represents the activity of a user interested in the pageviews related to the admission and advising.

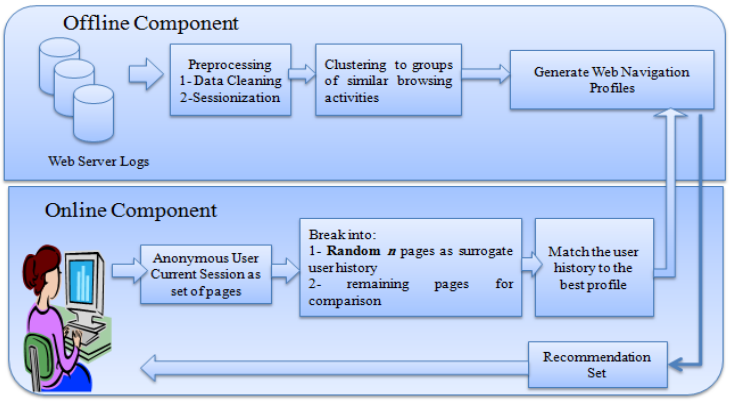

Figure 2. the Proposed Architecture Overview

When the user navigates the internet, the web server will start to keep his logs on a file. This file can be accessed to extract the current active navigation web pages called the Active Session. Using this active session, the online component is responsible for assigning this user activities to the best navigation profile where by a recommendation list is to be created and attached to the user navigation list. A statistical analysis for the matching purpose was used in this study. Since the active session and the choose profile can be represented as vectors; the cosine coefficient commonly used in information retrieval was used to do the matching purpose (Mobasher, et al., 2002). A recommendation score is computed for those items not already visited by the user in the active session in order to recommend them based on their scores.

$$\text{RecScore} = \sqrt{[\text{PageWeight} * \text{ProfileMatch}]} \quad (1)$$

Two factors are used in determining this recommendation score: the overall similarity of the active session to the profile as a whole, and the average weight of each item in the profile computed during obtaining the profiles (offline component).

Results and Discussion

Experimental Setup

Based on the proposed Architecture, a recommendation system is developed using Microsoft VC++ connected to Microsoft Access database through an Open Database Connection (ODBC). We used CTI dataset which contains 13745 sessions with 683 pageviews for the experiments with 70% for training and 30% for testing. We used the precision, coverage and F1 In order to evaluate the recommendation effectiveness. Assume that we have active current session A taken from the evaluation set and we have R as a recommendation set using the prediction engine over the navigation profiles. W represents the items that already visited by the user in A. The precision is defined as:

$$\text{Precision}(R, A) = \frac{|R \cap (A - w)|}{|R|}$$

the coverage is defined as $\text{coverage}(R, A) = \frac{|R \cap (A - w)|}{(A - w)}$

Finally, the harmonic mean of both is defined as $F1(R, A) = \frac{2 \times \text{Precision}(R, A) \times \text{coverage}(R, A)}{\text{Precision}(R, A) + \text{coverage}(R, A)}$

Evaluation of the recommendation Accuracy

Since the current user is anonymous to the recommender system with no previous navigation history, hence a sliding window technique over the current user session was used to represent the user history. To do so, the user current session is broken into two parts; the first part with size *n* pages is used as the surrogate user history which is matched against the web navigation profiles then produces a recommendation list from the selected profile. The remaining pages form the second part which is used for the comparison purpose to evaluate the recommendation accuracy. we used a window size equal to 2 to represent the surrogate user history and the rest pages are used for the evaluation purpose. Figures 3,4 and 5 relate the recommendation effectiveness for our system compared to the findings of previous methods namely, PACT and Hypergraph (Mobasher, et al., 2002). With a recommendation score's threshold varies from 0.1 to 1.0, the F1 measurement as a performance evaluation shows that our system performs better and achieves higher prediction accuracy. This improvement is due to the mining processes applied to the extracted navigation profiles by the offline component followed by a better classification of the current user to the best web navigation profiles.

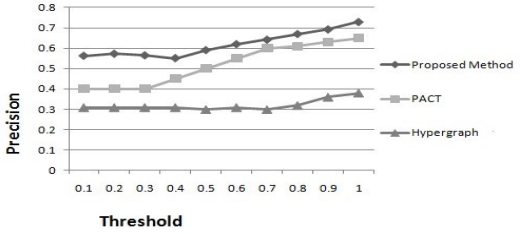

Figure 3. Precision Accuracy with Window Size=2

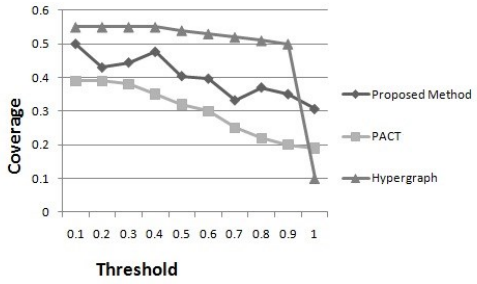

Figure 4. Coverage with Window Size=2

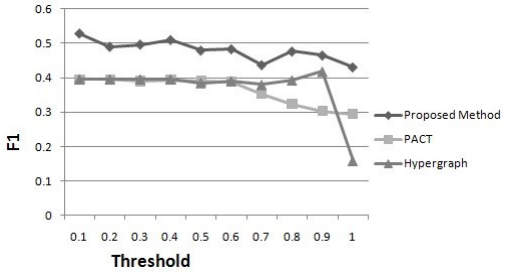

Figure 5. F1 Recommendation Measurement with Window Size=2

Conclusion and Future Works

The ability of predicting the next visited pages and recommending it to the user is highly recommended specially in e-commerce applications. This study proposed a recommender system to predict the anonymous user next navigation by assigning the user to the best web navigation profiles for similar interested users. The results showed higher prediction accuracy. Rebuilding the profiles is a time consuming process. Adaptive profiles are one of the future interests.

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GRID LOAD BALANCING USING ENHANCED ANT COLONY OPTIMIZATION

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ABSTRACT. This study presents a new algorithm based on ant colony optimization for load balancing management in grid computing. The concentration is on improving the way ants search the best resources in terms of minimizing the processing time of each job and at the same time balancing the workload on available resources. An enhanced technique is proposed for the pheromone update activities. Single colony of ants is used for searching the best resources to process jobs. The credibility of the proposed algorithm was tested with other load balancing algorithm and results showed that the proposed algorithm was able to balance the load on the resources.

Keywords: grid load balancing, ant colony optimization, resource utilization

INTRODUCTION

Load balancing is one of the main issues in grid resource management besides resource discovery, resource scheduling, resource monitoring, resources inventories and resource provisioning (Sharma and Bawa, 2008). Scheduling algorithm is a main part of the load balancing algorithm. A good scheduling algorithm influences the balancing of each resource in grid computing system. Scheduling algorithms are classified into static and dynamic algorithms. In static scheduling, decisions are made at compile time while in dynamic scheduling, jobs are allocated at runtime and decisions are made by using the system-state information.

The job scheduling problem is defined as Nondeterministic Polynomial (NP)-complete problem (Ibarra and Kim, 1977; Yagoubi and Slimani, 2007) which means that there is no exact algorithm that can solve them in a polynomial time (Blum and Roli, 2003). The only way to solve these problems is to use approximate (heuristic) algorithms such as Genetic Algorithm (GA), Simulated Annealing (SA), Tabu Search and recently Ant Colony Optimization (ACO). ACO algorithm is used in grid computing because it is easily adapted to solve both static and dynamic combinatorial optimization problems. There are various types of ACO algorithm such as Ant Colony System (ACS), Max-Min Ant System (MMAS), Rank-Based Ant System (RAS) and Elitist Ant System (EAS) (Dorigo and Stützle, 2004).

The study to improve ant algorithm for dynamic job scheduling in grid computing which is based on the basic idea of ACS was proposed by Yan et al. (2005). The pheromone update function in this research was performed by adding encouragement, punishment coefficient and load balancing factor. The initial pheromone value of each resource was based on its status where job was assigned to the resource with the maximum pheromone value. The strength of pheromone of each resource was updated after completion of the job. The encouragement and punishment and local balancing factor coefficient were defined by users and were used to update pheromone values of resources. If a resource completed a job successfully, more pheromone was added by the encouragement coefficient in order to be selected for the next job execution. If a resource failed to complete a job, it was punished by

adding less pheromone value. The load of each resource was taken into account and the balancing factor was also applied to change the pheromone value of each resource.

Balanced job assignment based on ant algorithm for computing grids called BACO was proposed by Chang et al. (2007). The research aimed to minimize the computation time of job executing in Taiwan UniGrid environment which also focused on load balancing factors of each resource. By considering the resource status and the size of the given job, BACO algorithm chose optimal resources to process the submitted jobs. From the experimental results, BACO was capable of balancing the entire system load regardless of the size of the jobs in the static scheduling environment.

Load balancing in non-dedicated grids using ACO was proposed by Chen (2008). The proposed static algorithm was based on ACO algorithm in solving the load balancing problem in grid computing system. In the algorithm, the efficiency of the resources was maintained by immigrating jobs from overloaded resources to under loaded resources. Experimental results showed that the proposed algorithm performed better than the other algorithms in terms of makespan and resource usage. However, the proposed algorithm did not consider the requirement of each submitted jobs and the capacity of resources which might effect its performance.

In Moallem and Ludwig (2009), two distributed artificial life-inspired algorithms were introduced, which are ACO and PSO in solving the static grid load balancing problem. Distributed load balancing are categorized as a robust algorithm that can adapt to any topology changes in a network. In the proposed algorithm, an ant acted as a broker to find the best node in terms of the pheromone value stored in the pheromone table. The node with the lightest load was selected as the best node. The position of each node in the flock could be determined by its load in PSO. The particle compared the load of nodes with its neighbors and moved towards the best neighbor by sending assigned jobs to it. The proposed algorithm performed better than ACO for job scheduling where jobs were submitted from different sources and different time intervals. PSO showed better results than ACO in terms of the makespan. However, PSO used more bandwidth and communication compared to ACO.

ACO algorithm for dynamic load balancing in distributed systems through the use of multiple ant colonies was proposed by Ali et al. (2010). In this study, information on resources was dynamically updated for each ant movement. Multiple ant colonies were adopted such that each node sent a coloured colony throughout the network. Colored ant colonies were used to prevent ants of the same nest from following the same route and also force them to be distributed all over the nodes in the system. Each ant acted like a mobile agent which carried newly updated load balancing information to the next node. This approach did not consider resources capacity and jobs characteristics, thus matching of jobs with best resources a difficult task. Ant based algorithm was also introduced by Ku-Mahamud and Nasir (2010) for dynamic scheduling of jobs in grid system. The performance of the proposed ant based algorithm in terms of job computational time was found to be better than the ant based algorithm proposed by Moallem and Ludwiq (2009). In this study an enhanced ant based algorithm called EACO is proposed in balancing the load in the grid system. The enhancement will focus on the current status of the resources when scheduling new submitted jobs. This was not considered in the work by Ku-Mahamud and Nasir (2010).

THE PROPOSED FRAMEWORK

The proposed framework which is an enhancement of Ku-Mahamud and Husna (2010) consists of three mechanisms which are initial pheromone value mechanism, resource selection mechanism and pheromone updating mechanism that are used to organize the work of an ant colony (refer Figure 1).

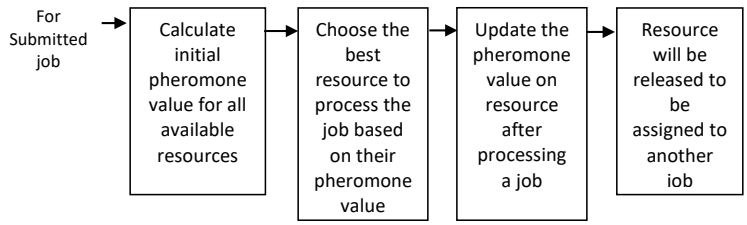

Figure 1. EACO framework

The initial pheromone value is calculated by considering the jobs characteristics and the capacity of resources. The resource selection mechanism is performed when ants try to search a new solution. However, this should be done under certain control to avoid exploring a very wide area of search space that might be far from the optimal solution. On the other hand, an exploitation of the search history is necessary to search the previously good solution. However, very strong exploitation is not required in order to prevent the stagnation problem of certain resources. The pheromone updating mechanism is also considered in this proposed framework. The global pheromone update mechanism is done after finishing processing a job. The best ant will deposit an amount of pheromone on its own nodes during the global pheromone update mechanism.

PROPOSED LOAD BALANCING ALGORITHM

The proposed EACO algorithm consists of 5 steps as below:

i. Obtain job requirements.
ii. Create an ant for the job.
iii. Calculate the initial pheromone value for all the resources.
iv. Assign resource with highest pheromone to the job.
v. Perform global pheromone update after complete processing the job.

In the first step, the scheduler will record details of the job size and CPU time needed by the job. Then an ant to represent a job in the grid system is created for every job that is submitted to the system. The task for the ant is to move from one resource to another with the aim to evaluate the best resource to be assigned to the job. Pheromone value on a resource indicates the capacity of each resource in grid system. In the third step, the initial pheromone value for each resource for each job is calculated based on the estimated transmission time and execution time of a given job when assigned to this resource. The estimated transmission time can be determined by $\frac{S_j}{bandwidth_r}$ where S_j is the size of a given job j and $bandwidth_r$ is the bandwidth available between the grid resource broker and the resource. The initial pheromone value is defined by:

$$PV_{rj} = \left[\frac{S_j}{bandwidth_r} + \frac{C_j}{MIPS_r * (1 - load_r)} \right]^{-1} \quad (1)$$

where PV_{ij} is the pheromone value for job j assigned to resource r, C_j is the CPU time needed of job j, $MIPS_r$ is the processor speed of resource r and $1-load$ is the current load of resource r. It is assumed that the load, processor speed and bandwidth can be obtained from grid information server. Pheromone value will be stored in a table called pheromone Value

Table (PVT) as a reference to the other ants. The ant decides which resource to choose in its next step by looking at the PVT. The largest entry will be selected as the best resource to process the corresponding job.

In the final step of the algorithm, global pheromone update is performed to recalculate the all the values in PVT when a job is completely processed. After all ants have constructed a solution, the pheromone value is updated according to the following formula:

$$PV_{rj}(t+1) = (1-\rho).\tau_{rj} + 1/(\rho\Delta\tau_{rj}^{bs}) \quad (2)$$

where $\Delta\ \tau_{rj}^{best} = 1/L^{best}$ and ρ is the evaporation rate value that adaptively change with grid condition. The evaporation rate value is defined by:

$$\rho = \left[(R/J) * 0.45^{n} * (J/R)\right] + 0.05 \quad (3)$$

where R is the number of resource, J is the number of job and n is defined by:

$$n = \sqrt[3]{(J/R) - 1} \quad (4)$$

The ant which is allowed to add pheromone may be the iteration-best solution or global best solution. If a specific resource is often used in the best solution, it will receive a larger amount of pheromone and stagnation will occur. The effect of the global pheromone update is to make an already chosen resource less desirable for the following ant (Dorigo et al., 1991). So, the exploration of not yet visited resource is increased. Once the job is finished, the resource will be released to be used by other jobs.

EXPERIMENTAL RESULTS

The performance of EACO algorithm was compared with Antz algorithm (Moallem and Ludwiq, 2009) in terms of resource utilization. Standard deviation in workload distribution is often taken as the performance measure of a load balancing algorithm. A good load balancing scheme is indicated by a smaller standard deviation value. The utilization of each resource in grid system is dependent on the number of jobs which are assigned to the machine by the grid scheduler and the power of its processing elements. The total utilization percentages of all resources are supposed to be 100% for each experiment. The utilization of each resource can be calculated by

$$Utilization = \frac{total\quad busy\quad time}{total\quad time\quad process\sin g\quad all\quad jobs}$$

In the experiments, each resource is assumed to consist of one machine and each machine may have one or several processors known as processing elements (PEs) ranging between 1 and 5. The speed of processor or computational power is defined by the number of Cycles per Unit Time. As the processors in each machine can be heterogeneous, so, they may have different processing power and in this study, the processing power of each PE is 10 or 50 MIPS. The bandwidth is set to either 1000 or 5000 bits/sec. The length of each job is presented in MIPS and each job has different input and output size requirements as depicted in Table 1.

Table 1. Jobs Characteristics.

Length	0 – 50000 MI
File Size	100 + (10% to 40%)
Output Size	250 + (10% to 50%)

Both algorithms were tested with exactly the same scheduling parameters such as the number of jobs, number of resources, number of machines per resource, number of PEs per machine, PE ratings, bandwidth, size of jobs, and CPU time needed by each job.

The first experiment was conducted with 10 resources to process 500 jobs. Result of the experiment is shown in Figure 1. The standard deviation for EACO algorithm is 0.24781421 while the standard deviation for Antz algorithm is 3.6131422. The utilization of resources when EACO algorithm is applied does not varies as much as when Antz algorithm is used.

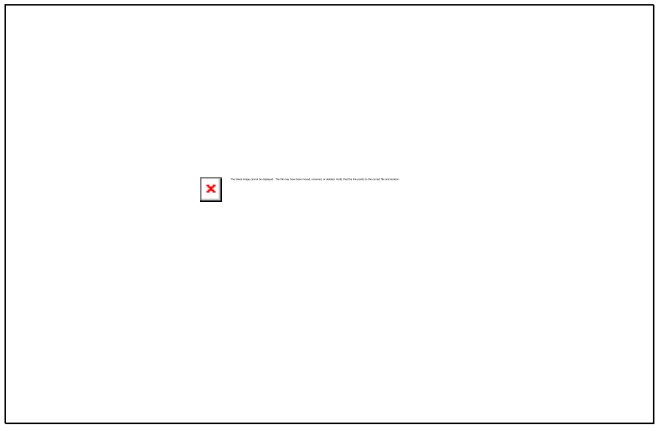

Figure 1. Utilization of 10 resources in processing 500 jobs by using EACO algorithm and Antz algorithm.

The second experiment was conducted to determine the utilization of each resource in processing 1000 jobs with 10 resources. Experimental results also showed that EACO algorithm was better than Antz algorithm as the standard deviation for EACO algorithm is 0.28084636 and the standard deviation for Antz algorithm is 2.77428296 (refer Figure 2). These results showed that the EACO algorithm successfully balanced the load among large number of resources.

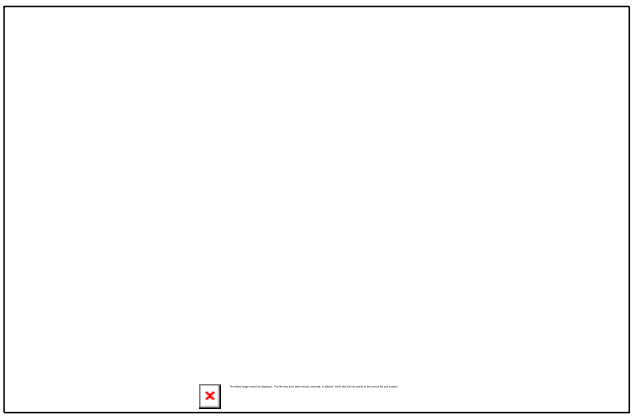

Figure 2. Utilization of 10 resources in processing 1000 jobs by using EACO algorithm and Antz algorithm.

The above experimental results showed that EACO performed better than Antz algorithm in terms of resource utilization. EACO algorithm has successfully scheduled the jobs among resource in all conditions which leads to a balanced load network.

CONCLUSION

The research output is a new member of the ACO family that offers the chance to enhance the performance in terms of utilization of available ACO algorithms on load balancing algorithms. The new proposed algorithm enhances the classical approach of ACO algorithm by minimizing the computational time of each job and dynamically schedule submitted jobs to suitable resources. At the same time, it balanced the entire resources. This is expected as the EACO algorithm keeps track of the state of all resources at each point in time which makes it able to make more optimal decisions each time when new jobs are submitted.

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LOCAL SEARCH MANOEUVRES RECRUITMENT IN THE BEES ALGORITHM

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ABSTRACT. Swarm intelligence of honey bees had motivated many bio-inspired based optimisation techniques. The Bees Algorithm (BA) was created specifically by mimicking the foraging behavior of foraging bees in searching for food sources. During the searching, the original BA ignores the possibilities of the recruits being lost during the flying. The BA algorithm can become closer to the nature foraging behavior of bees by taking account of this phenomenon. This paper proposes an enhanced BA which adds a neighbourhood search parameter which we called as the Local Search Manoeuvres (LSM) recruitment factor. The parameter controls the possibilities of a bee extends its neighbourhood searching area in certain direction. The aim of LSM recruitment is to decrease the number of searching iteration in solving optimization problems that have high dimensions. The experiment results on several benchmark functions show that the BA with LSM performs better compared to the one with basic recruitment.

Keywords: Bees algorithm, local search manoeuvres, recruitment strategy, neighbourhood search, benchmark test function

INTRODUCTION

Pham, Ghabarzadeh, et al. (2006) created The Bee Algorithm mimicking the foraging behaviour of honey bees when they are searching for foods around the bee hives. The Bees Algorithm had been used to test the benchmark function optimisation as their first experiment. In the first version of the algorithm, the authors did not mention about the possibility recruits lost during locating the food advertised food source. This paper studies the behaviour of honey bees when she tries to locate the food source after being recruited. The next step is to enhanced The Bees Algorithm basic version mimicking the lost bees. After that, the performance of the proposed enhancement to the optimisation of test function (Pham, Ghanbarzadeh et al. 2009) is proposed and investigating the behaviour of recruits when she try to locate the food source. The study is important for one reason, to examine the recruit's effort locate the food source.

Another interesting behaviour of recruits is when they cannot find the food source as advertised by dancer's bees; she will decide to continue searching or get more information in the hive. During the flight return, recruits sometimes did use the different flight path. This factor motivates the study to investigate the reason of different flight path. Another new motivation factor can be incorporated in optimisation process is recruits will take some times when they failed to locate the food source. Sometimes the duration is up to 20 minutes. Recruits will fly beyond the feeding station if they can't found the food source before return back to the hive. This means they will try harder to locate the food source. The recruit's

behaviour will be integrated in an existing Bees Algorithm and try to find another alternative and an option to optimise high dimension problem.

A few experiment benchmark test function are undertaken in this study that is based on (Pham, Ghanbarzadeh et al. 2006). The main contributions of the paper is Enhanced the Bees Algorithm inspired by recruits effort to locate the food source after joined the waggle dance.

The paper is organised as follow; Section 2 explain the behaviour of honey bees during locating the food sources and followed by Section 3, which describe the test for LSM recruitment in the BA to the benchmark test function. Section 4 presents the result and finally section 5 concludes all the sections of the study.

LSM RECRUITMENT

Learning Process of the Bees in the Nature

The study will begin by explaining on how the new idea mutates the natural behaviour of recruits. Seeley (1983) has done an experiment to check the bees behaviour including recruits searching time, recruits cannot find the food source, recruits search beyond the feeding station and recruits return with a different flight path.

Seeley (1983) also discover that food source found by recruits is more profitable and it's worth to return back to that food source compare found by scouts. Most of the recruits did not find food source at their first attempt. Normally they need to be guided by several dances before successfully reach the food source. Recruits also forage for a new food source firstly, but when they know it was failed, they may decide make a return flight to the hive.

Esch and Bastian (1970) had observed 70 honey bees during an experiment. Among these bees, 34 (recruits) were follow the waggle dance and only 14 (recruits) arrived at the food source and left 20 other bees (recruits) did not arrive at the food source. The food source distance between bee hive is a 200-250 meters.

There are two factors of recruit behaviour when she cannot locate the food source inspired us to create Local Search Manoeuvres recruitment in neighbourhood search. The first one is the searching space factor where the recruits will search beyond the food source if they unsuccessfully locate the food source. The second factor is a searching direction where recruits will fly with a different direction from normal 90 degree when they cannot find the food source (Seeley 1983) and (Esch and Bastian 1970).

Search beyond the feeding station

The recruits, 20 percent among them search beyond the food source (Seeley 1983). Authors (Riley, Greggers et al. 2005) had made an observation to the honey bees flight path when leaving bee hive. In-hive bees joined the dancer (scouts) during the waggle dance to get the information about the food sources. Then in-hive bees will decide to start foraging or continue joined the waggle dances. If some of the bees (recruits) starts locate the food source, may be several recruits cannot locate the food source. Recruits try may extend the searching beyond the feeding station. Recruits may return to the hive with some nectar or nothing. Figure 1 shows recruits search beyond the feeding station.

Search in different direction

The scout bees can reach up 200 meters when flying looking for food sources. The effort made by recruit's bees can be called as Local Searching Manoeuvre (LSM). Some of recruits return from a different location. For the first 200 meters distance, the mean for flight path direction is average 90 degree. When recruits fly farther, she adjusted the flight direction (Riley, Greggers et al. 2005). Figure 1 shows recruits search in different direction.

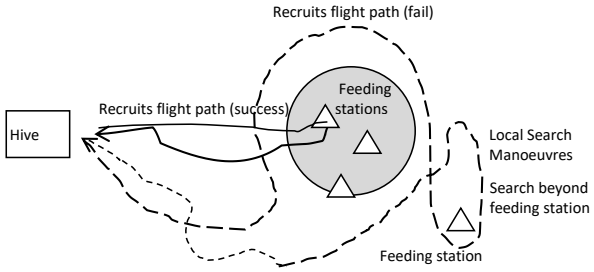

Figure 1. The Foraging Flight Path.

Leaning bees in the basic BA

How does bees learning inside the Bees Algorithm? Initially, groups of scouts, called as *n* will be released randomly to the searching space. The searching space will be called as sites. The scouts will then evaluate the optimisation problem at the searching space and come out with the fitness functions values. The fitness value of every sites then will be compared each other to know which sites are the fittest.

The number of *m* sites will be selected among all evaluated sites. The idea of selection is to increase the searching activities at the promising sites. During the selection, the algorithm will divided into two, first one was best *e* sites and the second one was the *(m-e)* selected sites. After that the number of recruits will be called to search at the selected sites. More recruits will search at the best *e* sites, known as *nep*, and less recruits will search other selected sites (*m-e*), called *nes*. The searching process by recruits (*nep* and *nes*) known as neighbourhood search to aim to exploit the good site quicker and efficiently. Furthermore, the algorithm will evaluate all bees performed the neighbourhood search compare each others. The algorithm then will select the fittest bees from each *e* and *(m-e)* sites.

Finally, in the last process, all fittest bees from all selected sites will combine with new random bees initiate another random search for the whole searching space. The process of searching, evaluating, recruiting and selecting will be repeated until it met certain criteria or at after certain number of evaluation. For example when the fitness values is equal with the answer or less than 0.001 (Pham, Ghanbarzadeh et al. 2006).

Table 1. The Comparison between BA with LSM and Basic BA.

Recruits behaviour	New features in Bees Algorithm	Basic features in Bees Algorithm
Searching exploration (size)	Increase or decrease the size of the neighbourhood	Static neighbourhood size, i.e. *ngh*=0.1 for all iterations. • For all dimension
Searching direction (dimension)	LSM neighbourhood size in random selected dimension.	Did not change dimension in neighbourhood size

Learning lost bees during locating the food source in the BA

In other words mutate a part of the dimension of the searching space. It may be one, or half or any numbers as long as is not all dimension. If mutate all dimension then features will change to shrinking or enlarge.

Based on information from the lost bees, the nature behaviour of these bees will be applied to the existing basic Bees Algorithm. We add the new features Local Search Manoeuvres

factor neighbourhood search. This feature is aims to reduce the number of function evaluation of searching the optimum value and tackle the high dimension problem. Figure 2 shows the pseudo-code with the LSM at the neighbourhood search. The LSM will increase or decrease the neighbourhood size in different dimensions. Table 1 show the comparison between the basic BA and LSM enhanced BA.

1. Begin the optimisation
2. Release scouts in searching space, *n*
3. Calculate the fitness value of every scouts
4. Decide best sites, *m*
5. Choose elite sites *e* among the best sites *m*
6. Send many recruits to elite sites, *ne*
7. Send fewer recruits to *m* sites, *nm*
8. Perform neighbourhood (*ngh*) search: increase/decrease *ngh* size for selected dimension, (1 < dimension < maximum dimension)
9. Choose the best sites between neighbourhood search
10. New population of scouts: best each sites + (*n*-*m*) scouts
11. Repeat no. 3

Figure 2. The Bees Algorithm with LSM Pseudo-code.

The LSM Operation on Neighbourhood Size

The first Local Search Manoeuvres operation was to increase the neighbourhood size of The Bees Algorithm. To get a new position in neighbourhood search basic BA approach, new position = random number between (selected position – *ngh*, selected position + *ngh*). In an enhanced version of the BA, we increased the neighbourhood size with Local Search Manoeuvres and use random selected dimension (dim) with condition, 1< *lsm* dim < max dim: New position = random number between (selected position – (*ngh* * *lsm*), selected position + (*ngh* * *lsm*)). Table 2 shows how to increase the *ngh* size.

Table 2. Increase Neighbourhood Size.

Initial *ngh*	0.1	
lsm >1	1.94149	
	without *lsm*	with *lsm*
start	0.1	0.005851
End	0.3	0.394149
original point	0.2	0.2
new range	***0.2***	***0.388298***
new rand()	***0.2551137***	***0.178707598***

The second Local Search Manoeuvres operation was to decrease the neighbourhood size of the Bees Algorithm. The operation started with select the number of dimension to be decreased and the condition of the dimension, 1< *lsm* dim < max dim. Then the new position = random number between (selected position – (*ngh* * *lsm*), selected position + (*ngh* * *lsm*)). Table 3 shows how to decrease the *ngh* size.

Table 3. Decreased Neighbourhood Size.

Initial *ngh*	0.1	
Lsm	0.5	
	without *lsm*	with *lsm*
start	0.1	0.15
end	0.3	0.25
Selected point	0.2	0.2
new range	0.2	0.1
new rand()	0.2330907	0.205542

Table 4. LSM Experiment Result with Benchmark Test Function.

	Test Function	n	m	e	nm	ne	ngh	lsm	Mean without LSM	Mean with LSM	% mean improve
1	De Jong 2d	10	3	1	2	4	0.1	0.52	1860.51	1614.48	13.22
2	Goldstein & Price 2d	20	3	1	1	13	0.1	0.01	11488.72	713.98	93.79
3	Branin	30	5	1	2	3	0.5	0.0095	15909.39	1355.63	91.48
4	Martin & Gaddy 2d	20	3	1	1	10	0.5	0.0095	885.88	590.61	33.33
5a	Rosenbrock 2d	10	3	1	2	4	0.1	0.52	1580.42	1288.39	18.48
5b	Rosenbrock 2d b	6	3	1	1	4	0.5	0.25	12072.27	4758.92	60.58
6	Rosenbrock 4d	20	6	1	5	8	0.0015	0.35	43727.99	42798.65	2.13
7	Hypersphere 6d	8	3	1	1	2	0.3	0.05	59472.39	2361.17	96.03
8	Grienwangk 10d	50	5	2	10	20	5	5	1314.46	487.18	62.94
										average %	52.44

EXPERIMENTS AND RESULTS

To evaluate the effectiveness of enhanced algorithm with the basic bees algorithm, the Local Search Manoeuvres will be applied to the eight benchmark test function as in (Pham, Ghanbarzadeh et al. 2006). Table 4 shows the number of parameters used in the benchmark test function. These parameters were initial population *n*, number of selected sites *m*, number of elites sites *e*, number of recruited bees in elites sites *ne*, number of selected bees around other selected sites *nm*, neighbourhood size *ngh* and Local Search Manoeuvres *lsm.* In test function 1, 2, 3, 4, 5a and 5b, only one dimension will be used for Local Search Manoeuvres. In test function six Rosenbrock four dimensions, test function seven Hypershere six dimensions and test function eight Griewank ten dimensions, the number of dimension for Local Search Manoeuvres should be selected for more than one dimension and not greater than the maximum dimension. In the first De Jong two dimensions test function, Local Search Manoeuvres improved by 13.22 percent compare to calculation using basic Bees Algorithm. The second function was Goldstein and Price with two dimensions test function show the improvement with 93.79 percent. The next test function was Branin two dimensions and it shown an improvement with a high percentage 91.48 percent. Martin and Gaddy two dimensions test function improved about 33.33 percent. There were two Ronsenbrock test function with a different range where 5(a) with a small range [-1.2, 1.2] and 5(b) with a bigger

range [-10, 10]. The Bees Algorithm with Local Search Manoeuvres recruitment also can improve the performance of the Rosenbrock (5a) with 18.48 percent and success to reduce the number of function evaluation for Rosenbrock (5b) by 60.58 percent.

The next three test function was a high dimension. First were Rosenbrock four dimension, Hypersphere six dimension and Griewangk ten dimension test functions. The results show an improvement using Local Search Manoeuvres with 2.13 percent for Rosenbrock, 96.03 percent for Hypersphere and Griewangk test function with a 62.94 percent improvement. The average improvement for eight benchmark test function was 52.44 percent.

CONCLUSION

The Local Search Manoeuvres recruitment in the Bees Algorithm mimicking lost recruits bees when locating the advertise food source able to increase or decrease the neighbourhood size, thus give a chance to find the optimum solution faster. As general the Bees Algorithm with LSM recruitment performs better compared to the one with basic recruitment especially for benchmark test functions with high dimensions. The LSM recruitment can perform well with benchmark test function optimisation problem stated that the parameters need to be selected properly for the Bees Algorithm. The Bees Algorithm had been applied with benchmark test function consists of low, medium and high dimension problems. The future works should implement and test the performance of the Bees Algorithm with Local Search Manoeuvres with the different type of optimisation problem such as the constrained engineering optimisation problems.

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WRITER IDENTIFICATION BASED ON HYPER SAUSAGE NEURON

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ABSTRACT. This paper proposes biomimetic pattern recognition (BPR) based on hyper sausage neuron (HSN) and applies it in writer identification. HSN is used to cover the training set. HSN's coverage can be seen as a topological product of a one-dimensional line segment and an n-dimensional supersphere. The feature extraction is moment invariants such as united moment invariants (UMI) and aspect united moment invariants (AUMI). The experiments result show that AUMI-HSN method is more effective than UMI-HSN method for identifying the authorship of handwriting.

Keywords: biomimetic pattern recognition, hyper sausage neuron, writer identification, united moment invariants, aspect united moment invariants

INTRODUCTION

Research on handwriting analysis based on the identification of the author's point of view in the last ten years experienced a significant development, particularly in forensic applications. A writer identification system aims to search a document legal ownership of a person against a large database with a sample of the author's handwriting recognition (Bulacu & Schomaker, 2007). Special image-making is done based on the features captured from each individual's handwriting. The final decision made by forensic experts to determine the identity of the author sample in question.

One of the problems of identification for purposes of the authors often appear in the court of justice in determining whether a conclusion about the authenticity of the document. This also applies in some institutions that analyze the text of former writers, and identification of various authors who took part in the preparation of the manuscript. The significant results from recent years in the field of handwriting recognition makes it possible to bring this significant answers to specific problems.

At this time, many researchers have used statistical decision model in identify the writer from the handwriting samples. Pattern classification used to determine the pattern without using some previous knowledge of the relationship between the samples in the same class. This differs from the human function.

Human being recognizes things individually by finding the commonalities between things in the same class. This is done by assuming that the sample points of the same class in the feature space would be continuous and recognizable characters. Hence, recognition of a certain class of objects is important, the analysis and cognition of the "shapes" of the infinite point sets constituted by all the objects in feature space. This concept is called biomimetic pattern recognition (BPR) by Wang Shoujue (Shoujue, 2003). BPR concept is incorporated

into writer identification for identifying authorship of handwriting (Samsuryadi & Shamsuddin, 2010).

This paper focuses on hyper sausage neuron (HSN) for writer identification. Firstly, some handwritings are extracted through united moment invariant (UMI) (Yinan, et.al, 2003) and aspect united moment invariant (AUMI) techniques (). Secondly, HSN classifier is used to identify the features obtained at the first step. The experiments of writer identification is implemented to demonstrate learning ability and the correct rate of AUMI-HSN and UMI-HSN methods.

WRITE IDENTIFICATION BASED ON HSN

Biomimetic Pattern Recognition (BPR)

In the real world, every one finds one by one similarity between things in the same class. If there are two samples belong to the same class, the differences between them should gradually change. So there must be a sequence of gradual changes between the two samples. Principle of continuity between homologous samples in feature space is called the principle of homology-continuity (PHC) (Shoujue & Xingtao, 2004). PHC can be described in mathematical formulas: suppose that point set A includes all samples in the class A in feature space. If $x, y \in \mathrm{A}$ and $\varepsilon > 0$ are given, there must be set B:

$$\mathrm{B} = \{x_1 = x, ..., x_{n-1}, x_n = y \,|\, \rho(x_i, x_{i+1}) < \varepsilon,\ \forall i \in [1, n-1], i \in N\} \subset \mathrm{A} \tag{1}$$

It is a kind of prior knowledge of sample distribution in the BPR to improve the cognitive ability, then BPR intends to find the optimal covering of samples in the same class. The basic step of BPR is to analyze the relation between training samples of the same class in the feature space, which is made possible through the PHC of sample distribution (Jiang, at. al., 2009).

Cover Neuron

HSN is as the basic covering unit of the training set. HSN's coverage in high dimensional space, which constructs a sausage like shape in feature space for covering the distribution area of the sampling points in the same class, (Shoujue & Xingtao, 2004). The HSN covering can be seen as a topological product of a one-dimensional line segment and an two-dimensional supersphere (Xu & Wu, 2010).

Cover process

Let $A = \{A_1, A_2, ..., A_n\}$, is the samples points of the training set and one sample denoted $A_i = (a_{i1}, a_{i2}, ..., a_{il})$, where $i = 1,2,...,n$ and l is dimension of the feature space or number of features.

The construction steps of HSN for writer identification are as follows:

Step 1. Calculate the Euclid distance every two points in the A, find two points with the shortest distance, denoted B_{11} and B_{12}. L_1 is segment line $\overline{B_{11}B_{12}}$. HSN covers B_{11} and B_{12} is denoted as H_1, and it coverage is C_1 :

$$C_1 = \{X \,|\, \rho(X, L_1) \le k\}, X \in R^n\} \tag{2}$$

$$L_1 = \{Y \,|\, Y = \alpha B_{11} + (1-\alpha) B_{12}, \alpha \in [0,1]\} \tag{3}$$

where $\rho(X, L_1)$ is the distance between the point X and the covering unit L_1.

Step 2. Let $U_1 = S - \{B_{11}, B_{12}\}$. Find point in U_1 is the nearest to B_{12}, denoted as B_{13} and make the second segment line $\overline{B_{12}B_{13}}$, denoted as L_2. HSN covers B_{12} and B_{13} is denoted as H_2, and it coverage is C_2 :

$$C_2 = \{X \mid \rho(X, L_2) \le k\}, X \in R^n\} \tag{4}$$

$$L_2 = \{Y \mid Y = \alpha B_{12} + (1-\alpha)B_{13}, \alpha \in [0,1]\} \tag{5}$$

Step i. Delete remaining points which are included in $C_1, C_2, ..., C_{i-1}$. Find point $B_{1(i+1)}$ in the remaining points,which is nearest to B_{1i} denoted line segment $\overline{B_{1i}B_{1(i+1)}}$, is as L_i. HSN covers B_{1i} and $B_{1(i+1)}$ is denoted as H_i, and it coverage is C_i :

$$C_i = \{X \mid \rho(X, L_i) \le k\}, X \in R^n\} \tag{5}$$

$$L_i = \{Y \mid Y = \alpha B_{1i} + (1-\alpha)B_{1(i+1)}, \alpha \in [0,1]\} \tag{6}$$

The above algorithm is terminated, if all the points in *A* have been covered.

Finally we have (n-1) HSNs, and the covering area of training samples in this case is the union set of the areas by these neurons:

$$C = \bigcup_{j=1}^{n-1} C_j \tag{7}$$

In this study, we adopted $k = \beta D_{ij}$, where D_{ij} is the distance between A_i, A_j (Xu & Wu, 2010). β is in the range of [0.30,0.75].

Identifying Algorithm

Calculate the distance ρ_i between sample point *A* for identifying and the union C_i of class i $(i = 1,2,...,q)$ and ρ_i was defined as formula (8).

$$\rho_i = \min_{1 \le j \le M_i} D_{ij} \tag{8}$$

where D_{ij} was the minimum distance from *A* to the complex geometrical body C_j $(j = 1,2,...,M_i)$ of union C_i.

Calculated each ρ_i for *A*. Finally the testing sample A would be classified to the class which corresponding to the least ρ_i namely,

$$r = \arg\min_{1 \le i \le q} \rho_i \tag{9}$$

RESULT AND DISCUSSION

In this paper, the handwriting data are obtained from IAM database. We choose 10 persons with 10 words were selected and each word was made for 10 times (all 1000 samples). We use two feature extraction methods such as united moment invariants (UMI) and aspect united

moment invariants (AUMI) to show that BPR is not relied on certain feature extraction method.

For each of 10 persons (writer) has 20 training samples (4 words x 5 repetition), and 25 testing samples (5 words x 5 repetition). Each training samples is used to training the neurons of BPR model for each class, thus each cover set of the 10 persons has 19 HSNs. The experiment result in percentage for beta value 0.30 as far as 0.75 can be showed in Table 1.

Table 1. Percentage Result for Each Writer and Beta Value Based on AUMI-HSN

Writer	Beta value				
	0.30	0.40	0.50	0.60	0.75
W1	56	92	100	100	100
W2	84	92	92	96	100
W3	32	48	64	76	84
W4	52	60	88	88	100
W5	20	40	72	84	96
W6	76	92	92	96	96
W7	64	76	84	88	96
W8	28	52	68	80	92
W9	48	60	84	96	100
W10	20	44	60	76	100
Average	48.00	65.60	80.40	88.00	96.40

Based on Table 1, W1 with beta value 0.30 can be identified 14 samples from 25 samples (56%), 92% (23/25) for beta value 0.40, and so on. The best average result of identifying writer from 10 writers in beta value 0.75 is 96.40%. We can see beta value has influence to identify the authorship of handwriting.

We do the same way for UMI-HSN with 10 writers, 20 training samples and 25 testing samples and the best average result in beta value 0.75 is 88.00%, detail result shows in Table 2.

Table 2. Percentage Result for Each Writer and Beta Value Based on UMI-HSN

Writer	Beta value				
	0.30	0.40	0.50	0.60	0.75
W1	24	64	80	96	96
W2	36	48	84	96	96
W3	8	20	32	76	88
W4	32	72	80	84	88
W5	24	36	64	76	84
W6	0	4	20	28	40
W7	40	48	56	68	88
W8	32	48	84	92	100
W9	32	84	92	100	100
W10	32	44	64	88	100
Average	26.00	46.80	65.60	80.40	88.00

Besides experiment above, we do the other training samples and testing samples to show the performance of the method. For instance, UMI(30,35) means 30 training samples and 35 testing samples for feature extraction, UMI and classification method, HSN (UMI-HSN) for beta values from 0.30 to 0.75. The complete result can be showed in Figure 1.

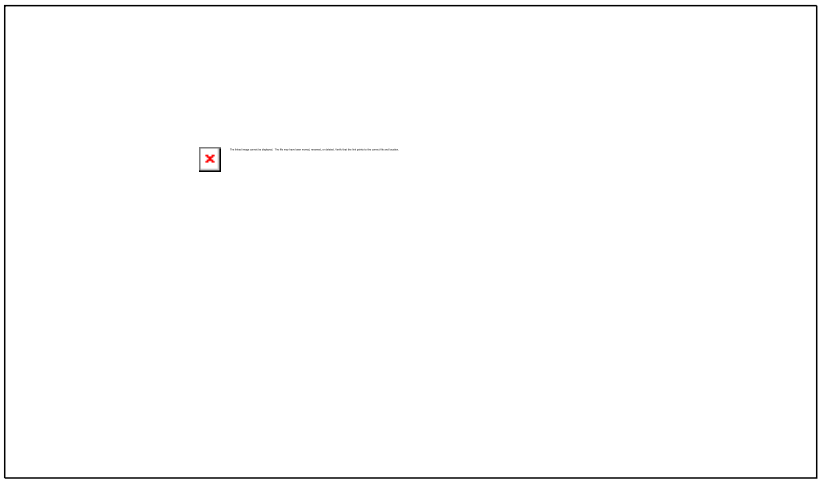

Figure 2. Bar Chart for UMI-HSN vs AUMI-HSN Based on Beta Values

Based on Figure 1, we make difference percentage correct rate between UMI-HSN method and AUMI-HSN method for beta values 0.75 as Table 3.

Table 3. The percentage matches the identification with UMI-HSN and AUMI-HSN

Data		Correct rate (%)	
Training Samples	Testing Samples	UMI-HSN	AUMI-HSN
20	25	88.00	96.40
30	25	86.00	97.20
20	35	89.71	95.14
30	35	88.00	97.14

Based on Table 3, correct rate UMI-HSN method for 25 testing samples with 20 and 30 training samples has the average result decrease from 88.00 to 86.00, and 35 testing samples with 20 and 30 training samples has the average result decrease from 89.71 to 88.00. This condition is different from AUMI-HSN method, the adding number of training samples can increase the percentage correct rate result.

CONCLUSION AND FUTURE WORK

This paper proposed AUMI-HSN and UMI-HSN for identifying the authorship of handwriting. The experiments in Table 3 showed that AUMI-HSN method was better than UMI-HSN method, the correct rate UMI-HSN was around 88% and AUMI-HSN was around 96%. Future work can be conducted to further explore the moment invariants feature extraction methods and cover neurons appropriate for BPR.

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AUTOMATED CLASSIFICATION OF BLASTS IN ACUTE LEUKEMIA BLOOD SAMPLES USING HMLP NETWORK

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ABSTRACT. This paper presents a study on classification of blasts in acute leukemia blood samples using artificial neural network. In acute leukemia there are two major forms that are acute myelogenous leukemia (AML) and acute lymphocytic leukemia (ALL). Six morphological features have been extracted from acute leukemia blood images and used as neural network inputs for the classification. Hybrid Multilayer Perceptron (HMLP) neural network was used to perform the classification task. The Hybrid Multilayer Perceptron(HMLP) neural network is trained using modified RPE(MRPE) training algorithm for 1474 data samples. The Hybrid Multilayer Perceptron (HMLP) neural network produces 97.04% performance accuracy. The result indicates the promising capabilities and abilities of the Hybrid Multilayer Perceptron (HMLP) neural network using modified RPE (MRPE) training algorithm for classifying and distinguishing the blasts from acute leukemia blood samples.

Keywords: Hybrid Multilayer Perceptron, artificial neural network, acute leukemia

INTRODUCTION

Leukemia is a type of cancer in which the body produces large numbers of abnormal cells typically white blood cells (WBC). There are two major kinds of leukemia: chronic and acute (Lim, 2002). The word acute means the diseases grow and progresses rapidly (Lim, 2002). The bone marrow is infiltrated with more than 20% of blast cells and when myeloid cells are affected, the disease is called acute myelogenous leukemia(AML) while the cells affects lymphoid cells, it is called acute lymphocytic leukemia (ALL) (Panovska-Stavridis et.al, 2008).

The early and rapid classification of the acute leukemia diseases, greatly aids in providing the appropriate and effective treatment for that particular type (Khasman et.al, 2010). This is important, as the natural history and reaction to treatment varies according to the type of blast involved in the leukemia process (Panovska-Stavridis et.al, 2008). The original classification scheme proposed by the French-American-British (FAB) Cooperative Group divides AML into 8 subtypes (M0 to M7) and ALL into 3 subtypes (L1 to L3). The FAB classifications of ALL (L1 to L3) which are differentiated based on morphology, including cell size, prominence of nucleoli, and the amount and appearance of cytoplasm (Bennett et.al, 1976 & Panovska-Stavridis et.al, 2008). According to French-American-British (FAB) classification also, the description of cells is small and uniform for ALL-L1. Meanwhile, cells of AML-M1 are large and regular (Bennett et.al, 1976 & Panovska-Stavridis et.al, 2008).

Currently, routine diagnosis and classification of morphological features for acute leukemia blood samples is using microscope evaluation (Sabino et al., 2003). The process is

an exhaustive, burdensome and repetitive work performed by hematologists, technologists or medical expertise (Sabino et al., 2003). To improve the reliability of the diagnosis and decreasing the dependence on human experts, several previous studies developed automated and semi automated diagnosis and classification using artificial neural network for medical images.

Artificial intelligence based on neural network applications has a great impact on the interpretation of medical images (Chenn J.H. et.al, 2004). The researches in neural network implementation for acute leukemia diagnosis have been done by several researchers. By using AML/ALL data sets Toure et al. (2001) proposed Multilayer Perceptron Network (MLP) and the highest performance rate 58% was achieved, Ryu et al. (2002) experimented with Modular Neural Networks as the classifier and the best performance was achieved 75% and finally, Xu et al.(2002) proposed ellipsoid ARTMAP neural network and the best result was 97.1%.

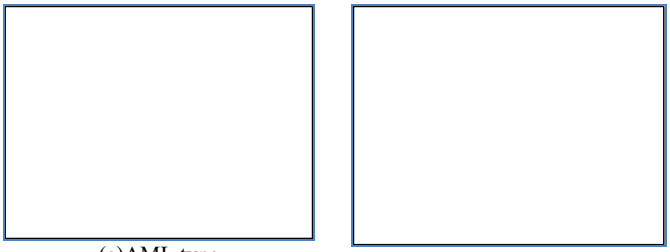
In 2000, Mashor has introduced the Hybrid Multilayered Perceptron Network (HMLP) that has been proven to significantly improve the performance of Multilayered Perceptron Network (MLP). The HMLP network has been tested on other data sets such as on cervical cancer and breast lesions data sets and successfully verified each type of data sets correctly with high percentage in both training and testing phase (Mat-Isa et al.,2004 & Mashor et al., 2007). Besides that, Mashor et al. (2004) had used the HMLP network to classified 3D object using 2D moment and best recognition accuracy of up to 100%.

As HMLP network has the promising potential to classify the various data sets, in the current study HMLP network also has been proposed as blasts classification in acute leukemia blood images. The HMLP network has been trained using modified RPE (MRPE) algorithm.

Blasts classification in Acute Leukemia blood samples using HMLP network

The HMLP network were applied and tested in order to classify the blasts from acute leukemia blood samples. The inputs to the HMLP network are some features of the blasts from acute leukemia images. The images of blasts from acute leukemia blood samples have been captured using *Infinity2* digital camera that is attached to *Leica* microscope. After that, the captured images were revised and approved by hematologists or technologists in order, to verify the correctness of the blasts in acute leukemia cells images. Then, six features have been manually extracted using image processing method from the images of acute leukemia blood samples.

The six features are the area for the blast, nucleus, and cytoplasm, perimeter for the blast and nucleus and ratio of nucleus to cytoplasm. The HMLP neural network receives these six features as the inputs and classifies the blasts in acute leukemia cells into two categories which are AML and ALL types. Samples of acute leukemia cells images are shown in Figure 1.



(a)AML type (b)ALL type

Figure 3. Samples of acute leukemia blood images

Hybrid Multilayer Perceptron (HMLP) neural network

Consider HMLP network with one hidden layer as shown in Figure 2. The HMLP network can be expressed by the following Eq. [1]:

where denote the weights between input and hidden layer, weights between hidden and output layer, and weights between input and output layer respectively.

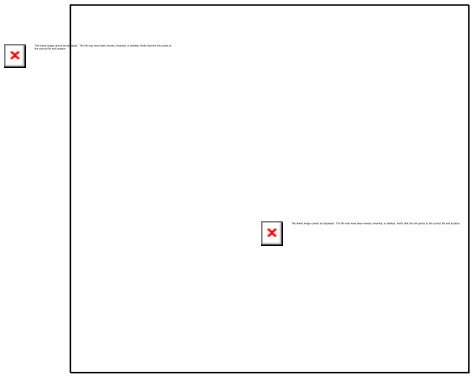


Figure 2. One-hidden layer HMLP network

and denote the thresholds in hidden nodes and inputs that are supplied to the input layer respectively; and are the number of input nodes, output nodes and hidden nodes respectively. is an activation function that is selected as sigmoid function. The weights and are unknown and should be selected to minimize the prediction error defined as:

where and are the actual outputs and network outputs respectively.

From Eq. (1), the values of and must be find out using appropriate algorithm. Chen et.al (1990) proposed recursive prediction error (RPE) to overcome the problems using BP algorithm. Subsequently to improve the convergence rate for RPE algorithm, Mashor (2000) proposed modified recursive prediction error (MRPE) algorithm. The description of MRPE algorithm could be found in Mashor (2000).

METHODOLOGY

In the current study, the HMLP network trained using MRPE algorithm is proposed as acute leukemia cells diagnosis technique. The analysis performance is based on overall performance and accuracy of correct determination of ALL and AML type. In order, to determine the suitability of the HMLP neural network as acute leukemia cells diagnosis technique, the HMLP neural network needs to go through training and testing phases. During the training phase, the weighs and bias of the network are calculated by using MRPE algorithm as mentioned above. The HMLP network was trained using the designing parameter for MRPE as follow;

Based on the values acquired from training phase, the performance of the HMLP network is analyzed to obtain appropriate values for testing phase. In order to find the optimum structure, the HMLP network performance has been analyzed for the optimum number of hidden nodes and epochs. For this situation, the epochs will be set to a certain fixed value. Then, the HMLP network was trained at the appropriate range of hidden nodes. The number of hidden nodes that have given the best performance is then selected as the optimum hidden nodes. After that, by fixing the optimum number of hidden nodes, the epochs will be analyzed in a similar way to obtain the optimum number of epochs that can give the highest or best accuracy.

In this study, 1474 data were used in diagnosing blasts in acute leukemia samples using HMLP network. 1100 data were used as training data while 474 data were used as testing data. From 1100 training data, 555 data for ALL type while 545 were AML type. In addition, for 474 testing data, 253 data for ALL type while 221 data were AML type**.** The distributions of the training and testing data sets are shown in Table 1**.** The data were taken from Hematology Department at Hospital Universiti Sains Malaysia (HUSM).

Table 1 Distribution of training and testing data sets

Types of acute leukemia cells	Training data	Testing data
AML	545	221
ALL	555	253
TOTAL	**1100**	**474**

The inputs of the network are six features which are the area for the blast, nucleus, and cytoplasm, perimeter for the blast and nucleus and ratio of nucleus to cytoplasm. The output nodes of the HMLP network are two which represents the two types of blasts for acute leukemia cells.

RESULTS AND DISCUSSIONS

Table 2 and 3 shows the diagnosis performance of the HMLP neural network using MRPE training algorithm for training and testing phase respectively. The HMLP neural network using MRPE training algorithm produced the highest and best performance at 5 training epochs and 30 hidden nodes.

Table 2.Results for acute leukemia cells size classification in training phase

Classification	True	False	Total	Accuracy (%)
ALL	544	11	555	98.00%
AML	531	14	545	97.43%
Overall	**1075**	**25**	**1100**	**97.72%**

From the Table 2, the results show that the HMLP network classified the ALL type better than AML type in the training phase with 98.00% and 97.43% accuracy respectively. Meanwhile, the overall performance of the HMLP network produced 97.72% of accuracy.

Table 3.Results for acute leukemia cells size classification in testing phase

Classification	True	False	Total	Accuracy (%)
ALL	242	11	253	95.65%
AML	218	3	221	98.64%
Overall	**460**	**14**	**474**	**97.04%**

The results obtained in Table 3 represent that the HMLP network successfully classified 98.64% of AML type as compared to 95.65% of ALL type during testing phase. Besides that, the overall performance of the HMLP network classified 97.04% blasts size from acute leukemia samples correctly.

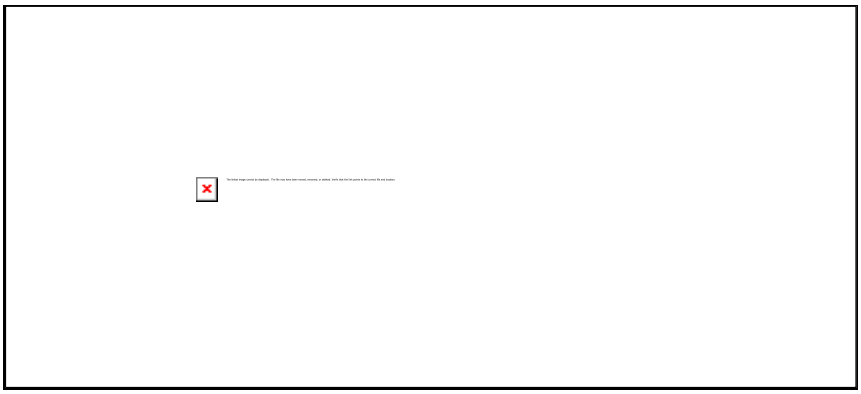


Figure 3. Overall performance accuracy during training and testing phase

Figure 3 indicates the resulted graph for HMLP neural network using MRPE training algorithm was achieved an optimal result at 5 training epochs and 30 hidden nodes. The results represent that the HMLP network has high capability and ability to classify the blasts in acute leukemia samples into two types, namely ALL and AML.

CONCLUSION

The HMLP network trained using MRPE training algorithm has been proposed to analyze and classify blasts into two types which are acute lymphocytic leukemia (ALL) and acute myelogenous leukemia (AML). Six features from acute leukemia blood samples, which are area for the blast, nucleus, and cytoplasm, perimeter for the blast and nucleus and ratio of nucleus to cytoplasm, have been used as HMLP network inputs data. From the results, it has been proved that HMLP neural network has successfully classified the blasts in acute leukemia blood samples with high percentage in training and testing phase. Furthermore, the HMLP network successfully classified 242(51%) of acute lymphocytic leukemia (ALL) as well as 218(46%) acute myelogenous leukemia (AML) cells correctly, from 474 total data during the testing phase. Only 14 (3%) data is miss - classified. It is concluded that, artificial intelligence using HMLP neural network can contribute efficient and accurate diagnosis for acute leukemia blood samples.

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MEASURING THE TANGIBLES AND INTANGIBLES VALUE OF AN ERP INVESTMENT

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ABSTRACT. Enterprise Resource Planning (ERP) recent is widely implemented in various fields of industry. However, there are companies which still vacillate to decide for investing the ERP systems. This vacillation comes from consideration that ERP system is the high investment cost and also there is an apprehensive of inadequate technical capability. Therefore, taking into account the ERP contribution or impact both of tangible and intangible value including cost and benefit to the evaluation is essential for the success of this project. This paper will reveal how the factor of cost and benefit in an economic analysis can be applied to ERP investment plan. The expected increase of market share due to the customer satisfaction is determined in expressions of information cycle time and quality between customers and suppliers by using fuzzy rule based system. Furthermore, the expected Net Present Value (NPV) is calculated by employing the Monte Carlo simulation method.

Keywords: ERP, cost-benefit analysis, economic analysis, Fuzzy rule based system, Monte Carlo simulation

INTRODUCTION

Enterprise Resource Planning (ERP) is an information system designated for manufacturing and service industries, which is able to integrate and automate business processes related to aspects of the operation, production and distribution in the industry concerned. There are two values added that have been delivered by ERP implementation and not occur in non-integrated departmental systems (Umble, 2003). Firstly, encompasses all functions and departments within the firm, while secondly is enhancing the interdepartmental cooperation and coordination because of the firm database in which all business transactions are entered, recorded, processed, monitored, and reported.

The ERP history started from 1960 where signed by the system designed to assist the manufacturing process. The first software that was developed in this process happens to be MRP (Material Requirement Planning) in the year 1975. This was followed by another advanced version namely MRP II (Manufacturing Resource Planning), and ERP itself evolved from MRP II (Robert Jacobs and Ted' Weston, 2007). This development of ERP in several times to create a more optimal system that can leverage the potential cost savings and productivity becomes a reason the companies from various industries for adopting this system. Due to these successful, the ERP system market is one of the fastest growing markets in the software industry (Willis T.H. and Willis-Brown, 2002). Since the early to mid-1990s, the ERP software market has been and continues to be one of the fastest growing segments of the IT industry with growth rates averaging from US$25.4 billion in 2005 to US$28.8 billion by 2006 and the number was projected to grow at a compound annual growth rate of 11% until 2011 (S. Jacobson, 2007). However, a recent Standish Group report on ERP implementation projects reveals that these projects were on average of 178% over budget,

took 2.5 times as long as intended and delivered only 30% of promised benefit (Zhang et al., 2005). One explanation for the high failure rate is that managers do not take prudent measures to assess and manage the key factors either tangible or intangible that caused these projects failure or success (Wright, 2001). Thus, this paper proposes a fuzzy rule-based system to measure both of intangible and tangible value of an ERP system. In addition, the Monte-Carlo simulation method is used to calculate the expected net present value (NPV) in order to evaluate the feasibility.

LITERATURE REVIEW

There are number of methods have been conducted for measuring the impact of ERP systems in the business process of an industry. It was taken by researchers since the growing up of interest to the ERP. Definitely, management of companies considers the importance of ERP implementation due to the intention to meet customer's need and to maximize their profit for facing a more complex and competitive environment than ever before. Business success is no longer a matter of analyzing only the individual firm, but rather the chain of delivering and supplying organizations. Consequently, to pursue successful and to be competitive for improving firm and business unit performance, the managers must use information and communication technology such as ERP system (Xiaohong and Gang, 2009). In reality, several companies have satisfied with the outcome generated after ERP implementation. Davenport and Brooks (2004) proposed that implementing ERP systems brings many benefits to the organization that concern to customer satisfaction, including reduction of cycle time, improvement in information flow, rapid generation of financial information, promotion of e-commerce, and assistance in development of new organizational strategies. Some managers reported reduced costs due to the lower error rate experienced in purchasing, production and sales while the positive changes in Return on Assets during the implementation period are statistically significant at the 5% level (Hendricks, Singhal and Stratman, 2007).

From all those methods used above, cost benefit analysis (CBA) is a methodology that is often used in calculating the impact either ERP system or other enterprise information. Furthermore, these findings of ERP adoption are advanced observed by involving the intangible values in order to find the more significance benefit or examine the multi-criteria as the critical factors that impact to business performance. Murphy and Simon (2001) incorporated the intangible values in the cost benefit analysis or ERP evaluation and found that the customer satisfaction improved by 5%. Wier et al. (2007) investigated empirically whether the joint adoption of an ERP system and the inclusion of non-financial performance indicators (NFPI) in executive compensation contracts significantly enhances customer satisfaction and business performance measured by the return on assets (ROA) and the return on stocks (ROS) as compared to either of them alone. These methods are focused for providing the involvement both of tangible and intangible value into cost-benefit analysis. However, it still needs to provide an approach that not only includes the multiple criteria, but also provides the effectiveness standard of the framework to assess and manage the key factors as a reason the ERP success or failure. In addition, the uncertainty factors should be incorporated by reason of no absolute matter in every subject (Zhao, Tong and Sun, 2009). Therefore, we introduce an approach that can handle the problem defined earlier such as;(1) how to combine both of tangible and intangible values into cost and benefit analysis, (2) how to assess and manage the key factors as a reason the ERP success or failure, which is in uncertainty matters.

COMBINING TANGIBLES AND INTANGIBLES VALUE OF ERP ADOPTION INTO ECONOMIC ANALYSIS

This paper proposes an approach a feasibility analysis for evaluating the ERP attractiveness. To conduct this analysis, the main cost items of the investment are examined.

In another side, the targets to be realized after ERP adoption is to reduce the annual purchase material cost, annual inventory cost, and annual direct labor cost (Barjis et al., 2010). Furthermore, increasing sales due to the customer satisfaction is determined in expressions of information cycle time and quality that support activities of customers, employees and suppliers (Xiaohong and Gang, 2009). The cost reduction contributes to increasing profits and increased customer satisfaction contributes to increasing sales and market share (Law and Ngai, 2007).

The solution design of the problem in this paper will be conducted by the following two phases. First is the technique to handle the intangible value by using fuzzy rule-based system (FRBS) before assigned its output to appropriate probabilistic distribution. In addition, the probability distribution of cost saving items is assigned. Once a FRBS has been set up, the probability distributions of those intangible and tangible factors are linked to an economic model in order to define the relationship between each value and cost saving in terms of total benefit calculation before forecasting the certainty level of expected NPV.

Intangible Value Analysis

With regard to the impact of intangible value toward the revenue model which is represented by increasing sales, we involve expert's opinion to handle the increasing by producing a FRBS. A fuzzy rule-based system (FRBS) is a systematic reasoning methodology that can capture the contextual judgment of experts by using fuzzy set theory (Zadeh, 1965). Currently, quite a few of researchers have proposed fuzzy set theory especially the FRBS for various purposes such as Fuzzy evaluation approach is applied to quantify intangible benefits of ERP (Wu et al., 2006). Ustundag et.al (2010) utilize the FRBS for determining the revenue increase due to the quality of supply chain of companies after RFID implementation. We use Mamdani model due to its advantages in representation of expert knowledge and in linguistic interpretation of dependencies. Hence, the increase in sales is attempted to be calculated in a Mamdani-type. The composition of Mamdani-type fuzzy logic rule bases is in the following form;

If x_1 is A_1, x_2 is A_2 …. And x_n is A_n then y is B where A and B are linguistic variables defined by fuzzy sets of the universe of discourse x and y respectively. The output of the fuzzy rule-based model whose rule base is constructed using Mamdani-type fuzzy logic rules is shown in Equation (1)(Jang and Gulley, 1997).

$$Z_{MOM} = \frac{\int_{z'} z dz}{\int_{z'} dz} \tag{1}$$

where Z_{MOM} is the defuzzified output, z' is the maximizing z at which the membership function reaches its maximum. In this paper, both triangular and trapezoidal fuzzy numbers are used to consider the fuzziness of the decision elements. The membership functions of information cycle time, information quality and increase rate for sales are defined by the experts and given in Fig. 1, Fig. 2, and Fig. 3, respectively.

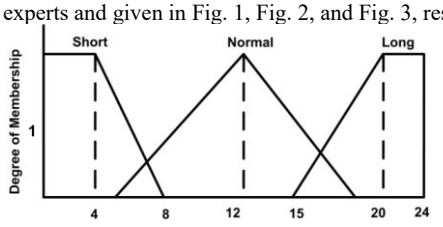


Fig. 1 The MFS of information cycle time

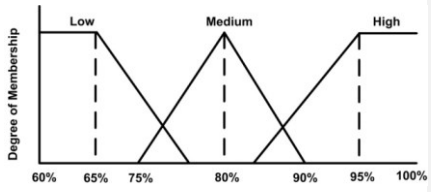


Fig.2 The MFS of information quality

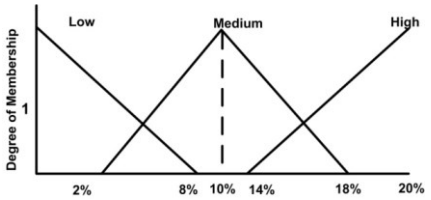


Fig.3 The MFS of increase rate in sales

The rules established for the increase rate in sales is structured such as; Rule 1: IF Information Cycle Time is Short AND Information Quality is High THEN Increase Rate in Sales is High. Rule 2: IF Information Cycle Time is Short AND Information Quality is Medium THEN Increase Rate in Sales is Medium. Rule 3: IF Information Cycle Time is Normal AND Information Quality is High THEN Decrease Rate for Traffic Volume is Medium. Rule 4: IF Information Cycle Time is Normal AND Information Quality is Medium THEN Increase Rate in Sales is Medium.Rule 5: IF Information Cycle Time is Long AND Information Quality is Low THEN Increase Rate in Sales is Low.

All rules defined by the experts, which is implemented in Matlab Fuzzy Toolbox. The max–min method is used for the aggregation mechanism whereas the mean of maximum method is used for the defuzzification process of fuzzy outputs. By implementing the input data into model, the probability distribution of expected increase rate in sales is generated as shown in Table 1. In addition, the experts' estimation as well as the expected cost saving rates (r) by ERP adoption with probabilities of 10%, 30% and 60% are shown in Table 2.

Table 1 The expected increase in sales

Probability (%)	Cycle Time (h)	Quality (%)	Increase Rate in Sales (%)
10	15	65	3.3
30	10	80	10
60	6	95	18.5

Table 2 The expected cost saving rates

Probability (%)	Cost saving rates (%)		
	Labor	Material	Inventory
10	2	6	15
30	3	8	20
60	5	10	25

Model of Cost-Benefit Analysis

In the ERP cost-benefit analysis, the implementation costs of ERP are structured by onetime costs (C_{Xn}) and ongoing costs (C_{Yn}). These costs consist of (a) installation costs include hardware, software and customizing; (b) Data control costs include inventory records, bills of material (BOM), and routings; (c) Education costs include external, internal, direct labor, full time project leader, outside consultancy, and miscellaneous. In contrast, the benefits of ERP (B) that calculated in Equation (2) are derived from revenue increase (RI) and costs saving such as annual purchase material saving (CS_m), inventory saving (CS_i), and direct labor saving (CS_l). Indeed, the variables of total benefit are calculated considering the increase rate of sales (s) which has been estimated by fuzzy rule based system as earlier. The increased sales (S') is calculated by Equation (3).

$$B = (CS_m + CS_i + CS_l) + RI \quad (2), \qquad S' = S(\mu,\sigma) \times (1+s) \quad (3)$$

where $S(\mu,\sigma)$ is the yearly sales with a mean μ and standard deviation σ. The cost savings are computed considering the increased sales (S'), cost unit (c), cost saving rate (r) as shown in Equations (4)-(6).

$$CS_m = S' + c_{material} + r_{material} \quad (4), \quad CS_i = S' + c_{inventory} + r_{inventory} \quad (5), \quad CS_l = S' + c_{labor} + r_{labor} \quad (6)$$

The revenue increase is calculated considering yearly total sales (S), the increase rate of sales (s) and profit for each unit (p) in Equation (7). Finally, the net NPV of the total ERP investment is determined for n years in Equation (8) where i indexed as discount rate.

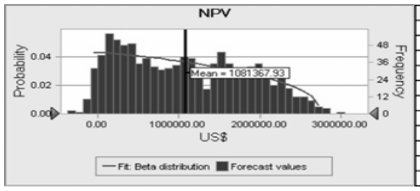
$S(\mu,\sigma)$ x s x p (7)

$$NPV = -(C_{X1} + .. + C_{Xn}) + \sum_{n=1}^{t} \frac{[B - (C_{Y1} + .. + C_{Yn})]}{(1+i)^n} \quad (8)$$

In relation to investment analysis, the Monte Carlo simulation is the method that appropriate for estimating the impact of ERP critical factors to the project result by randomizing value from each of the uncertain variables and calculating the objective or target value of the investment model (Hacura, Jadamus-Hacura and Kocot, 2001). This method uses random numbers from probability distributions to compute the probability distribution of NPV, which meant not only produce one value of NPV.

SIMULATION, RESULTS AND DISCUSSION

Once the tangible and intangible values have been associated in a model of cost-benefit, then the investment model spreadsheet is produced by compiling the revenue elements and cost elements. For instance, the revenue element of ABC Company consists of total of sales with the yearly amount before ERP adoption is 800 units with standard deviation 18% and the price per unit of US$10000. The implementation cost elements are structured by onetime costs (C_{Xn}) and ongoing costs (C_{Yn}) as US$598000 and US$27000 per year respectively, while the cost unit for the target of cost savings consists of average of annual direct labor cost per unit product (50 labor) of US$10, annual purchase material cost per unit product of US$1500, annual material inventory value per unit product of US$500. By using the commercial software Crystal Ball Version 7.2.1, a simulation generates the probability distribution of net present value (NPV) of the ERP investment in 3 years horizon and discount rate i of 10% as shown in Fig.4.



Percentiles:	Forecast values
0%	$ (362,503)
10%	$ 122,046
20%	$ 295,140
30%	$ 490,942
40%	$ 753,923
50%	$ 1,026,932
60%	$ 1,279,252
70%	$ 1,566,384
80%	$ 1,846,905
90%	$ 2,152,699
100%	$ 3,235,379

Fig 4. The simulation results for the NPV of ERP investment with percentiles analysis

The distribution of the NPV of ERP investment has the mean value of US$1,081,367 and the standard deviation US$766,476, which varies between US$(362,053) and US$3,235,379. As shown in percentile analysis, the ERP investment in three years horizon has more than 90% certainty level the NPVs will be positive and there is still probability that the ERP investment will be loss with amount of less than 5%. Summarizing, although this result assists the managers to decide the ERP investment, the ABC managers should consider the failure probability by ensuring the good performance of ERP.

CONCLUSION

The purpose of this paper is to propose an approach to relate both tangible and intangible value of ERP investment into a model of cost-benefit analysis by utilizing the FRBS. Furthermore, the Monte Carlo simulation calculates the probability distribution of expected NPV with regard to the analysis of the feasibility that considers uncertainty factors. The simulation result showed that applying this proposed approach is an effective way to assess and manage the key factors of the ERP success or failure.

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ETL PROCESSES SPECIFICATIONS GENERATION THROUGH GOAL-ONTOLOGY APPROACH

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ABSTRACT. The common design-related problems for extract, transform, load (ETL) processes are far away from being resolved due to the variation and ambiguity of user requirements and the complexity of ETL operations. These were the fundamental issues of data conflicts in heterogeneous information sharing environments. Current approaches are based on existing software requirement methods that have limitations on reconciliation of the user semantics toward the modeling of the DW. This will prolong the process to generate the ETL processes specifications accordingly. The solution in this paper is focused on the requirement analysis method for designing the ETL processes. The method - RAMEPs (Requirement Analysis Method for ETL Processes) was developed to support the design of ETL processes by analyzing and producing the DW requirements in perspectives of organization, decision-makers, and developers. The ETL processes are modeled and designed by capturing DW schemas and data sources integration and transformation. The validation of RAMEPs emphasizes on the correctness of the goal-oriented and ontology requirement model, and was validated by using compliant tools that support both these approaches. The correctness of RAMEPs was evaluated in three real case studies of Student Affairs System, Gas Utility System, and Graduate Entrepreneur System. These case studies were used to illustrate how the RAMEPs method was implemented in generating the ETL processes specifications.

Keywords: requirement analysis, ontology requirement model

INTRODUCTION

DW is a system for gathering, storing, processing, and providing huge amounts of data with analytical tools to present complex and meaningful information for decision makers (Ta'a et al., 2010). These data are collected, stored, and accessed in centralized databases in order to sustain competitiveness in businesses (Inmon, 2002). However, the DW system requires the ETL processes to provide the data (Kimball & Caserta, 2004). Specifically, the success of DW system is highly dependent on the ETL processes specifications. There are many issues in requirement, modeling, and designing of the ETL processes due to the non-standardization of methods imposed by the providers through their own DW tools. Moreover, the design tasks need to tackle the complexity of ETL processes from the early phases of DW system development. An early phase is important to ensure the appropriateness of information for the DW systems (Giorgini et al., 2008).

GOAL-ONTOLOGY FOR ETL PROCESSES REQUIREMENTS

Requirement analysis of ETL processes focuses on the transformation of informal statements of user requirements into a formal expression of ETL processes specifications. The

informal statements are derived from the requirement of stakeholders and analyzed from the organization and decision-maker perspectives (Giorgini et al., 2008). We argue that analyzing the DW requirements from the abstract of user requirements toward the detail of ETL processes is important in tackling the complexity of DW system design. It is widely accepted that the early requirement analysis significantly reduces the possibility misunderstanding of user requirements (Yu, 1995). The better understanding amongst stakeholders, the higher are the chances on agreeing on terms and definitions used during the ETL processes execution.

Therefore, our requirement analysis method for ETL processes (RAMEPs) is centered on the organizational and decisional modeling and focuses on the transformation model from the perspective of a developer. By adapting the approach used by Giorgini et al. (2008), the RAMEPs model is presented in Figure 1. The extended works in RAMEPs model are highlighted in the shaded area. The organizational modeling is used to identify the goals that are related to facts, and attributes. The decisional modeling is focused on the information needs by decision makers and related to facts, dimension, and measures. The developer modeling is defined the related actions for the data sources and business rules given. The detail of RAMEPs method is presented in Ta'a et al. (2010).

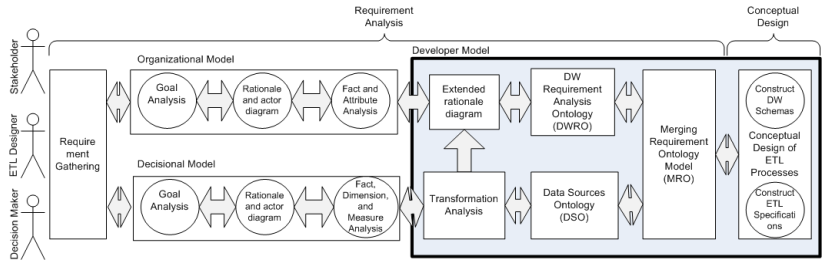

Figure 1. The RAMEPs

THE VALIDATION AND EVALUATION OF RAMEPS

The aim of RAMEPs is to support the design of ETL processes by analyzing and producing DW requirements as required by the decision-maker and organization. Through RAMEPs, the ETL processes are modeled and designed by capturing two important facts: i) DW schemas and ii) data sources integration and transformation activities. Since the RAMEPs is based on the goal-oriented and ontology approach, the validation process is emphasized on the correctness of both approaches. Consequently, the correctness of RAMEPs is not enough until it can be evaluated in the real design of ETL processes. To validate the correctness and ensuring the satisfaction of the RAMEPs, the appropriate goal-oriented and ontology compliant tools are required for capturing and analyzing the DW requirements. The compliant goal-oriented tools must be able to accommodate the elements of organizational, decisional, and developer into the modeling functionalities. Moreover, the compliant ontology tools must be able to capture and present the DW requirements and data sources in an ontology model. The evaluation is conducted for ensuring the usefulness of RAMEPs for designing the ETL processes and was implemented in the real DW project case studies.

Model Checking Process

Generally, model checkers are used to verify the correctness of software systems at design stage. The correctness of a software system is verified according to their system's properties that must be a model-checked. System properties in RAMEPs are DW components (i.e. facts, dimensions, measures, business rules, measures) as defined from the goal-oriented analysis. The method proposed by Ogawa et al. (2008) was adopted to validate the DW components by using compliant tools (DW-Tool and Protégé-OWL). This method was chosen because it uses goal oriented requirement analysis for formal presentation of the software properties.

Moreover, the validation of properties is focused on the sufficiency of design against requirements, which is similar to our objectives. However, our approach is based on Tropos model that emphasized on the goal and resources that describing the DW characteristics. The model checking process and tools are illustrated in Figure 2.

In the checking method, the compliant tools are used to ensure the DW components are properly captured from one model to the next model. For examples, the goals, facts, and attributes in organizational modeling correctly support the goals, facts, dimensions, and measures in the decisional modeling. These DW components in decisional modeling correctly support the developer modeling. The complete DW requirements are modeled as ontology and rechecked for their correctness as ontology structure by using ontology reasoner called Pallet. Since the DW-Tool (Giorgini et al., 2008) not support data transformation analysis as required for ETL processes, a transformation analysis (TA-Tool) was developed and provides the data transformation diagram in developer modeling.

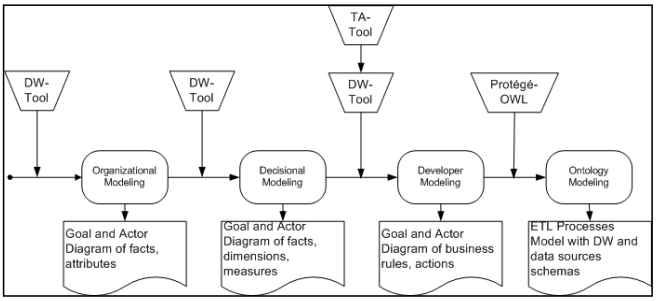

Figure 2. Model Checking Process and Compliant Tools

Model Checking Examples

In organizational modeling phase, the goal cannot be updated in the fact definition. Furthermore, the facts also cannot be updated in the dimension definition. The DW-Tool will ensure the goals only can be inserted or updated within the goal definition area. The gray area of goal description explains the checking mechanism of the model correctness. This principle applies for all phases of modeling to avoid inconsistency among the diagram produced by the DW-Tool. Meanwhile, the TA-Tool is used as an interface for inserting new actions and business rules for data transformation analysis. The TA-Tools is developed by using Visual Basic and make use XML-based data for goal diagram to be manipulated. The goal diagram in DW-Tool is stored in XML and helping developer to added new diagram as proposed for the data transformation analysis.

The Case Study

The case study discussed in this paper focuses on Gas Malaysia (M) utility company. This company promotes, constructs, and operates the Natural Gas Distribution System within Peninsular Malaysia. The company mission in providing the cleanest, safest, cost effective, and reliable energy solutions were motivated them to provide innovative energy solutions to the nation. The requirements' gathering was carried out with the company stakeholders and focuses on the information needed. These requirements are focused on the billing area, which is comprised of billing transaction activities. The billing system is implemented in the Utility Billing Information System (UBIS), which focus is on residential customers and supported by the external application systems namely JDE System and Call Center System (CCS).

i) Organization Modeling

The main goal of the company is Innovative Value for Energy Solutions Provider. This main goal is supported by four sub-goals that need to be fulfilled for achieving the main goal.

To simplify the evaluation process, the case study is focused on the Cost Effective Energy Solution that related to the billing area. The analyses task commence by modeling the DW requirements in the perspective of organization (i.e. the billing department). The stakeholders involved in billing area were identified and represented them by using an actor model. An Actor model explains about dependencies among actors (i.e. billing department, customer, billing operator, call center department). The next step is to analysis fact. Fact analysis aims to identify all the relevant facts for the billing area. The facts are explaining about the information required within goal structure in the billing area. Thus, the analysis is carried out by identifying the facts for each goal from top to down of the goal hierarchy.

ii) Decisional Modeling

There are four phases in decisional modeling: goal analysis, fact analysis, dimension analysis, and measure analysis. All four analyses are connected to each other and aimed to identify and define the DW components. The requirement analysis shifted to decisional modeling, which focuses on the decision-maker perspectives. The tasks are surrounded with the goals for the decision maker to define the requirements. The analysis process starts with identifying actors in goal analysis, and extends it to the fact, dimension, and measure. In this case study, a Billing Manager (BM) was selected as an actor for the decision maker. In previous approaches, the requirement analysis process ends at this stage. The knowledge of facts, dimensions, attributes, and measures will be used in further design of DW and ETL processes. However, the extended analysis on data transformation related to defining facts, dimensions, and measures need to be carried out to ensure the successful implementation of DW system. Therefore, the analysis on data transformation activities is explained next.

iii) Developer Modeling

In business rule analysis, the developer needs to identify the constraint applicable to the ETL processes according to the user requirements. The ETL processes will populate the data sources according to the constraints given. In the case study, the business rules were identified for facts of Sale Volume and Revenue and Billing and Customer Status. According to the analysis, list of business rules is presented in Table 1.

Table 1. List of Business Rule

Facts	Measures	Business Rules
Sale Volume and Revenue	Count Total Customers	Only for spot billing and prepaid billing mode
Billing and Customer Status	Count Total Consumption	Only for spot billing and prepaid billing mode
	Total Customers	• Only for residential customer • Only for spot billing and prepaid billing mode
	Total Billing	Only for spot billing

Based on the business rules given, the transformation analysis can be carried out for conceptually presenting the actions to be taken for providing the DW. The transformation analysis emphasized on the achievement of the ETL processes model for the user requirements and required business rules to absorb the complexity of the data sources. Based on the extended goal diagram of the BM, the plans of actions for Total Customers and Total Consumption for Sale Volume and Revenue goal are presented in Figure 3. The integration of UBIS and JDE data sources will be based on the ontology structure, which clarify the semantic of data sources by define the concepts, classes, properties, and relationship. The ontology mapping between DWRO and DSO is shown in Table 2. The merged requirement ontology (MRO) is reconstructed and rechecked by using Pallet as shown Figure 4.

Table 2. Partial DWRO and DSO mapping for Sale Volume and Revenue

DWRO	DSO	The Mapping
Fact (Sale Volume and Revenue)	UBIS, JDE	Concept: Sale Volume, Sale Revenue
Dimension (account number, customer type, supply type, gas consume, cost billing, billing mode)	Concept: Mode Billing (tbillmode, -) Concept: Customer Type (tbConsType, CommType) Concept: Customer Profile (tbConsumer, Customer) Concept: Supply Type (tbSuppType, SupplyType) …	Billing Mode ↔ Concept: Mode Billing Customer Type ↔ Concept: Customer Type Customer, Account number * ↔ Concept: Customer Profile Supply Type ↔ Concept: Supply Type …

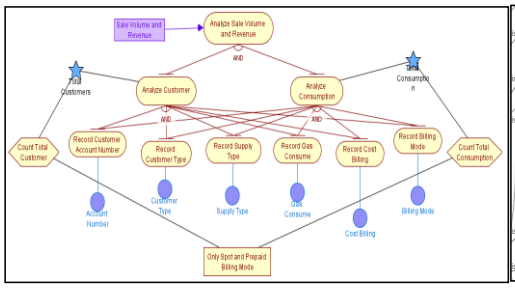

Figure 3. Transformation analysis

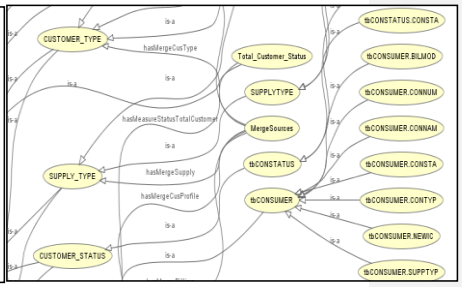

Figure 4. The MRO

iv) Constructing the ETL Processes Specifications

Using the MRO as knowledge representation of DW requirements and ETL operations of billing area, the generation of ETL processes specifications are done automatically. This task can be realized by manipulating the semantic annotation of user requirements and the data sources in MRO. The manipulation process propose set of ETL processes specifications that transform the data sources to the DW schemas as determined in the goal-oriented analysis approach. The generic data transformations used in this case study are EXTRACT, MERGE, FILTER, CONVERT, AGGREGATE, and LOADER. As presented in MRO, the knowledge about information as required and their related data sources have been defined according to RDF/OWL based language. Thus, the MRO is processed according to the algorithm defined by Ta'a et al. (2010) to identify and proposed a set of ETL processes specifications. The reasoning power is based on an inference mechanism in ontology that deals with a wide range of elaborative processing of information. Ontology reasoning is applied on classes and their related properties to derive the ETL processes specifications according to the generic data transformation tasks. To generate the ETL processes specifications automatically, a prototype application for reading, and manipulating the MRO was developed by using Java. The MRO structure that is represented by RDF/OWL language is manipulated through Jena 2 Framework that running on the Eclipse platform.

RESULTS

The results have shown that the ETL processes specifications can be derived from the early stages of user requirements. The list of ETL processes represents data transformation of

utility billing for producing the information Sale Volume and Revenue and Billing and Customer Status. The ETL processes specifications can further be translated into SQL statements or applied to any ETL tools for DW system implementation. However, it is out of this paper scope. The sequence of ETL processes executions were following the results as produced in the generation process. Therefore, the execution order may not necessarily be following the sequences of the ETL processes list. The best practices still depend to the developer efforts, experiences, and knowledge.

EXPERT REVIEWS

The expert reviews were conducted to help clarify the strengths and weaknesses of RAMEPs by using DW scenario of the case study. This method known as an exemplar and is used for evaluating the methodology, especially for requirement engineering approach (Cysneiros et al., 2004). A set of a questionnaire together with the case study was given to six DW developers, which three of them are from government agencies, and others are from DW companies. Their experiences are within the ranges of three to seventeen years in developing and implementing the DW systems in various organizations. The set of questionnaires were designed and accommodate within the scope of RAMEPs. As shown in Figure 5, the experts agreed that the RAMEPs can be implemented by using proper tools, but it will take time to implement in the real environments because of the complexity of DW model and requires more time for learning the method. Nevertheless, the RAMEPs approach enables DW developers to model the DW system from the beginning to the generation of ETL processes.

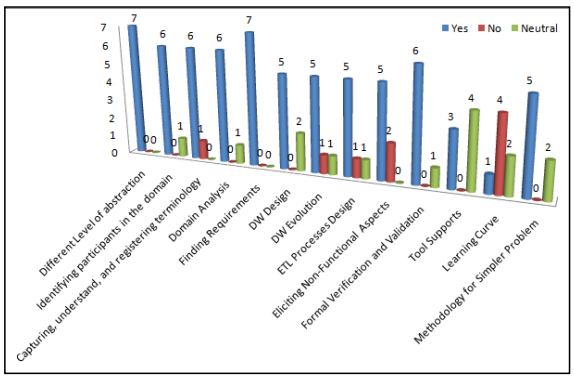

Figure 5. Expert Review Feedbacks

CONCLUSION

The RAMEPs approach has proven that the ETL processes specifications can be derived from the early stages of DW system development. The methodology used in analyzing the user requirements has been validated by DW-Tool and Protégé-OWL successfully. The evaluation approach was carried out by implementing the RAMEPs into various domains of case studies. This will give the multi views of information in DW systems. The DW experts have reviewed the RAMEPs and positively support the method to be implemented in the real environment. It is believed that the adoption of this method can help developers to clearly define the ETL processes prior to the detail design and accelerates the implementation of DW systems. Furthermore, the ontology helps a developer to resolve semantic heterogeneity problems during data integration and generate the ETL processes specifications.

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RESERVOIR WATER RELEASE DECISION MODELLING

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ABSTRACT. Reservoir water release decision during emergency situations typically, flood and drought is very crucial as early and accurate decision can reduce the negative impact of the events. In practice, decision regarding the water release is made by experience reservoir operator. During emergency such as heavy upstream rainfall that may causes massive inflow into the reservoir, early water release cannot be done without the attendance and knowledge of the operator. Additionally, the operator has to be very certain that the water released will be replaced with the incoming inflow as maintaining the water level at the normal range is very critical for multipurpose reservoir. Having this situation every year the reservoir operation record or the log book has become knowledge or experience rich "repository". Mining this "repository" will give an insight on how and when the decision was made to release the water from the reservoir during the emergency situations. The neural network (NN) model was developed to classify the data that in turn can be used to aid the reservoir water release decision. In this study NN model 8-23-2 has produced the acceptable performance during training (93.94%), validation (100%) and testing (100%).

Keywords: reservoir water release decision, neural network, repository mining

INTRODUCTION

Reservoir dam is one of the defence mechanism for both flood and drought disasters. The use of dam for flood mitigation aims to impound water in a reservoir during periods of high flow in order to maintain safe downstream discharges (Smith and Ward, 1998). The opening of the dam's spillway gate must be adequate to ensure that the reservoir capacity will not over its limits and the discharges will not cause overflow downstream. During drought, the reservoir needs to impound water and release adequately to fulfil its purposes.

In both flood and drought situations, decisions regarding the water releases are made in accordance with the available water, inflows, demands, time, and previous release (Jain and Singh, 2003; Hejazi et al., 2008). The decision includes determining the quantities of water to be stored and to be released or withdrawn from a reservoir under various conditions (Wurbs, 1993). However, reservoir operation during these two situations is critical as it involve different objectives and purposes, thus required different operation rule. Moreover, these situations are not static where it changes as the subsequent to the climate changes (Hejazi et al., 2008). The relationship between the water release and the hydrologic information is nonlinear (Labadie, 2004; Hejazi et al., 2008) and there is a strong tie between them (Hejazi et al., 2008).

In this paper temporal data mining specifically sliding window technique is proposed to extract temporal data from the reservoir operation record. The backpropagation (BP) neural network (NN) was then constructed to learn the temporal pattern and perform the

classification. The performance of the NN is measured based on the classification accuracy and the square error.

In the next section, an overview of temporal data mining is given, followed by an overview of NNs. The methodology of this study is presented in the research design section. The findings are presented in the findings section followed by the discussion and conclusion of the study.

TEMPORAL DATA MINING

Data Mining (DM), an activity that extracts some new nontrivial information contained in large databases (Laxman and Sastry, 2006), is a part of knowledge discovery in databases (KDD). Dunham (2002) defined DM as the use of algorithms to extract the information and patterns derived by the KDD process. Dunham divide DM tasks into eight categories typically, classification, regression, time series analysis, prediction, clustering, summarization, association rules, and sequence discovery.

Temporal data mining is branch of DM research. According to Laxman and Sastry (2006) temporal data mining is concerned with data mining of large sequential data sets (data that is ordered with respect to some index). Lin et al. (2002) defined temporal data mining as *"...a single step in the process of Knowledge Discovery in Temporal Databases that enumerates structures (temporal patterns or models) over the temporal data, and any algorithm that enumerates temporal patterns from, or fits models to, temporal data is a Temporal Data Mining Algorithm."*

Based on these definitions, temporal data mining can be considered as mining temporal data from temporal database. Temporal data are those which are organized based on time or certain sequence order. Roddick and Spiliopoulou (2002) has determined four broad categories of temporality within data, i.e. static, sequences, timestamped, and fully temporal. Static data contains no temporal information, but the temporal inference can be made through reference to transaction-time such as referring to audit trails or transaction logs. Sequence data is an ordered list of events. The temporal information can be extracted based on the sequences. Compare to sequences, timestamped contains more temporal information as it is a timed sequence of static data taken at certain intervals. Total temporal information can be found in fully temporal category as each tuple in a time-varying relation in the database may have one or more dimensions of time.

Temporal pattern from the database can be extracted using window sliding technique. Sliding window technique is used to capture the time delay within the data set. Sliding window technique was proven able to detect patterns from temporal data (Ku-Mahamud et al., 2009; Li and Lee, 2009). This process is called segmentation process. Modeling the temporal events can be performed using artificial intelligence techniques such as NN (Moisao and Pires, 2001; Shanmugasundaram et al. 1997; Zehraoui and Bennani, 2005).

NEURAL NETWORK

Neural Network (NN) is an algorithm that has been developed based on generalizations of mathematical models of biological nervous system. It dynamically inherits human neuron information processing capability (Graupe, 1997). This capability enables NN to perform a brain like function such as forecasting, classification, and pattern matching. The NN model is used to predict the consequence of the given action. NN can be categorized into single and multi layer network. Single layer network is a model that consists of input and output layers while multi-layer network consists of at least one hidden layer between input and output layer.

In this study, standard BP NN with bias, learning rate and momentum are used to classify the rules of reservoir water release. BP NN uses a feed forward topology, supervised learning and the backpropagation learning algorithm (Bigus, 1996). The role of NN is to learn the rule

pattern by creating a mapping between the input data (premise) and the target output (consequent). This mapping was established by training the NN to minimize the square error (*SE*) between the target (*t*) and the network output (*y*) (Equation 1).

(1)

Where *m* is the total number of output units.

RESEARCH DESIGN

Data Acquisition

In this study, Timah Tasoh reservoir was used as a case study. Timah Tasoh reservoir is one of the largest multipurpose reservoirs in northern Peninsular Malaysia. Timah Tasoh located on Sungai Korok in the state of Perlis, about 2.5km below the confluence of Sungai Timah and Sungai Tasoh. Timah Tasoh reservoir covered the area of 13.33 Km^2 with the catchment area 191.0 Km^2. Its maximum capacity is 40.0 Mm^3. Timah Tasoh reservoir serves as flood mitigation in conjunction to other purposes: water supply and recreation. Water from Timah Tasoh is used for domestic, industrial and irrigation.

In this study, a total of 3041 daily data from Jan 1999 – April 2007 were gathered from the Timah Tasoh reservoir operation record. Operation of Timah Tasoh reservoir was influenced by upstream rainfall which was manually recorded through 5 upstream gauging stations. Rainfall observed from these stations will eventually increase the reservoir water level. In this study the current water level (*t*), tomorrow water level (*t+1*), and the changes of water level at *t*, *t-1*, …, *t-w* were used as the input data, while the gate opening/closing at *t* is used as the target or the expected outcome. The constant *t* and *w* represent time and days of delays (which later represented as window size).

Data Processing

Data were imported into MS Excel and sorted based on the date. A column that represents gate opening/closing was clean to remove noise. Gate opening/closing value is in range of zero to six. Zero indicates gate is closed and values from one to six indicate the number of gates that are open. Change of this value implies the decision point. At this point window slice will be formed begin from that point and preceding to *w* days according the window size. In this study, the segmentation processes based on sliding window technique begin with window size 2, that represent 2 days of delay. The maximum window size was set to 10. Each segmentation process will return a total of 124 instances. Redundant and conflicting instances are then removed. Table 1 shows the usable number of instances and the window size.

Table 1. Data Set and the Number of Instances

Data Set	Window Size	Number of Instances
1	2	43
2	3	54
3	4	71
4	5	82
5	6	95
6	7	109
7	8	113
8	9	118
9	10	119

Classification Method

In this study, nine NN models were developed. Each NN model is trained with one data set. Inputs of all data sets are normalized using min-max method and rescale into a range of [-1,1]. The output was represented based on Binary-Coded-Decimal (BCD) scheme. The value "0" is replaced with "-1" so that all outputs are in the range of [-1,1]. Each model is trained with different combination of hidden unit, learning rate and momentum. Training is control by three conditions (1) maximum epoch (2) minimum error, and (3) early stopping condition. Early stopping is executed when the validation error continue to arises for several epochs (Sarle, 1995). Fig. 2 shows the pseudo code for the NN training. The aim of this procedure is to get the combination that gives the best result. Prior to the training, each data set is randomly divided into three different sets (Bigus, 1996): training (80%), validation (10%) and testing (10%) sets (Table 2).

```
for each hidden unit (HU)
where HU = {3,5,7,9,11,13,15,17,19,21,23,25}

    for each learning rate (LR)
    where LR = {0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9}

        for each momentum (Miu)
        where Miu = {0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9}

            Training:
                    Feedforward()
                    Backpropagation of error()
                    Weight update()

            Validation()

        end loop (Miu)
    end loop (LR)
end loop (HU)
```

Figure 2. Pseudo Code for NN Training

Table 2. Division of Data Sets

Data Set	Number of Instances	Training	Validation	Testing
1	43	35	4	4
2	54	44	5	5
3	71	57	7	7
4	82	66	8	8
5	95	75	10	10
6	109	87	11	11
7	113	91	11	11
8	118	94	12	12
9	119	95	12	12

FINDINGS

The results of NN training, validation, and testing are shown in Table 3. Overall, the lowest error achieve for training, validation and testing was 0.065795, 1.59E-07, and 9E-10 respectively. The best results of training, validation, and testing was 98.35%, 100%, and 100% respectively. These results show that NN classifier has performed well on temporal rules. Based on the results in Table 3, data set 4 is chosen to be the best data set. NN train with data set 4 achieves 93.94% of training performance and 100% of validation and testing

performance. The error was 0.23505, 0.023383, and 0.007085 respectively. Data set 4 was formed with window size 5 with 82 instances.

Values for the network parameters that were achieved from the training phase are shown in Table 4. As for data set 4, the total epoch is 86 and the best result achieved was with learning rate (LR) 0.8 and momentum (Mom) 0.2. The best network architecture achieved is 8-23-2.

Table 3. Results of Training, Validation and Testing

Data Set	Training		Validation		Testing	
	%	Error	%	Error	%	Error
1	90.00	0.39996	87.50	0.5	100.00	9E-10
2	90.91	0.362563	100.00	0.007216	100.00	6.13E-05
3	95.62	0.147186	85.72	0.626408	100.00	0.034537
4	93.94	0.23505	100.00	0.023383	100.00	0.007085
5	89.34	32.00295	100.00	1.59E-07	100.00	1.4E-07
6	97.70	0.092475	95.46	0.188657	100.00	0.002146
7	98.35	0.065796	100.00	0.032103	95.46	0.191186
8	93.09	0.276602	95.84	0.166669	95.84	0.168359
9	97.37	0.104647	95.84	0.171619	100.00	0.003985
Min	89.34	0.065795	85.72	1.59E-07	95.455	9E-10
Max	98.35	32.00295	100	0.626408	100	0.191186

Table 4. NN Parameters

Data Set	Epoch	#Input	#Hidden Unit	#Output Unit	LR	Mom
1	77	5	25	2	0.9	0.4
2	42	6	23	2	0.8	0.4
3	33	7	17	2	0.7	0.3
4	86	8	23	2	0.8	0.2
5	31	9	9	2	0.9	0.8
6	31	10	7	2	0.7	0.5
7	54	11	5	2	0.5	0.5
8	42	12	25	2	0.4	0.8
9	27	13	9	2	0.4	0.6

DISCUSSION

In this study, reservoir water level data which includes the current, the (expected) tomorrow water level and the changes of water level were extracted from the reservoir operation record. In actual reservoir operation and decision making, the current water level represent the current stage of reservoir water level (*t*), while the tomorrow water level is water level that is expected for tomorrow at *t+1*. Theoretically, this water level can be forecasted based on hydrological variables (Wan-Ishak et al., 2010). The changes of reservoir water level represent the increase or decrease of reservoir water level. Observing the changes of reservoir water level at time *t* and the preceding *t-1, t-2, ..., t-w* will give an insight on when to release the reservoir water.

The sliding window technique has been successfully employed on reservoir water release data, to extract the changes of the reservoir water level that lead to the water release decision, which is opening/closing of reservoir's gate. The findings reveal that window size 5, which represent 5 days of observed water level changes contribute to the best classification performance of NN classifier. This information is vital for reservoir management to plan early water release.

The finding of this study has also shown that NN architecture 8-23-2 has produced the acceptable performance during training (93.94%), validation (100%) and testing (100%). In addition, training the network takes only 86 epochs.

CONCLUSION

Findings of this study provide and alternative information to the reservoir operator to make early decision of reservoir water release. Manually, reservoir operator monitors the changes of

water level and consults the superior officer before taking the appropriate action. Having unpredicted circumstances of the weather, early decision of the reservoir water release is always a difficult decision.

Early water release from reservoir will reserve enough space for incoming inflow due to heavy upstream rainfall. In addition, water release can be controlled within the capacity of the downstream river. Thus flood risk downstream due to extreme water release from the reservoir can be reduced. In this study, window sliding has been shown to be a successful approach to model the time delays, while NN was shown as a promising modeling technique.

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SOLAR RADIATION ESTIMATION WITH NEURAL NETWORK APPROACH USING METEOROLOGICAL DATA IN INDONESIA

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ABSTRACT. The objective of this study is to determine the solar energy potential in Indonesia using artificial neural networks (ANNs) approach. In this study, the meteorological data during 2005 to 2009 from 3 cities (Jakarta, Manado, Bengkulu) are used for training the neural networks and the data from 1 city (Makasar) is used for testing the estimated values. The testing data are not used in the training of the network in order to give an indication of the performance of the system at unknown locations. Fifteen combinations of ANN models were developed and evaluated. The multi layer perceptron ANNs model, with 7 inputs variables (average temperature, average relative humidity, average sunshine duration, longitude, latitude, latitude, month of the year) are proposed to estimate the global solar irradiation as output. To evaluate the performance of ANN models, statistical error analyses in terms of mean absolute percentage error (MAPE) are conducted for testing data. The best result of MAPE are found to be 7.4% when 7 neurons were set up in the hidden layer. The result demonstrates the capability of ANN approach to generate the solar radiation estimation in Indonesia using meteorological data.

Keywords: solar radiation, artificial neural network, meteorological data

INTRODUCTION

In Indonesia, some meteorological station only has relative humidity, temperature, wind speed, and sunshine duration recorder. Measurement of solar radiation with reliable and calibrated pyranometers is not available or only available in the limited location.

This study proposes the ANN based for solar radiation potential in many locations in Indonesia. The proposed approach can be used as a method to estimate the solar irradiation potential in the remote and rural locations in the islands with no direct measurement devices.

This paper is organized as follows: literature review about ANN theory and previous works on predicting solar irradiance is described in section 2. The database and the method of ANN application for predicting solar irradiations are presented in section 3. The result of simulation ANN model and evaluations are shown in section 4. Conclusion is given in section 5.

LITERATURE RAVIEW AND PREVIOUS WORK

ANNs consist of an interconnection of a number of neurons. There are many varieties of connection under study, in this study only discuss about one type of the network which is called the multi layer perceptron (MLP). The MLP is the most popular learning rule is the error back propagation algorithm. Back Propagation (BP) learning is a kind of supervised learning. The BP algorithm minimizes the mean square difference between the network

output and the desired output. The MLP have ability to learn complex relationship between input and output patterns.

The advantage of neural networks is their learning ability to perform specific tasks. Learning is accomplished by adjusting the weights of the connections between neurons. Weights are adjusted so that the network can be producing the outputs as close as possible to the known correct answers of training data. During the training stage, the network is learning the rule for associating the inputs with the target outputs. Due to the generalization capabilities of the neural networks, it performs similarly on data for testing that have not used for training (Mohandes et al, 1998).

There are several studies to predict monthly average global solar irradiation potential based on ANN method. Since ANN are highly nonlinear and require no prior assumption concerning the data relationship, they have become useful tool for predicting solar irradiation. Particularly, in the meteorological and solar energy resources fields, ANN based models have been successfully developed to model different solar radiation variable in many location. Jiang (2008) developed estimation of monthly mean daily global solar irradiation using ANN method in China. The data period used are from 1995 to 2004 and the inputs for the networks are latitude, altitude and mean sunshine duration.

Alawi and Hinai (1998) developed ANN model in Oman for analyzing the relationship between the solar radiation and climatological variables in areas not covered by direct measurement instrumentation. Zhou et al (2005) found the estimation of solar irradiation in China based on ANN is superior to other available model. Result indicated that Ann model shows promise for evaluating solar possibilities; however that model is only suitable for Beijing.

From the above reviewed, ANN models have been successfully demonstrated to have potential in estimating monthly average global solar irradiation by many researchers in many countries. However, these ANN models are location dependent and specific to each location. So far, there is no report about estimation of solar radiation potential for Indonesia by using ANN method in many locations, except previous work by authors. In the previous work, Rumbayan and Nagasaka (2010) have developed ANN to estimate solar radiation in Manado location, a city in Indonesia.

This study aims to develop neural network based models for estimating monthly average global solar irradiation potential in many locations of Indonesia based on meteorological data available.

DATA AND DEVELOPED MODEL OF ANN

This section is described about the database used and the method of ANN application for estimating the global solar radiation in the island area of Indonesia. The data were gathered from meteorological station in four cities namely Manado, Jakarta, Bengkulu, Makasar that represent one region in the four big islands of Indonesia that spread over in the part of east and middle of Indonesia. The map of Indonesia with the four locations where the data has been taken are presented in Figure 1.

The database consists of measured value of average solar radiation, temperature, relative humidity, sunshine duration covering the four cities in Indonesia for 5 years (2005-2009) recorded by meteorological station. The data were split into two, as 3 cities (Manado, Jakarta, Bengkulu) were used for training a neural network and 1 city (Makasar) for testing.

Figure 1. Map of Indonesia and location of data.

The training of the models uses a feed-forward neural network with Back Propagation training algorithm. The inputs were monthly average sunshine duration, monthly average relative humidity, monthly average temperature, latitude, longitude, altitude and month of the year. The output was monthly average global solar irradiation potential. Training the model was done using a neural net simulator known as "NeuroShell". The steps are used in this study is described in Figure 2.

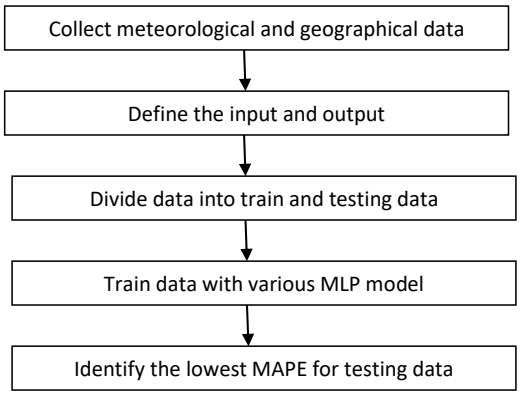

Figure 2. The methodology used in this study

The processes of neural networks for estimating the monthly global solar radiation potential were divided into two sections, i.e training and testing. First, training data, the group of data by which the network adjusts, in order to reach the test fitting of the non linear function representing the phenomenon. In this case, the recorded data in three cities (Manado, Jakarta, Bengkulu) during the period of 2005-2009 were chosen as the training set. Second, testing data, a set of data which is not include in the training data. The function of the testing data is to predict whether the model has effectively approached the general function representative of the learning pattern phenomenon. In this case, the data recorded in Makasar during the period of 2005-2009 as a test data. Data for Makasar were not included as a part of training set in order to make the results can demonstrate the generalization capability of the model to produce accurate estimation for solar radiation as unknown location.

The feed-forward back propagation algorithm with single hidden layer is used in this analysis. Several attempts of ANNs model by changing the number of neuron at hidden layer

in order to find the best MAPE. Predicted values of global solar irradiation were compared with measured values taken from meteorological data through analysis of error, in terms of Mean Absolute Percentage Error (MAPE).

Models are evaluated in terms of errors that are given by Eq. (1) where H_{mi} is measured values and H_{pi} is predicted values for monthly average global solar irradiation, n is the number of testing examples.

The mean absolute percentage error (MAPE) is defined by Eq. (1).

$$\text{MAPE} = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{H_{mi}-H_{pi}}{H_{mi}}\right| \quad (1)$$

In MAPE, sign of errors are neglected and percentage errors are added up to obtain the average. MAPE is commonly used in quantitative forecasting methods because it produces a measure of relative overall fit. It usually expresses accuracy as a percentage.

SIMULATION RESULT AND EVALUATION

This section presents the results of ANN model simulation and evaluation by comparing between measured and predicted neural network values based on statistical error.

The neural networks with multilayer perceptron (MLP) type were trained to estimate global solar irradiation potential in Makasar as testing. Data testing were not included as part of ANN training data. Hence, these results demonstrate the generalization capability of this method over unseen data.

One hidden layer was used in order to minimize the complexity of the proposed ANN model. One hidden layer is chosen to simplify the network architecture proposed. The parameters of learning rate, momentum, initial weight were selected from trial and error attempts, by setting 2 parameters fixed and vary 1 parameter in software simulation. These parameters were optimized during learning step of the ANN, with criteria of statistical error based on MAPE. The parameter selection of learning rate, momentum, initial weight of 0.1, 0.3, 0.5 respectively were used as optimum parameter for ANN model for reporting the result of estimation. The above parameter has been used for training the ANN model with varying neurons in single hidden layer by MLP type.

This study explores 15 models of MLP structures i. e 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 neurons at hidden layer. The performance of the neural networks model in term of MAPE versus number of hidden layer is presented in Figure 3.

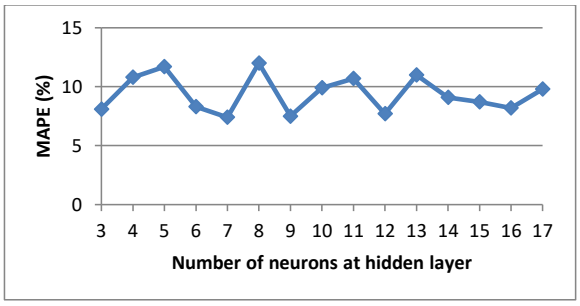

Figure 3. The MAPE versus number of neurons at hidden layer.

After several trials in varying the number of hidden neuron, it was found 7 amounts of neuron to be least error (MAPE = 7.4%) for the testing process in the neural network. The best estimator with the minimum error with 7 neurons at hidden layer was chosen to be presented in this paper as described in Figure 4.

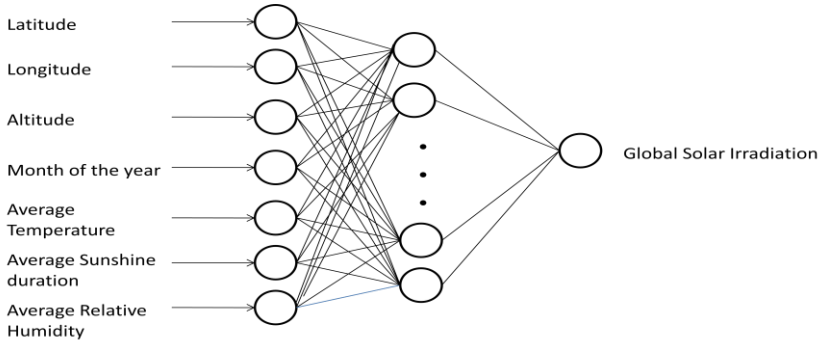

Figure 4. ANN model developed for estimating monthly global solar radiation potential in Indonesia.

Performance the best ANN model (i.e 7-7-1) between measured and predicted values (five years period) of monthly average global solar radiation for Makasar as testing data were presented in Figure 5.

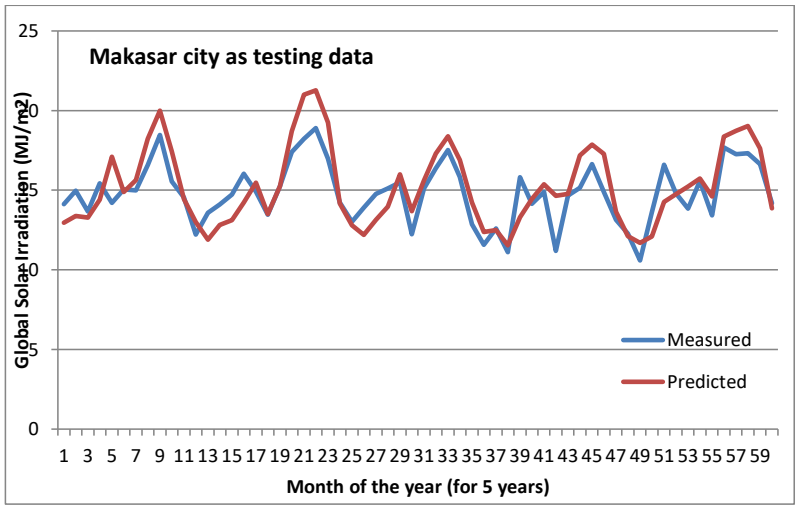

Figure 5. Measured and predicted values with 7-7-1 MLP structure in Makasar (as testing data) for 5 years, during 2005 to 2009.

It was found that the prediction of global solar irradiation obtained for the testing data well compared with the actual measured value, giving a correlation coefficient of 0.86 and MAPE is 7.4 % for testing data. It can be seen that in general, there is a good agreement between measured and predicted value of monthly global solar irradiation potential in Indonesia. This

shows the potential of ANN technique to estimate monthly global solar irradiation in island area of Indonesia in reasonable accuracy.

CONCLUSION

This study has been proposed the model of ANN to predict monthly average global solar radiation in islands of Indonesia. The results of this study indicate that the best of neural networks model for solar radiation potential can achieve 92% accuracy and MAPE of 7.4% when 7 neurons were set up at the hidden layer with the 7 inputs layer, i.e. latitude, longitude, altitude, month of the year, average sunshine duration, average relative humidity and average sunshine duration. Result of this ANN model has shown good agreement between the estimated and measured values of monthly average global solar irradiation.

This study proves that ANN can be used for estimating global solar irradiation potential in some locations in Indonesia by using meteorological data. The use of ANN method can be useful in the remote location for islands sites in Indonesia which there are no solar measurement devices. For further work, the predicted solar irradiation potential values by ANN method were presented in the form of solar mapping for the entire country.

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TOWARDS AN ISLAMIC LIFELONG LEARNING INFORMATION SYSTEM: A VISIONARY MODEL OF AN ISLAMIC LEARNING COMMUNITY

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ABSTRACT. Statistics from studies and analysis showed that the Muslim countries are the least democratic, having lowest income, as well as slowest growth income per head. Such are the results from inefficient system and management of education as well as not being able to practice lifelong learning to the upmost. Education has been the answer at the early time of Islam during the prophet's life. Based on the claim, this paper aimed at proposing an alternative educational model in order to implement the need for mass-educating the Muslim community in general. The model, which is based on the Nested Learning Community Concept, takes into account current ICT infrastructure and pervasive computing applications. It consists of five integrated layers, supported by three information system pillars namely content, communication, and self directed assessment performance. The model adopted a non formal education system which does not require students to sit in class and follow instructions to pass exams. It provides a platform for life improvement and wellbeing of oneself. Should the model be implemented in a structured way, it can fulfill all the requirements for an effective educational system in the current lifestyle of the digital age and bring us back to the glory of Ottoman Empire.

Keywords: Lifelong Learning, Learning Community, Islamic Study Circle

INTRODUCTION

Islam has never been able to gain its position as an important world political player since the fallen of the Ottoman Empire in 1924 (Muhammad, 2001, p.1). The falling of the empire has affected not only the political map of the Muslim world but also the social and economic health of the Muslim. Many statistics from studies and analysis done have reflected the many maladies befallen the Muslim countries. Muslim countries are known to be the least democratic countries especially the Middle Eastern countries (Pryor, 2007). In terms of economics for example, the Economist Review journal (2002) pointed out that one in five Arabs still live on less than $2 a day. And, over the past 20 years, growth in income per head, at an annual rate of 0.5%, was lower than anywhere else in the world except sub-Saharan Africa.

The current chaotic situation sweeping across the Arab countries are self telling about the life condition those countries are in now. In Malaysia, the general social and economic condition of Muslim is generally known to be unbefitting the Muslim ummah in general. The situation of Muslim in Malaysia in the midst of other non-muslim population is a reflection of the general Muslim countries situation compared to other countries in the world.

The only way to alleviate the Muslim from the current situation is education. One important fact to be highlighted is that the Muslim must return back to the basics in order to elevate their position in today's complicated and challenging world. All Muslims, regardless of social background must be firmly grounded to the true principles of Islam (Tauhidi, 2001). Education has been the answer at the early time of Islam during the prophet's life; it will again be the answer that will elevate the position of the Muslim today. Approaching the problems in the Muslim community requires us to deliver effective Islamic education to as many members of the Muslim community as possible regardless of age and groups in the community. Besides that the provision of the Islamic education must also be made readily available to the community continuously in the sense that it must be close to the life of the community and easily accessible at their convenience time.

This paper aimed at proposing a model of mass-education of the Muslim community in general. The idea of democratizing Islamic education for the whole ummah requires an appropriate model and proper implementation which can fulfill all the requirements for an effective educational system given the current lifestyle in the digital age. In other words, the system to be proposed must be a non formal education system which requires students to sit in classroom and follow instructions and pass exams. The system proposed must be an informal system which will provide an ongoing environment which is able to continuously improve the life of the 'learners' involved.

The current implementation of lifelong learning and learning community is very much related to the use of modern communication and network technology. As such the paper will introduce a visionary general information system model which will be the glue elsewhere in the implementation of the Islamic learning community model based on the *usrah* system.

WHY LIFELONG LEARNING?

Lifelong learning has been a term very widely discussed and debated. It is an ambiguous term for some with different meaning to different person (Jarvis 2009, p. 9). Nevertheless many efforts have been given to formalize the understanding of the term and furthermore implement it in real life. Although the concept of lifelong learning can be traced back to very old time, the term is given a new life when picked up by major world organizations and given specific meanings. Numbers of literatures discussing concepts on lifelong learning have been published by many institutions such as the Council of Europe, the European Union, UNESCO in 1970, Faure Commission report in 1972, Organization of Economic Co-operation and Development (OECD) in 1973 (Bittner, 2000; Longworth, 1999, p. 17-18). Lifelong learning concept was rejuvenated in 1996 through the Delors report on Education for the 21st Century which was produced after OECD ministerial conference on lifelong learning. The European Commission furthermore declared 1996 as the 'European Year of Lifelong Learning'.

One form of real implementation of the lifelong learning concept is the formation of spatial learning entities in many countries including in Europe, US, Australia and China. Several terminologies were associated with this entity – among them are learning city, community or region. Faris (2006) pointed out that the virtues of having spatial groupings as oppose to virtual one may seems paradoxical in the midst of the current states of art ICT setup, nevertheless he argues that the arrangement is the most natural setup known to human being besides other logistical advantages. The idea is furthermore supported by several others in their literatures (Longworth, 1999; Jarvis, 2009, p. 163).

Basic Characteristics of Lifelong Learning

Myriad of literatures have listed ideals and special elements pertaining to lifelong learning in order to crystallize the concept and theory of lifelong learning (Morgan-Klein and Osborne, pp. 10-20; Longworth, 1999, p. 105; Wain, 1987, pp. 37 - 39). Summing up the major themes of the concept are

i. The notion of learning versus education and training
ii. The active role of learners in learning as opposed to passive role students in a formal classroom setup.
iii. The use of ICT to facilitate the implementation of lifelong learning ideals.

Understanding Learning Region

Definitions of learning region varies in terms of its focus; Walters as included by Jarvis (2009, p. 165) highlighted economics objectives in defining the term while Longworth (1999) is more open in his definition. He envisions the learning city as entity that provides structural and mental frameworks which helps people to face changes in a positive way. (p. 110)

A detail discussions and practical considerations were given by Longworth (1999) in his book on the concept and implementations of learning region or learning city. One important concept related to our discussion of is the Nested Learning Community Concept of Faris (2006). Figure 1 shows a layer of different learning community nested in a layer forms starting from the learning circles as the smallest scale to the Virtual Global learning communities with several scales of communities in between. This concept is in fact very compatible with the *usrah* system implementation to be discussed in the next section.

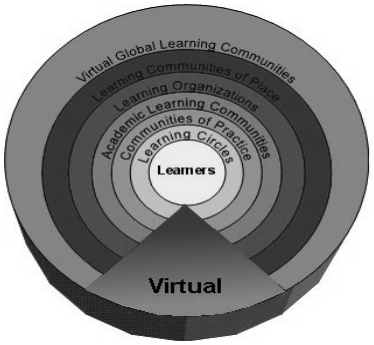

Figure 1: Learning Communities: A Nested Concept of Expanding Scale and Cascade of Social Learning Environments (Faris, 2006)

Faris (2006) pointed out that each layer is subjected to "virtualization" i.e. can be implemented as online activities. Learning in every community also is a two way, social process – in other words, is a lifelong learning process fulfilling all of its characteristics.

USRAH SYSTEM: AN ISLAMIC MODEL OF LEARNING COMMUNITY

The *usrah* system was introduced by the late Hassan Albanna, the founder of the famous Muslim Brotherhood movement in 1943 (Mahmud, 2001). The term *usrah* is an Arabic words meaning family. Indeed Albanna envisioned the *usrah* to be a family unit where an ideal Muslim is produced (Albanna, p.286). The word *usrah* today are very familiar among the Islamists as an Islamic education medium.

Usrah Pillars

Albanna in his booklets on the *usrah* system (*nizam al-usari*) listed down three pilars of the usrah system which are *ta'aruf* (Knowing each other), *tafaahum* (understanding each other) and *takaaful* (helping and caring for each other). Regarding this he mentioned that:

> "Islam emphasize heavily on the establishment of family units from among its followers which will direct them to great examples, strengthen its brotherhood and changes the meaning of brotherhood from just a mere theory to real implementation.

So prepare yourself my brothers, so that you can be the best building block for this Islamic building."

(Albanna (2003), p. 543)

Usrah Implementation

Dr. Abdul Halim Mahmud in his book *Wasaa-il attarbiyah 'indal Ikhwan* (The Means of Education for the Muslim Brotherhood) describe the usrah structure as practiced by the Muslim Brotherhood. According to him, *usrah* session is a weekly meeting facilitated by an elected leader which can possibly be alternated among members. There are four basic elements of usrah – *taujih* (instructions), *tarbiyah* (education), *tadrib* (training), *takwin wal mutaba'ah* (development and control). An usrah session usually begins with five minutes instruction or reminders of certain issues. The *tarbiyah* session usually consist of discussion and study of selected books or articles on predetermined topics. Included in this session is reading Quran, memorizing it and explaining the meaning of the verses. The training element might include performing research on certain topics and presenting them. Training can also be in personality development such as endurance training by undergoing a long walk together.

The last element involve usrah targets fulfillment. Each member will provide self evaluation of their performance for the pass week. The detail evaluation will be known only to him/her self. The facilitator will declare the general statistics of the group achievement for the week before departing so that everybody can discuss measure to improve their performance for the week to come. The usrah will themselves set a KPI (Key Performance Indicator) to measure their continuous achievement and improvement especially in performing different deeds such as prayers and non-obligatory fasting. (Mahmud, 2001, pp. 196 – 209).

METHODOLOGY

In order to implement a learning model for the Muslim community, we propose an Islamic learning community model based on the usrah system. As such, the proposed model should support the requirements and operation of the usrah system. It is important to understand that the usrah system was originally in a closed system. In order for it to be a public system, proper tools are needed that will render the usrah system to be a mass usable system. This is where ICT will play a role in helping the democratization of the usrah system.

In order to realize the idea of reviving the Muslim ummah situation, the approach has to be bottom up rather than top down. Utilizing the Nested Learning Community model as the basis, we propose a bottom up learning community model. The theory behind this is that able individuals create able families; strong families bring to strong community while good communities are the seed of a good nation. Figure 2 depicts the bottom up Islamic Learning Community Model (ILCM) based on individual as the seed.

Morgan-Klein and Osborne (2007, p. 129) rightly pointed out that one of the important element in a lifelong learning implementation is flexibility. This includes fulfilling learners' needs at different times, places and at their own pace. Several research has been performed for implementations of different aspects of the lifelong learning ideals and characteristics; each of them in general pointed out to the fact that flexibility is the key area where ICT can contribute the most (Wessner M., Haake J.M., Tietze D.A. (2002)**),** Okada M., Mendori T., Shimizu A. (2002), Kay, J. (2008).

Islamic Learning Community Information System Architecture (ILCIS) will be architected to support the four elements of the usrah system. Table 1 shows the modules needed to support the four elements of usrah system.

Table 1: Modules needed to support the four Usrah elements for the ILCM

Usrah Element	ILCIS Module	Description
Taujih	Communication Module (CM)	Providing Instructions as a top down mechanism
Tarbiyah	Development Resources (DR)	A dynamic database of knowledge and Information Resources for learning linked to outside sources for continuous updates.
Tadrib	Development Resources (DR)	
Takwin walmutaba'ah	Performance Assessment Module (PAM)	Providing self directed Assessment help to facilitate control and performance evaluation

THE ISLAMIC LEARNING COMMUNITY MODEL (ICLM)

The nested concept of learning region used as the basis of the Islamic learning community lacked some elements needed in an Islamic learning community setup. One important aspect is the follow-up mechanism. Besides that, religious contents will need verification and authorization to be acceptable to the authority and public. This is to avoid misunderstanding in religion which can prove to be more fatal than in other areas. As such each layer will be monitored by the respective establishments as shown in Figure 2.

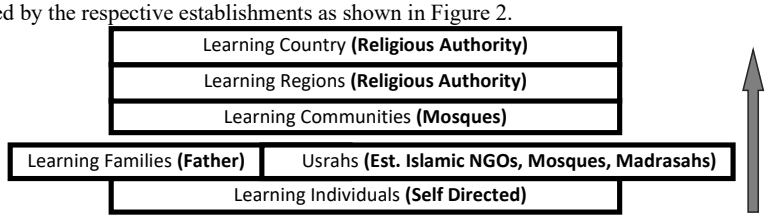

Figure 2: Proposed model of Islamic Learning community model (ILCM)

On the other hand the Islamic learning community model will be filled by different institutions in the layers. A clear different is the inclusion of family as a very important institution where learning should naturally happen. The other element introduced is the usrah system which will act as a peer based learning circle where individual with same objectives will sit down together, learning and performing self and community development activities together.

The lower layer entity of learning community in the model is actually a smaller unit which will construct the higher layer unit. As such, several individuals – optimally maximum of seven will construct an usrah learning circle. Several usrah in a given physical locality will construct a learning community unit. Likewise a learning region consists of several learning communities and a learning country is consisting of active and effective learning regions in it. The learning family is a natural unit of where individual belongs to besides he/she is also a member of an usrah group.

Islamic Learning Community Information System (ILCIS) Architecture

The resulted Information system architecture for supporting the ILCM will be an online system with the three modules interacting with each others as depicted in figure 3.

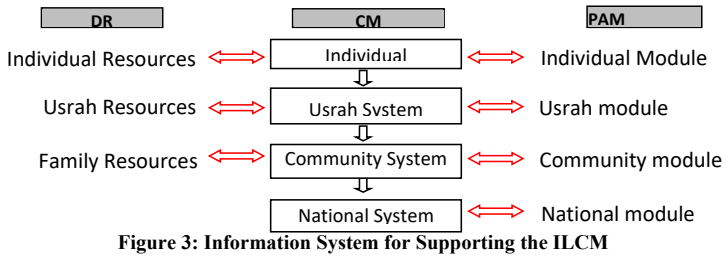

Figure 3: Information System for Supporting the ILCM

CONCLUSION AND FUTURE WORKS

The new paradigm of learning need to be infused in the Muslim community based on the lifelong learning model to replace the traditional 'education' concept to create a democratized learning environment. The notion of learning community becomes very important in creating a vision of continuously improving learning society. As such, the Islamic learning community model supported by a proper ICT structure is very much needed to realize the idea.

The proposed model (ICLM and ILCS) is a visionary model and in its general form. More work has to be performed in specifying the details of the architecture. However it is hoped that this will be a beginning for more sparks of research in the area of Islamic learning communities or Islamic lifelong learning.

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SPEEDING UP INDEX CONSTRUCTION WITH GPU FOR DNA DATA SEQUENCES

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ABSTRACT. The advancement of technology in scientific community has produced terabytes of biological data. This datum includes DNA sequences. String matching algorithm which is traditionally used to match DNA sequences now takes much longer time to execute because of the large size of DNA data and also the small number of alphabets. To overcome this problem, the indexing methods such as suffix arrays or suffix trees have been introduced. In this study we used suffix arrays as indexing algorithm because it is more applicable, not complex and used less space compared to suffix trees. The parallel method is then introduced to speed up the index construction process. Graphic processor unit (GPU) is used to parallelize a segment of an indexing algorithm. In this research, we used a GPU to parallelize the sorting part of suffix array construction algorithm. Our results show that the GPU is able to accelerate the process of building the index of the suffix array by 1.68 times faster than without GPU.

Keywords: Indexing technique, Graphic Processor Unit (GPU), Speed up, DNA sequences.

INTRODUCTION

String matching is an essential process for some computer applications. String matching is the process of finding the existence and positions of a pattern within a longer string or text. The applications of string matching process include spelling checker, parser, validating of id and password and many others. It is also a basic operation in areas like information retrieval, pattern recognition, data compression, network security and others. Because of the vast application of string matching and the rapid increased of data size, string matching is an active area in even until to date.

There are two common techniques used to string matching process, that are lookup tables such as direct-address tables or hash tables, and text preprocessing or indexing such as suffix tree (ST) or suffix array (SA). The advantage of lookup table is that it is faster to access a number from a list than to compute the number. However, lookup tables need larger memory space because of the extra variable needed to track all numbers and stored unused numbers. Therefore, most fast string matching algorithm pre-process the text to facilitate faster searching.

Developments in the molecular biology techniques lead to the increasing number of genomic and proteomic data. The size of GenBank and its collaborating DNA and protein databases which contain data coded as long strings has reached 100 Giga bases , doubles every 17 months. It has become critical for researchers to develop effective data structure and efficient algorithms and also using sophisticated technology equipment for storing, querying, and analyzing these data.

Recent graphics architectures provide tremendous memory bandwidth and computational horsepower. For example, the NVIDIA GeForce 6800 Ultra can achieve a sustained 35.2

GB/sec of memory bandwidth. Performance of the graphics hardware increases more rapidly than CPUs.

This paper offers a faster suffix array construction algorithm using GPU. To construct index quickly, we adopt the algorithm proposed by (Karkkainen & Sanders et al., 2006) that represents a reliable indexing technique with time complexity of $O(n)$. Sorting technique is important part of this algorithm, effort to increase the speed of sorting on this algorithm is done by replacing sequential radix sort with parallel radix sort using GPU (Satish, Harris et al. 2009).

RELATED WORKS

Several index structures for sequence data has been introduced, including PATRICIA trees (Morrison,1968), inverted files (Weiner,1973), prefix index (Jagadish et al. ,2000), String B-Tree (Ferragina and Grossi, 1999), q-grams (Burkhardt et al.,1999), suffix trees (ST) (Weiner ,1973), and suffix arrays (SA) (Manber and Myers, 1990). Biological data sequence, a special type of string, do not have a proper structure whereby it cannot be segmented into meaningful terms. Some of the existing data structure such as inverted files, prefix index and string B-Tree, which are efficient to natural language strings, are not applicable to biological sequences. That also applies to q-gram, which plays an important role in fast exact string matching algorithms, is not suitable for low similarity search as in pattern search(. Thus, there is an increasing interest on ST and SA as desirable index structures to support a wide range of applications on biological sequence data.

Weiner proposed the idea of suffix trees in 1973 (Weiner,1973). McCreight in 1976 reported an efficient but complex algorithm that builds a suffix tree in a time proportional to the length of the input string (Edward,1976). Ukkonen gave another simpler linear-time algorithm for this purpose in 1995(Ukkonen,1995). Although suffix trees are fundamental to string processing, they are not widely used in practical software programs because they involve extensive space usage. In 1990, Manber and Myers (Manber and Myers,1990) invented suffix arrays, which have been widely accepted as a space-efficient alternative to suffix trees. An experimental comparison of many suffix array construction algorithms are presented in (Puglisi, Smyth et al. ,2007). The best algorithms in the comparison is the algorithm by Maniscalco and Puglisi(Maniscalco and Puglisi, 2006) which is the fastest but has an $\Omega(n^2)$ worst-case complexity, and a variant of the algorithm by Burkhardt and Karkkainen (Burkhardt and K¨arkk¨ainen ,2003). Some other researcher focused on using faster computer and parallelism for example: using 128 processor for a scalable parallel suffix array construction (Kulla and Sanders ,2007), using PC cluster for a parallel construction of large suffix (Chen and Schmidt, 2005), and parallel/distributed external-memory suffix tree construction introduced by (Gao and Zaki, 2008).

BASIC SUFFIX ARRAY CONSTRUCTION (Kasahara and Morishita, 2006)

Definition 1: Let S denote the target string $b_0 b_1 .. b_{n-1}$ of length n. The *i-th* element of S is described by $S[i]$. The substring of S that ranges from the left position l*-th* to the right position r*-th*, $b_l .. b_r$, is denoted by $S[l,r]$, where $l, r \in [0, n-1]$. A *prefix* is a substring starting from the 0-th position, $S[0,r]$, while a *suffix* is a substring ending at the last position, $S[l, n-1]$.

Prefix and suffix are proper if they are shorter than original string.

Example 1 Let S denote ATAATACGATAATAA. In the following table, the left half shows proper prefixes of S, while the right presents proper suffixes of S.

S [0,0] = **A** S [10,14]= **AATAA**
S [0,1] = **AT** S [11,14]= **ATAA**
S [0,2] = **ATA** S [12,14]= **TAA**

Definition 2: Let S be a string of length *n.* A *suffix array* SA of S is an array of lexicographically sorted suffixes of S such that $SA[i] = k$ if and only if the *i-th* suffix in the lexicographic order starts at position *k* in S. An *inverse suffix array* ISA is such an array that ISA [*k*] = *i* if and only if SA [*i*]=*k.* In other words, the suffix starting at *k* position in S has rank ISA [*k*] in lexicographic order. We assume that both SA and ISA have zero-origin indexing.

SUFFIX ARRAY CONSTRUCTION ALGORITHM

Linear-Time Suffix Array Construction (LSAC)

Linear-Time Suffix Array Construction (LSAC) algorithm adopt the idea of the divide-and-conquer approach (Karkkainen, Sanders et al. 2006) . Given an input string of length n, this algorithm builds the suffix array of 2*n*/3 suffixes. Let T (*n*) denote the computation time of the overall execution. The recursive call takes T (2*n*/3), and hence we have the recurrence T (*n*) = T (2*n*/3) + *cn.* Solving this gives T (*n*) ≈3*cn*, and therefore the time complexity of the algorithm is $O(n)$.

Figure 1 represents operation of Karkkainen-Sanders (LSAC) algorithm. S12 [j] describes the starting position *i*= f (*j*) for the suffix in the input S. The first half stores such indexes that *i* mod 3 = 1, e.g., 1, 4, 7, and the latter half contains *i* mod 3 = 2, e.g., 2, 5, 8… We then radix sort first triplets of individual suffixes so that all the triplets are ranked and put into rankl2. Then we replace the starting positions of suffixes in $S12$ with ranks of the first triplets of suffixes. For example, the first triplet TAA in the suffix starting at position 1 of S is ranked 7 among all the triplets, and hence 7 is assigned to $S12$ [0]. This replacement transforms $S12$ into the list of ranks of triplets, 7863234551.

If all triplets are ranked differently, it is almost straightforward to order suffixes in $S12$ according to the ranks of triplets; however, more than one triplet can have the same rank. In this case, we call the algorithm recursively to generate the suffix array 9435687201 for string 7863234551. Since the length of 7863234551 is 10, which is two-thirds the length of the input S, the original problem is partitioned into a smaller problem.

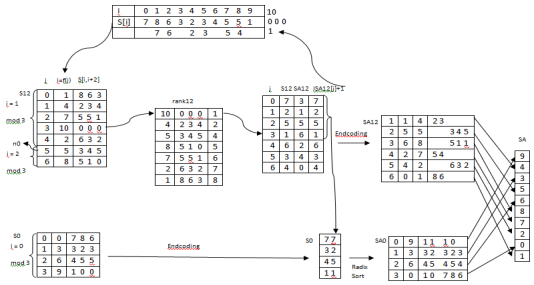

Figure 1. Operation kärkkäinen-Sanders algorithm (Karkkainen, Sanders et al. 2006).

Next, we consider how to build the suffix array of suffixes that start at position *i* mod 3 = 0. First, the starting positions of these suffixes are put into $S0$. We then treat each suffix as the pair of its first element and the rank of the suffix next to the first element according to the

order defined by $SA12$. For instance, the suffix starting at position 0 is represented by A9, because its first element is A and its next suffix is ranked 9. This encoding allows us to radix sort pairs for suffixes in SO to build the suffix array $SA0$ for $S0$, which takes time proportional to the size of $S0$. Having the two sorted lists of suffixes in $SA12$ and $SA0$, the final step is to merge them.

Having the two sorted lists of suffixes in SA12 and SA0, the final step is to merge them. Care must be taken to compare the two elements in these two lists. A suffix in SA12 that starts at x can be represented in one of the following two forms:

- If x mod 3 = 1, the suffix starting at x+1 is ranked, making it possible to represent the suffix as the pair of the first element and the rank of the following suffix, e.g., Al for x=13.
- If x mod 3 = 2, the suffix starting at x+1 is not ranked because x+1 mod 3 = 0. We herefore denote the suffix by the triplet of the first and second elements and the rank of the following suffix, e.g., 128 for x=5.

In the former case, a suffix cannot be represented by the triplet because the rank of the suffix starting from x+2 is missing; e.g., consider the case when x=l. Similarly, in the latter case, we cannot express a suffix by a pair. However, a suffix in SA0 can be denoted by both representations. For example, the suffix starting at 0 can be expressed by either A9 or AT4, making it possible to compare it to any suffix in SA12. Merging the two sorted lists yields the suffix array of the original input string in S. This step is straightforward and takes time proportional to the sum of the lengths of the two lists.

GPU Radix Sort

Satish, Harris and Garland (Satish, Harris et al. 2009) parallelized the radix sort on CUDA by dividing the sequences into p blocks for each thread. Their method focuses on utilizing the memory bandwidth into two ways, minimizing communication with global memory and maximizing synchronizing of scatters. The first goal was accomplished by partitioning the data and limits the size of digit b > 1. The second goal was achieved by locally sort the partitioned data using on-chip shared memory.

Our propose algorithm.

The input to our algorithm is the DNA text file. The steps are given as follows:

1) Convert DNA alphabet as number (A=1, C=2, G=3, T=4).
2) Give three digit values 0 at the end of sequence.
3) Divide suffixes into two classes, e.g., suffixes starting at positions *i* mod 3 ≠ 0 and the others
4) Construct the suffix array of the first class by using GPU radix sort of the first triplets of individual suffixes, so that all the triplets are ranked and put into histogram. If more than one triplet have the same rank, repeat steps 3 and 4.
5) Use the result in step 4 to radix sort pairs for suffixes in second class to build the suffix array
6) Merge the two suffix arrays into one, and return the result.

The above algorithm is designed as heterogeneous computing. Construction suffix array is done in sequential, whereas the sorting process, step 4 and 5, that is the most compute intensive parts are done in parallel using GPU. In sorting process, we adopt the method by (Satish, Harris et al. 2009) whereby CUDA kernels are executed by blocks of t = 256 threads each, processing 4 elements per thread or 1024 elements per block. Since each block will process a tile of 1024 elements, we use $P = [n/1024]$ blocks in our computations.

IMPLEMENTATION AND RESULT

In this section, we describe the experiments carried to evaluate performance of the indexing techniques, and compare them based on their construction times. We used a standard desktop computer with AMD Phenom-II810 2.6GHz Quad-Core processor, Dual Channel 4GB (2x2GB) DDR2-800 Memory, Tesla C2050 Cards (GPU), Ubuntu 8.04 64-bit Operating System. We used the C++ source code to implement sequential radix sort and LSAC algorithm, CUDA source code and Thrust libraries (Seward 2000) to implement GPU radix sort and our algorithm.

Sort Performance

Before implementation of our algorithm, we test performance of sequential radix sort and of GPU radix sort. To conduct this experiments, we use some input data which randomly chosen consisting of four alphabet.

Table 1. Construction time and Speedup data.

N	Gpu Radix Sort Second)	Sequential sort (second)	Speedup
2^{19}	0.08	0.02	0.25
2^{20}	0.09	0.04	0.44
2^{21}	0.09	0.08	0.89
2^{22}	0.1	0.14	1.40
2^{23}	0.12	0.29	2.42
2^{24}	0.15	0.57	3.80
2^{25}	0.22	1.16	5.27
2^{26}	0.35	2.32	6.63
2^{27}	0.63	4.62	7.33
2^{28}	1.16	9.24	7.97

For the number of data that is smaller than 2^{21}, sequential radix sort is faster than the GPU radix sort. GPU radix sort outperforms sequential radix sort when the size of data is larger than 2^{21}.

Table 1 present the time of sorting. The speed up of GPU radix sort is 7.93 times faster compared to the sequential sort. These results suggest that adopting GPU sort algorithm with GPU to construct DNA data using the LSAC algorithm can significantly increase the speed indexing construction. To prove this hypothesis, we carried out our algorithm in constructing SA using actual DNA data as input data.

We use 25 Homosapiens (DNA) data, which is presented in fasta. We removed the header lines, new line symbols, and blanks from original data.

Figure 4 show that our algorithm works well in constructing SA for all the DNA data that we took as sample. It also shows the speed up of the construction algorithm of SA is 0.98 to 1.68 times compared to the original LSAC algorithm.

Implementation Sequential and Linear-Time Suffix Array Construction with GPU for DNA data sequences

Figure 4. the graph shows the performance of LSAC and LSAC

CONCLUSION

Base on the results, we conclude that the GPU is a device that can potentially to improve the performance of suffix array constructing algorithm. Selection sorting task can be processed in parallel with GPU, because it provides a significant effect on construction time, where it can accelerate the process to 1.68 times. Indeed, acceleration of suffix array construction process is much slower than acceleration of GPU sorting which reached 7.93 times. This is because to construct SA of a DNA data that has characteristics of the loop alphabet; require sorting process in multiple times to form an unique ranking. Plus in the process of formation of ranking the number of data in sorting process shrinks if looping is common. Therefore, it reduces performance because the GPU radix sort is low performance when sorting small data as shown in Fig.3 In other words if the GPUs are involved in the processing of data, problems handling large bioinformatics data quickly can be resolved by using the GPU.

ACKNOWLEDGEMENT

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STUDY OF NOISE ROBUSTNESS OF FIRST FORMANT BANDWIDTH (F1BW) METHOD

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ABSTRACT. The performance of speech recognition application under adverse noisy condition often becomes the topic of researchers regardless of the language used. Applications that use vowel phonemes require high degree of Standard Malay vowel recognition capability. In Malaysia, researches in vowel recognition is still lacking especially in the usage of Malay vowels, independent speaker systems, recognition robustness and algorithm speed and accuracy. This paper presents a noise robustness study on an improved vowel feature extraction method called First Formant Bandwidth (F1BW) on three classifiers of Multinomial Logistic Regression (MLR), K-Nearest Neighbors (k-NN) and Linear Discriminant Analysis (LDA). Results show that LDA performs best in overall vowel classification compared to MLR and KNN in terms of robustness capability.

Keywords: Malay Vowel, Spectrum Envelope, Speech Recognition, Noise Robustness.

INTRODUCTION

Normally, human listeners are capable of recognizing speech when input signals are corrupted by low level of noise. According to Devore & Shinn-Cunningham (2003), human listeners can select and follow another speaker's voice (Devore & Shinn-Cunningham, 2003). Even in more adverse scenarios such as at packed football stadium, listeners can select and follow the voice of another speaker as long as the signal-to-noise ratio (SNR) is not too low. In terms of speech recognizers, most of these applications are affected by adverse environmental conditions. According to (Uhl & Lieb (2001), it is important to suppress additive noise before the feature extraction stage of any speech recogniser (Uhl & Lieb, 2001). Invariance to background noise, channel conditions and variations of speaker and accent are the main issues in noise robust applications (Al-Haddad, Samad, Hussain, & Ishak, 2008; Huang, Acero, & Hon, 2001). Development of signal enhancement techniques is an effort to remove the noise prior to the recognition process but this may cause the speech spectral characteristics to be altered. This may cause the speech signal to be unsuitable to be used in the already designed acoustic models of the recognizer thus deteriorating the performance of the recognizer (Kyriakou, Bakamidis, Dologlou, & Carayannis, 2001). This justifies the efforts of developing a robust speech recognizer modeled from robust speech features.

This paper will present a robustness study on First Formant Bandwidth (F1BW) method introduced by Shahrul Azmi (2010) (Shahrul Azmi, Siraj, Yaacob, Paulraj, & Nazri, 2010) which is an improved formant method based on single framed analysis on isolated utterances.

LITERATURE REVIEW

There are many researches on the topic of vowel recognition. Features such as formant features of formant frequency, bandwidth, and intensity were used to classify accents conversions between British, Americans and Australian speakers (Yan & Vaseghi, 2003). Formant Amplitude and 2-dimensional formant Euclidean were also used for vowel classification (Carlson & Glass, 1992; Vuckovic & Stankovic, 2001). The first three formant values of F1, F2, and F3 using Praat's linear predictive coding algorithm were used to study formant characteristics of vowels produced by mandarin esophageal speakers (Liu & Ng, 2009).

According to Hillenbrand and Houde (2003), majority of vowel identification models assumed that the recognition process is driven by either the formant frequency pattern of the vowel (with or without a normalizing factor of fundamental frequency) or by the gross shape of the smoothed spectral envelope (Hillenbrand & Houde, 2003). Several other researchers have made excellent reviews of this literature. The main idea underlying formant representations is the notion that the recognition of vowel identity is controlled not by the detailed shape of the spectrum but rather by the distribution of formant frequencies, mainly the three lowest formants (F1, F2 and F3).

In terms of robustness analysis, Luo (2008) proposed a method to sharpens the power spectrum of the signal in both the frequency domain and the time domain by integrating simultaneous masking, forward masking and temporal integration effects into traditional mel-frequency cepstral coefficients (MFCC) feature extraction algorithm (Luo, Soon, & Yeo, 2008). Yeganeh (2008) proposes a set of noise-robust features based on conventional MFCC feature extraction method based on a weight parameter (Yeganeh, Ahadi, & Ziaei, 2008). Rajnoha (2007) uses white noise and car noise to study the classification robustness of MFCC and PLP features (Rajnoha & Pollak, 2007). Gajic (2006) investigated how dominant-frequency information can be used in speech feature extraction to increase the robustness of automatic speech recognition against additive background noise (Gajic & Paliwal, 2006). In Malaysia, Al-Haddad (2009), proposed an algorithm for noise cancellation by using recursive least square (RLS) and pattern recognition by using fusion method of Dynamic Time Warping (DTW) and Hidden Markov Model (HMM) (Al-Haddad, Samad, Hussain, Ishak, & Noor, 2009). He collected Malay number speech data from 60 speakers.

METHODOLOGY

Vowel Recognition Process

Vowel Recognition process starts with the Data Acquisition process followed by filtering, pre-processing, frame selection, Auto-regressive modelling, and feature extraction process. These processes are shown in Fig.1 and their details will be explained in the rest of this paper. Data Collection process was taken from a total of 80 individuals consisting of students and staff from Universiti Malaysia Perlis (UniMAP) and Universiti Utara Malaysia (UUM). The speakers consist of individuals from both male and female genders. They are from the three main races of Malaysia which are Malay, Chinese and Indians. The details of the data collection are explained in (Shahrul Azmi et al., 2010).

Improved Vowel Feature Extraction Method

In order to train the data, two features were extracted from each recorded vowel during data collection. The first feature was extracted based on the energy of the first formant (F1) peak and denoted by $F1BW_1$. The second feature was extracted from the valley between the first (F1) and the second formant (F2) peaks and denoted by $F1BW_2$. Mean intensity of $F1BW_1$ *and* $F1BW_2$ were calculated using equation (2) where *SI* is the spectrum intensity.

$$F1BW_x(vowel) = \frac{1}{N}\sum_{f=F_{low}}^{f=F_{high}} SI(f) \quad (2)$$

Six Malay vowels were represented by a total of twelve features of *F1BW1a*, *F1BW2a*, *F1BW1e*, *F1BW2e*, *F1BW1i*, *F1BW2i*, *F1BW1o*, *F1BW2o*, *F1BW1u*, *F1BW2u*, *F1BW1ə* and *F1BW2ə*. The details of the method can be found in (Shahrul Azmi et al., 2010).

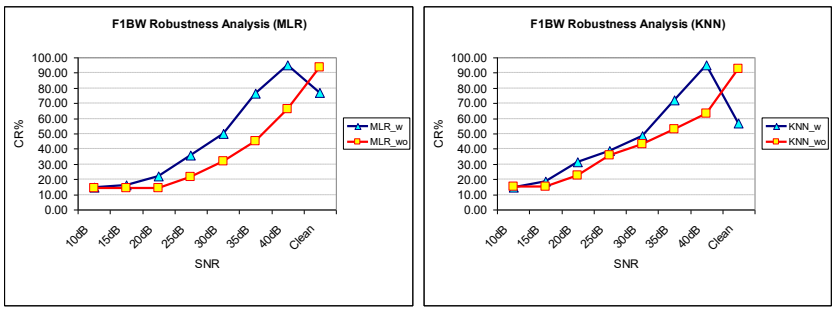
Classification Techniques Used

In this study, two non-linear classifiers which are K-Nearest Neighbours (KNN), Multinomial Logistic Regression (MLR) and a linear classifier which is Linear Discriminant Analysis (LDA) will be used to classify all the features in this study. These classifiers were chosen based on their popularities in speech recognition researches. All the features in this paper are classified using MATLAB built-in functions for all the four classifiers.

NOISE ROBUST ANALYSIS

A robustness analysis was done to study the robustness of the proposed features of First Formant Bandwidth and compare the results with the single frame Mel-Frequency Cepstrum Coefficients. White Gaussian noise was used to proof robustness. Seven signal-to-noise (SNR) levels of 10dB, 15dB, 20dB, 25dB, 30dB, 35dB and 40dB were used in this experiment in addition to the clean signal. These experiments were done on three of classifiers which are Multinomial Logistic Regression (MLR), K-Nearest Neighbors and Linear Discriminant Analysis (LDA). In the rest of the figures in this paper, the abbreviation "_w" means that the classifier model was trained with noise and "_wo" means that classifier model was trained without noise. The analysis was based on cross validation testing where the original data is randomized and split into 70% training set and 30% testing set (unseen input).

In Figure 1, blue line represents the overall vowel classification rate of F1BW features trained with noise and tested with different SNR level data. The red line represents the overall vowel classification rate of F1BW features trained with data from raw signal only and tested with different SNR level data. For the overall vowel classification trained with only clean, classification rate increases as SNR increases as shown by the plotted red lines in Fig. 6.1. Optimum overall vowel classification rates obtained for MLR, KNN and LDA were 93.78%, 92.50% and 90.19% respectively. For the overall vowel classification trained with noise, MLR and KNN overall vowel classification rates were better for SNR of 40dB and lower compared to the features trained with only clean data. As for LDA, for the overall vowel classification trained with noise, the optimum overall vowel classification rate were obtained at SNR of 30dB which is better compared to both MLR and KNN. For all classifiers, for the classification rate results trained with noisy data, "over trained" behavior was observed.



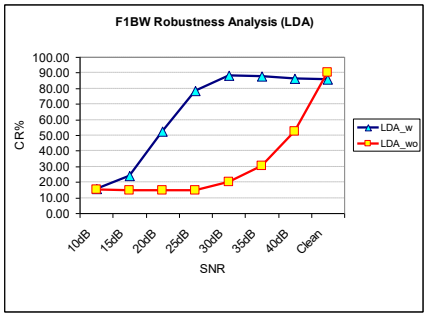


Figure 1. Overall F1BW Classification Rate by Different SNR level

In terms of classification rate trained with noisy data, LDA classifier performs the best among the three classifiers because as SNR increases, the classification rate approaches optimum faster at less than 30dB SNR which was better than MLR and KNN suggesting it to be the most noise robust. Furthermore, LDA shows less "over trained" effect when compared to KNN and MLR.

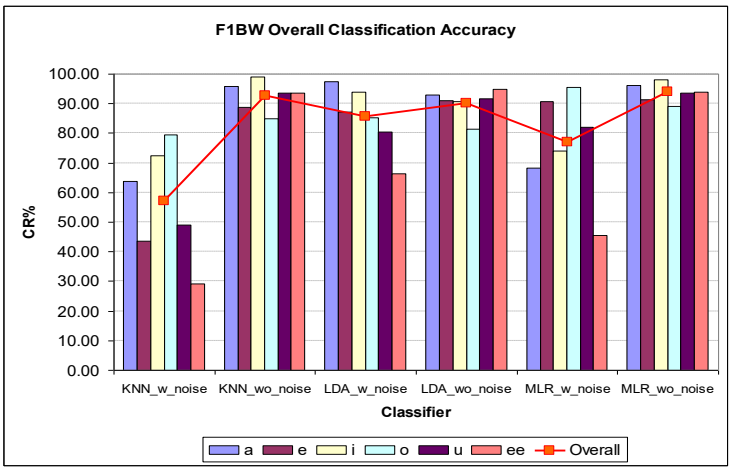


Figure 2. Overall F1BW Classification Rate of Vowels based on Classifiers and Training Conditions using Clean Training Data

Figure 2 shows the detailed overall classification result of F1BW features classified with MLR, LDA and KNN classifiers trained using only clean data. In figure 2 and table 1, the abbreviation "_w_noise" means that the clean trained classifier model was tested with noisy unseen data "_wo_noise" means that the clean trained classifier model was tested with raw unseen data. Based on overall vowel classification, MLR classifier gave the best result of 93.78% when tested with clean data with vowel /i/ giving the best classification accuracy. This is shown in Table 1.

Table 1. Overall Classification Rate of Vowels on F1BW features using Clean Training Data (Tabulated Results)

Classifiers	Testing Data	a	e	i	o	u	ə	Overall Vowel CR%
KNN	With noise	63.67	43.50	72.55	79.41	49.09	29.02	57.07
KNN	Without noise	95.87	88.85	98.98	84.84	93.48	93.66	92.50
LDA	With noise	97.50	87.30	93.92	85.21	80.32	66.30	85.65
LDA	Without noise	92.81	91.11	90.69	81.54	91.57	94.82	90.19
MLR	With noise	68.18	90.71	74.14	95.54	82.12	45.58	76.98
MLR	Without noise	96.26	91.50	97.96	89.26	93.55	94.06	93.78

MLR tested with data with noise gave only 76.98% with /o/ giving the highest classification rate. This difference in vowel recognition performance between classifier model trained with and without noise may be caused by how well the classifier model adapt to the noisy data. For the model which is trained with noisy data, LDA obtained the highest overall classification rate of 85.65% followed by MLR with 76.98% and KNN with a low classification rate of only 57.07%.

CONCLUSION

This paper presents a noise robustness study on a new improved vowel feature extraction method of First Formant Bandwidth based on formant and spectrum envelope called First Formant Bandwidth (F1BW). It was observed that LDA performs best in overall vowel classification compared to MLR and KNN in terms of robustness capability with less "over trained" effect. It also performs better compared to MLR and KNN in the robustness category especially for SNR above 20dB. The worst robust performed feature is F1BW for LDA clean trained model.

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IMPROVING ACCURACY METRIC WITH PRECISION AND RECALL METRICS FOR OPTIMIZING STOCHASTIC CLASSIFIER

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ABSTRACT. All stochastic classifiers attempt to improve their classification performance by constructing an optimized classifier. Typically, all of stochastic classification algorithms employ accuracy metric to discriminate an optimal solution. However, the use of accuracy metric could lead the solution towards the sub-optimal solution due less discriminating power. Moreover, the accuracy metric also unable to perform optimally when dealing with imbalanced class distribution. In this study, we propose a new evaluation metric that combines accuracy metric with the extended precision and recall metrics to negate these detrimental effects. We refer the new evaluation metric as optimized accuracy with recall-precision (OARP). This paper demonstrates that the OARP metric is more discriminating than the accuracy metric and able to perform optimally when dealing with imbalanced class distribution using one simple counter-example. We also demonstrate empirically that a naïve stochastic classification algorithm, which is Monte Carlo Sampling (MCS) algorithm trained with the OARP metric, is able to obtain better predictive results than the one trained with the accuracy and F-Measure metrics. Additionally, the *t*-test analysis also shows a clear advantage of the MCS model trained with the OARP metric over the two selected metrics for almost five medical data sets.

Keywords: optimized classifier, optimal performance, stochastic classification algorithm

INTRODUCTION

Instance selection (IS) is one of the classification methods which aim to reduce the instances as much as possible and simultaneously attempt to achieve the highest possible classification accuracy. From the previous studies, some of the IS methods are developed using stochastic methods such as Monte Carlo (Skalak, 1994), genetic algorithm (Garcia-Pedrajas et al., 2010) and tabu search (Ceveron & Ferri, 2001). In general, these algorithms use the training stage learns from the data and at the same time attempt to optimize the solution by discriminating the optimal solution from the large space of solutions. In order to find the optimal solution, the selection of suitable evaluation metric is essential. According to Ranawana and Palade (2006), to select the suitable evaluation metric for discriminating an optimal solution, the selected evaluation metric must be able to maximize the total number of correct predicted instances in every class. In certain situation, it is hard to build an optimized classifier that can obtain the maximal value for every class. This is because, traditionally, most of the stochastic classification algorithms employ the accuracy rate or the error rate (1-*accuracy*) to discriminate and to select the optimal solution. In (Huang & Ling, 2005; Ranawana & Palade, 2006; Wilson, 1996), they have demonstrated that the simplicity of this accuracy metric could lead to the sub-optimal solutions. For instance, when dealing with

imbalanced class instances, it is often happen that the classification model is able to perform extremely well on a large class instances but unfortunately perform poorly on the small class instances. Furthermore, the accuracy metric also exhibits poor discriminating power to discriminate better solution in order to build an optimized classifier (Huang & Ling, 2005, Ling et al., 2003, Rakotomamonyj, 2004).

Based on the drawbacks of the accuracy metric, clearly, this indicates that the main objective of any development of evaluation metric should be able to maximize all class instances in order to build an optimized classifier. Thus, in this study, we are going to propose a new evaluation metric that attempts to improve the accuracy metric. In this study, we are proposing to combine the accuracy metric with the precision and recall metrics. The new evaluation metric is known as an optimized accuracy with recall-precision (OARP) metric.

Precision and recall are two evaluation metrics that are commonly used as the alternative metrics to measure the performance of binary classifiers for two different aspects (Buckland & Gey, 1994). Basically, precision is used to determine the fraction of positive instances that are correctly predicted in a positive class, while recall measures the fraction of positive instances being correctly classified over the total of positive instances. However, it is not easy to apply both precision and recall metrics separately because it will turn the selection and discrimination processes more difficult due to multiple comparisons. In fact, this strategy can lead to the sub-optimal solution especially when the classifier attempts to maximize both metrics simultaneously. Moreover, the conventional precision and recall metrics are not suitable to be employed for the combination process with the accuracy metric. This is because both metrics only measure one class of instances (positive class). This is somewhat against the ideal idea of formulating the best evaluation metric as aforesaid, which is must be able to maximal the correct predicted instances for every class. To resolve this limitation, the extended precision and recall metrics proposed by (Lingras & Butz, 2007) were suggested for the combination. The main justification is that every class instance should be able to be measured individually using both metrics.

In this paper, we will show that our newly constructed evaluation metric will improve the conventional accuracy metric using one counter-example in terms of discriminatory and perform optimally when dealing with imbalanced class distribution. To prove this theoretical evidence, we demonstrate empirically that the OARP metric is better than conventional accuracy metric using a naïve stochastic classification in classifying five medical data sets that obtained from UCI Machine Learning Repository (Frank & Asuncion, 2009). From this experiment, the expectation is to see that the naïve stochastic algorithm trained by the OARP metric will produce better predictive result than the one trained by the accuracy metric.

OPTIMIZED ACCURACY WITH PRECISION AND RECALL (OARP)

As aforesaid, the purpose of this study is to improve the accuracy metric by combining the accuracy metric with the extended precision and recall metrics. In order to combine these metrics into a singular form of metric, we have adopted two important formulas from (Ranawana & Palade, 2006), which are the Relationship Index (RI) and OP. Due to limited pages, the details of these reference metrics can be found in (Lingras & Butz, 2007; Ranawana & Palade, 2006). The combination process involves two-step efforts, whereby first we have to find a suitable way to employ the RI formula and next is to identify the best approach to adopt the OP formula in order to improve the accuracy metric.

As proved by (Lingras & Butz, 2007), for two-class problem, the extended precision value in a particular class is proportional to the extended recall values of the other class and vice versa. From this correlation, the RI formula can be implemented. To employ the RI formula, the precision and recall from different classes were paired together (p_1, r_2), (p_2, r_1) based on the correlation given in (Lingras & Butz, 2007). At this point, the aim is to minimize the value of

$|p_1-r_2|$ and $|p_2-r_1|$, and maximize the value of p_1+r_2 and p_2+r_1. Hence, we define the RI for both correlations as stated in Eq. (1) and (2).

$$RI_1 = \frac{p_1 - r_2}{p_1 + r_2} \tag{1}$$

$$RI_2 = \frac{p_2 - r_1}{p_2 + r_1} \tag{2}$$

However, these individual RI values are still pointless and could not be applied directly to calculate the value of new evaluation metric. Thus, to resolve this problem, we compute the average of total RI (AVRI) as shown in Eq. (3) to formulate the new evaluation metric.

$$AVRI = \frac{RI_1 + RI_2}{2} \tag{3}$$

As mentioned earlier, the use of accuracy value alone could lead the searching process to the sub-optimal solutions mainly due to its less discriminative power and inability to deal with imbalanced class distribution. Such drawbacks motivate us to combine the beneficial properties of AVRI with the accuracy metric. With this combination, we expect the new evaluation metric is able to produce better value (more discriminating) than the accuracy metric and at the same time remain relatively stable when dealing with imbalanced class distribution. The new evaluation metric is called the optimized accuracy with recall-precision (OARP) metric. The computation of this OARP metric is defined in Eq. (14).

$$OARP = Acc - AVRI \tag{4}$$

However, during the computation of this new evaluation metric, we noticed that the value of OARP may deviate too far from the accuracy value especially when the value of AVRI is larger than accuracy value. Therefore, we proposed to resize the AVRI value into a small value before computing the OARP metric. To resize the AVRI value, we employed the decimal scaling method to normalize the AVRI value as shown in Eq. (5).

$$AVRI_{new\_val} = \frac{AVRI_{old\_val}}{10^x} \tag{5}$$

where x is the smallest integer such that max ($|AVRI_{new\_val}|$) < 1. In this study, we set the x=1 for the entire experiments. By resizing the AVRI value, we found that the OARP value is comparatively close to the accuracy value as shown in the next sub-section. At the end, the objective of OARP metric is to optimize the classifier performance. A high OARP value entails a low value of AVRI which indicates a better generated solution has been produced. We also noticed that via this new evaluation metric, the OARP value is always less than the accuracy value ($OARP < Acc$). The OARP value will only equal to the accuracy value ($OARP=Acc$) when the AVRI value is equivalent to 0 ($AVRI=0$), which indicates a perfect training classification result (100%).

EMPIRICAL VERIFICATION

In this particular section, two types of empirical verification have been conducted in order to verify the advantage of OARP metric. Firstly, we compare the OARP metric with the conventional accuracy metric using one simple counter-example. Secondly, we empirically compare the OARP metric with the accuracy and F-Measure metrics for selecting and discriminating five medical data sets using a naïve stochastic classification algorithm.

OARP vs. Accuracy using Counter-examples

In this particular sub-section, we attempt to demonstrate that the OARP metric is better than the accuracy metric using the following counter-example. Let us consider counter-example as shown in Table 1 that focused on imbalanced class distribution. In this counter-example, the

accuracy metric could not distinguished whether *a* or *b* is better, while the OARP metric otherwise. Intuitively, we can conclude that *b* is better than *a*. This is because, *b* is able to predict correctly all the minority class instances if compared to *a*. Clearly, *a* is poor since no single instance from minority class instances is correctly predicted by *a* (non-informative output for the minority class). Hence, we can conclude that the result obtained by the OARP metric is similar to intuitive decision and clearly better than the accuracy metric in discriminating the optimal solution. On top of that, the counter-example in Table 1 also shows that the accuracy metric could not work optimally when dealing with imbalanced class distribution.

Table 1. Accuracy vs. OARP for imbalanced data set (95:5)

s	tp	fp	tn	fn	TC	Accuracy	OARP
a	95	5	0	0	95	0.950000	0.850000
b	90	0	5	5	95	0.950000	0.934545

Note: tp-true positive, fp-false positive, tn-true negative, fn-false negative, TCC-total correct classified

Real Data Sets

As we established in the previous section, it is not enough to claim that the OARP metric is better than accuracy metric using one simple counter-example. Through the counter-example, we only can demonstrate a very little evidence in order to prove that the OARP metric is really better than the accuracy metric. Thus, in this particular section, we are going to demonstrate the generalization capability of the OARP metric using real world application data sets. Instead of accuracy metric, we add another existing metric that is F-measure (van Rijsbergen, 1979) to compare with the OARP metric. F-measure is chosen to represents the conventional precision and recall metrics. As aforesaid, it is hard to apply the precision and recall metrics separately, thus, F-measure is the best way to represents these two metrics. In fact, F-measure is proven to be the more favorable evaluation metric for evaluating the imbalanced class distribution (Joshi, 2002).

Experimental Setup. For the purpose of comparison and evaluation on the capability of OARP metric against the accuracy and F-measure metrics, five medical data sets from UCI Machine Learning Repository (Frank & Asuncion, 2010) were selected. The brief descriptions about these selected data sets are summarized in Table 2.

Table 2: Brief description of each medical data set.

Dataset	No. of Instances	No. of Attributes	Missing Value	Class Distribution
Breast-cancer	699	9	Yes	IM
Heart270	270	13	No	IM
Hepatitis	155	19	Yes	IM
Liver	345	6	No	IM
Pima-diabetes	768	8	No	IM

All data sets have been normalized within the range of [0, 1] using min-max normalization. Normalized data is essential to speed up the matching process for each attribute and prevent any attribute variables from dominating the analysis (Al-Shalabi et al., 2006). All missing attribute values in several data sets were simply replaced with median value for numeric value and mode value for symbolic value of that particular attribute across all instances. In this study, all data sets were divided into ten approximately equal subsets using 10-fold cross validation method similar to (Garcia-Pedrajas et al., 2010). Each data set was run for 10 times.

In this experiment, all of selected data sets were trained using a naïve stochastic classification algorithm which is Monte Carlo Sampling algorithm (Skalak, 1994). This algorithm combines simple stochastic method (random search) and instance selection strategy. There are two main reasons this algorithm is selected. Firstly, this algorithm simply applies accuracy metric to discriminate the optimal solution during the training phase. Secondly, this

algorithm is aligned with the purpose of this study which is to optimize the stochastic classification algorithm. To compute the similarity distance between each training instance and prototype solution (each class has one representative instance), the Euclidean distance measurement is employed. The MCS algorithm was re-implemented using MATLAB Script version 2009b. To ensure fair experiment, the MCS algorithm was trained simultaneously using the accuracy, F-Measure and OARP metrics for selecting and discriminating the optimal solution. For simplicity, we refer these four MCS models as MCS_{Acc}, MCS_{FM} and MCS_{OARP} respectively. All parameters used for this experiment are similar to (Skalak, 1994) except in the number of generated solution, *n*. In this experiment, we employed n=500 similar to (Bezdek & Kuncheva, 2002). From this experiment, the expectation is to see that the MCS_{OARP} is able to predict better than the model optimized by the MCS_{Acc} and MCS_{FM}. For evaluation purposes, the average of testing accuracy ($Test_{Acc}$) will be used for further analysis and comparison.

Experimental Results. Table 3 shows the average testing accuracy for each data set based on each MCS model. From Table 3, we can see that the average testing accuracy obtained by MCS_{OARP} is better than the MCS_{Acc} and MCS_{FM} models. The average testing accuracy obtained by MCS_{OARP} model is 0.8542 while the MCS_{Acc} and MCS_{FM} models obtained 0.8186 and 0.7806 respectively for all five medical data sets. On top of that, the MCS_{OARP} model has improved the classification performance in all data sets if compared to MCS_{Acc} and MCS_{FM} models.

To verify this outstanding performance, we perform a paired *t*-test with 95% confidence level on each medical data set by using the ten trial records from each data set. The summary result of this comparison is listed in Table 4. As indicated in Table 4, the MCS_{OARP} model obtained four statistically significant wins against both MCS_{Acc} and MCS_{FM} models. Meanwhile only one data set (Heart270) shows no significant differences from both comparisons.

Table 3: Average testing accuracy for both MCS models.

Data set	Use MCS_{Acc}	Use MCS_{FM}	Use MCS_{OARP}
	$Test_{Acc}$	**$Test_{Acc}$**	**$Test_{Acc}$**
Breast-Cancer	0.9700	0.9685	*0.9814*
Heart270	0.8704	0.8556	*0.8778*
Hepatitis	0.8454	0.8183	*0.8900*
Liver	0.6468	0.5302	*0.7160*
Pima-diabetes	0.7513	0.7305	*0.8060*
Average	0.8168	0.7806	**0.8542**

Table 4. Comparison summary of the *t*-test analysis based on ten trial records for each medical data set.

Data set	MCS_{OARP} vs. MCS_{Acc}	MCS_{OARP} vs. MCS_{FM}
Breast-Cancer	*Ssw*	*ssw*
Heart270	*Sns*	*sns*
Hepatitis	*Ssw*	*ssw*
Liver	*ssw*	*ssw*
Pima-diabetes	*ssw*	*ssw*

Note: *ssw*-statistically significant win, *ssl*-statistically significant loss, *sns*-statistically not significant

CONCLUSION AND FUTURE WORKS

In this paper, we have proposed a new evaluation metric called the Optimized Accuracy with Recall-Precision (OARP) based on combination of three existing metrics, which are the accuracy, and the extended recall and precision metrics. Theoretically, we have proved that our newly constructed evaluation metric is better than conventional accuracy metric using a simple counter-example. From this counter-example, we have showed that the OARP metric is more

discriminating than accuracy metric. More importantly, the OARP also shows that it can work optimally when dealing with the imbalanced class distribution. To support our theoretical evidence, we have compared experimentally the OARP metric against the accuracy metric using five medical data sets. In this experiment, we have added the F-Measure metric for representing the conventional precision and recall metrics. Interestingly, the naïve stochastic classification algorithm, which is Monte Carlo Sampling (MCS) algorithm optimized by the OARP metric has outperformed and statistically significant than the MCS algorithm optimized by the accuracy and F-Measure metrics. This indicates that the OARP metric is more likely to choose an optimal solution in order to build an optimized stochastic classifier. For the future work, we are planning to extend this new evaluation metric, OARP for solving multi-class problems. Moreover, we are also interested to verify the advantage of the OARP metric using a statistical consistency and discriminatory analysis proposed by Huang and Ling (2005).

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THE MFIBVP REAL-TIME MULTIPLIER

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ABSTRACT. This paper presents the architecture of the MFIBVP real-time multiplier which is ideal to be used in real-time system application. The MFIBVP technique is a combination of the *MSB–First* computation, the *Interval-Bounded Arithmetic* and the *Variable-Precision* computation techniques. The MFIBVP computation guarantees the computation carried out will produce high accuracy from the early computation time, self error estimation and time-optimal computation. This paper shows the performance of the MFIBVP real-time multiplier unit that can gives accuracy of it's intermediate-result more than 99% since the second phase of its process.

Keywords: real-time system, interval-bounded arithmetic, *MSB-First*, variable-precision, multiplier

INTRODUCTION

Real time system is a system built to support the success of the processes that is time-bounded, according to it's definition:

"*A Real-time System is one whose logical correctness is based on both the correctness of the outputs and their timeliness"*(Laplante, 2004).

Based on this definition, the main characteristics of real-time system are:

1. System have to produce a computation result correctly (*logical/functional correctness*), and
2. System have to produce a computation result before exceed the deadline (*timing correctness*).

From the point of view of the real-time computation in the hardware level, most present-day strategies are focused on increasing hardware computational performance by using parallelism, segmentation or multiprocessing design techniques in order to decrease the average response delay.

These strategies are not always the most suitable ones for solving certain problems and they give rise to a multitude of questions: in the demand for requirements of reduced size applications, is the incorporation of multiprocessor architectures embedded in the system acceptable? For minimum timing constraint applications, can a logically correct decision be made only on an imprecise numeric result? Does adaptation to changes in environmental requirements require the system architecture to be redesigned? The investigation described in this paper considers these questions in the current implementations of calculation techniques and proposes a real-time architecture for arithmetic calculations that adapts the processing delay to the required time of the task.

BASIC THEORY OF MFIBVP

MSB-First

Conventionally, computation process is carried out by a computer from the least significant bit first (LSB-First) just like we calculate, thus this technique gives slow numeric accuracy escalation throughout the process.

Nielsen and Kornerup (Nielsen & Kornerup, 1995) conducted research on MSB-First digit serial arithmetic and our previous research on MSB-First arithmetic architecture (Kerlooza, 2004a; 2004b; 2007a; 2007b; 2008) shows the potential advantage of this technique over conventional ones. Those previous researches also shows the need of the intermediate-result: a successive product of ongoing arithmetic process execution that can be accessed by other computation tasks or elements during process time. Figure 4 below shows difference between the calculation concept of the LSB-First (conventional) vs. the MSB-First computation.

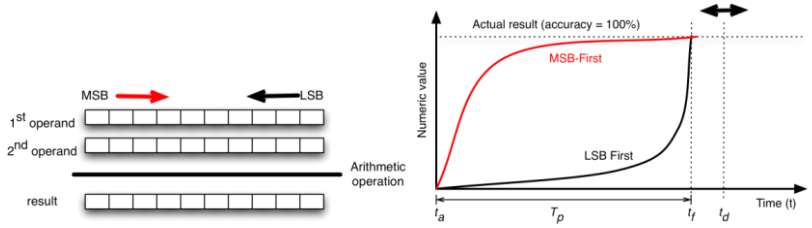

Figure 4. The calculation concept and the performance of LSB-First vs MSB-First

By starting the process of addition from number (can be bit or digit) with the highest value first will provide result with high accuracy since the beginning of the process. We can predict how the two technique (LSB-First and MSB-First) performance in gaining numeric value in arithmetic operation as depicted in Figure 4. To maximized the advantage of the MSB-First computation, the incomplete result (we call it the intermediate-result) should be able to be accessed during the computation time.

Interval Arithmetic

If we look again to Figure 4, both LSB-First and MSB-First techniques can not tell us its computation accuracy before t_f. We can add the ability to predict where the final computation value lies by using the same idea of the interval arithmetic methodology introduced by (Moore & Yang, 1959), (Moore, 1962), and (Boche, 1963). The interval arithmetic produces two values for each arithmetic operations. The two values correspond to the lower and upper endpoints (bounds) of an interval, such that the true result is guaranteed to lie on this interval. The width of the interval, i.e., the distance between the two endpoints, indicates the accuracy of the result. Interval arithmetic was originally proposed as a tool for bounding rounding-off errors in numerical computation (Moore, 1962). It is also used to determine the effects of approximation errors and errors that occur due to non exact inputs. Interval arithmetic is especially useful for scientific computations, in which data is uncertain or can take a range of values.

We can produce lower and upper bound for LSB-First and MSB-First by adopting several algorithms, one of the simplest thing to compute the upper bound is by subtracting the maximum value of the arithmetic operation with the lower bound (computed by the original algorithm) in parallel. In this way during computation time, there will be two intermediate-results which denote the lower and upper bound of the true value. Figure 5 depicts the basic idea of the interval bounded concept.

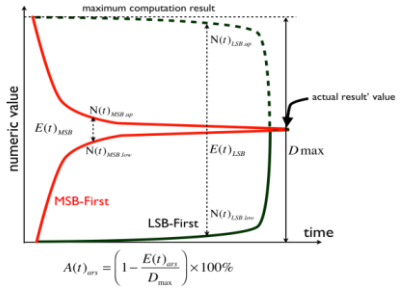

Figure 5. The concept of interval-bounded in calculating the accuracy of the intermediate-result before the final answer is produced

Variable Precision

The delay adjustment ability and the variable quality of the result of each function depends on the possibility of partially executing its implementation. In general, each operator has a part that must be executed obligatorily and another that can be partially calculated (Deng & J. W.-s Liu, 1997; J. W. S. Liu, SHIH, Lin, Bettati, & Chung, 1994). The execution control of this optional part will allow us to adjust the function performance according to the application requirements (accuracy needed or time available). In this aspect, the implemented partial execution technique (stages or iterations) must provide capabilities for successive refinement of the solution and thus, support real-time requirements. Response delay is related to the number of calculated stages or iterations of the operations. Normally, a shorter process time results in less accuracy in the results. If the computation accuracy is met or the time left for computation is up, the execution can be stop and intermediate-result can be accessed by other process. This is the basic concept of variable precision computation covered in this paper, as shown by Figure 6.

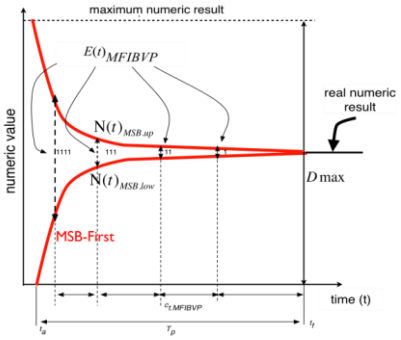

Figure 6. The Variable-Precision concept in the MFIBVP technique

THE MFIBVP REAL-TIME MULTIPLIER ARCHITECTURE

The first implementation of the multiplication operation depicted in Figure 11 is basically a well-known multiplier technique: the unsigned array multiplier (Mi Lu, 2004). It consists the following steps:

Generation of partial products: The partial products generation process is crucial to the operation's overall performance. Two aspects must be taken into account in its design: the

complexity of the generating circuit and the number of partial products generated. The first aspect is linked to the time taken in generating each partial product, whereas the second one affects the time taken in the second step below to reduce them into two operands that will be added in the last step.

Reduction in the number of partial products: The general way in which a high performance multiplier works consists of combining the partial products in order to reduce their number until a total of two is reached. We can use Wallace tree method (Wallace C.S., 1964) for the reduction of the partial products.

Final addition: It can be implemented by well-known addition methods; nevertheless, due to the MFIBVP features, we have used the previously proposed adder, the MFIBVP adder.

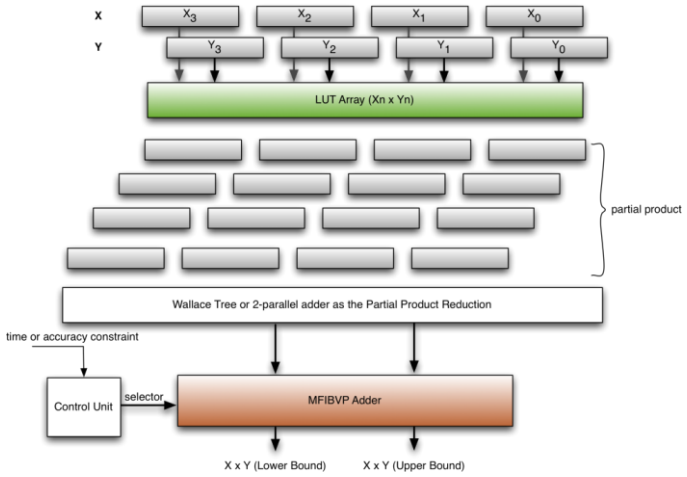

Figure 7. The architecture of the MFIBVP multiplier.

TESTING AND ANALYSIS

The tests presented in this paper are conducted to reveal:

Comparison of calculations accuracy and time required in each phase between the MFIBVP multiplier and the commonly used multiplier architecture.

The accuracy of calculations and time required by the MFIBVP multiplier in each phase.

The accuracy of intermediate-result is calculated using Eq.2 below

$$A(t)_{ars} = \left(1 - \frac{E(t)_{ars}}{D_{\max}}\right) \times 100\% \quad (2)$$

As performance comparison of the MFIBVP real-time multiplier, the performance of two commonly used multiplier architecture designs, the Array Multiplier using Carry Propagate Adder and the Carry Lookahead Adder will also be presented. Figure 8 below presents the performance comparison of these multipliers' architecture.

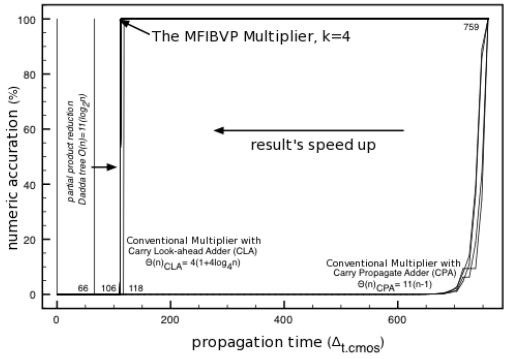

Figure 8. Performance comparison between the MFIBVP Real-Time Multiplier vs the Array Multiplier using Carry Lo*ok*-ahead Adder and Carry Propagate Adder on 50 pairs of random numbers (64-bit,*k*=4)

The Figure 8 shows that since 2nd phase or $104\Delta_{t.cmos}$ propagation time, the MFIBVP real-time multiplier has produced an error calculation less than 1%. This deterministic execution time and accuracy certainty provided by the MFIBVP real-time multiplier can improve the performance of the Real-Time System due to the ability to make trade-off between the accuracy needed and time available that can be integrated into arithmetic instruction.

By using transistor propagation time, this architecture can be implemented on any microelectronic technology that eventually determine the actual processor clock.

CONCLUSION AND FUTURE WORKS

By the performances measurement we can conclude that the MFIBVP real-time multiplier gives better computation performance than conventional multiplier architecture by it's ability to:

1. produce intermediate-result during execution time,

give certainty in computation accuracy even before the process finish time by providing two intermediate-results which act as the lower and upper bound of the real and complete computation result.

gain high computation accuracy from the early time of the execution process.

This research is a part of greater research that tries to develop new paradigm in numeric calculation that incorporates time or accuracy as a parameter of calculation. By this paradigm, real-time computation will be easier to manage both automatically on-the-fly by new scheduling system in the operating system's level, or manually by a programmer in the software design phase. Other arithmetic units and logic units with the MFIVBP technique should be designed in order to develop new real-time processor as well as new programming language, compiler and real-time operating systems.

NOTATION

A*(*t*)*ars	the accuracy of the calculations produced by arithmetic unit with *ars* architecture
E*(*t*)*ars	the error or the difference between the upper bound and bound value
Dmax	the largest calculated value that may be produced from arithmetic operations of two operand with *n* bit wide

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ARTIFICIAL NEURAL NETWORK LEARNING ENHANCEMENT USING ARTIFICIAL FISH SWARM ALGORITHM

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ABSTRACT. Artificial Neural Network (ANN) is a new information processing system with large quantity of highly interconnected neurons or elements processing parallel to solve problems. Recently, evolutionary computation technique, Artificial Fish Swarm Algorithm (AFSA) is chosen to optimize global searching of ANN. In optimization process, each Artificial Fish (AF) represents a neural network with output of fitness value. The AFSA is used in this study to analyze its effectiveness in enhancing Multilayer Perceptron (MLP) learning compared to Particle Swarm Optimization (PSO) and Differential Evolution (DE) for classification problems. The comparative results indeed demonstrate that AFSA show its efficient, effective and stability in MLP learning.

Keywords: Artificial Neural Network; Artificial Fish Swarm Algorithm; Classification problems.

INTRODUCTION

The main implication of Artificial Neural Network (ANN) is learning and improving through the environment where machine learning technique enables it to learn from experience, generalize on their knowledge, perform abstraction, make errors and does not need to be reprogrammed. The most common algorithm used in ANN is Backpropagation (BP) (Shamsuddin *et.al,* 2001). However, BP algorithm is always trapped in local minima and has slow convergence rate. Due to the weaknesses, Genetic Algorithm (GA) has been introduced to improve the BP network learning. Still, GA has complex functions and it is more time consuming in producing output. Subsequently, Swarm Intelligence (SI) technique called Particle Swarm Optimization (PSO) is became a popular method in because of its intuitiveness, its ease to be implemented and where it is more effective in solving nonlinear optimization problems. Otherwise, Differential Evolution (DE) has spontaneous self adaptability, diversity control and continuous improvements. Artificial Fish Algorithm (AFSA) is one of SI technique. The AFSA is intelligence and random search algorithm generated by studying the behavior of fish swarm in nature, solving optimization problem using swarm and artificial where it is less likely to get stuck in local minima, have adaptive ability and more capable in getting global optimum. It is a robust stochastic technique in solving optimization problem based on the movement and intelligence of swarms in food finding process. In previous related applications and research, AFSA has an advantages such as forming gradient information independently with objective function, the ability to solve complex nonlinear high dimensional problems, act as good global astringency, has strong robustness, insensitive to initial values, tolerance to parameters and simplicity of implementation. Compared to DE, AFSA can perform easily with less iteration and require less adjustment of parameters because it does not possess the mutation and crossover

processes. Furthermore, the basic DE algorithm is unsteady because the individuals in size of population vector and target vector are randomly generated and selected during the period of evolutionary procedures.

ARTIFICIAL NEURAL NETWORK (ANN)

An artificial neural network consists of a pool of simple processing units which communicate by sending signals to each other over a large number of weighted connections. In creating a functional model, there are three main basic components:

- The weight of the model which decides the strength of the connection between input and neuron. Negative weight values reflect inhibitory connections, while positive values designate excitatory connections (Haykin, 2008).
- The linear combination where it sums up all the inputs (from *j* to *p*) modified by their respective weights for neuron *i*. $v_k = \sum_{j=1}^{p} w_{kp} x_p$ (1)
- The sigmoid activation function that controls the amplitude of the output of neuron, between 0 and 1, denoted by $X = v_k + \theta_k$:
  $Y^{sigmoid} = \tanh\left(\frac{v}{2}\right) = \frac{1}{1+e^{-X}}$ (2)

In order to be a good predictor, an error is composed from the different between desired and actual output. The information in this error is feed back to the system so that the parameters can be adjusted in a systematic fashion (the learning rule). The network error, Mean Square Error (MSE),

$$\text{MSE} = \frac{1}{2}\sum(desired - actual)^2 \quad (3)$$

ARTIFICIAL FISH SWARM ALGORITHM (AFSA)

The basic behaviors of AFSA are AF_Prey, AF_Swarm, AF_Follow where AF_Prey is food searching, AF_Swarm is the fish get together in group and AF_Folllow is where the swarm will follow a fish when it found food. Firstly, the algorithm constructs simple basic behaviors of artificial fish, then based on local searching behaviors, come out with global optimum finally. AFSA can search global optimum efficiently and has certain ability in adapting to space searching. Acording to Chen, *et al.*, (2007), The AF will evaluate current environment and select suitable behavior that has better improvement state to be executed. Let i^{th} AF represented with a D-dimensional vector $X_i = (x_1, x_{2, \ldots,} x_D)$ where i= 1,2, … n and a random selected states within visual position of X_i is $X_j = (x_1^j, x_{2,\ldots,}^j x_n^j)$, where

$$y = f(x) \quad (4)$$
$$d_{ij} = \| x_i - x_j \| \quad (5)$$
$$x_j = x_i + \text{Visual.Rand(), i } \epsilon \text{ (O,n]} \quad (6)$$
$$S = \{X_f \mid \|X_i - X_j\| < \text{Visual}\} \quad (7)$$
$$X_{next} = X_i + \frac{x - x_i}{\|x - x_i\|} \text{. Step.Rand()} \quad (8)$$

y is fitness function at position x (represent food concentration, FC), d_{ij} is distance between the AF i and j, Visual is visual distance, Rand() is function produces random numbers between 0 and 1, Step is moving step length, S is set of AF exploring area at present position (neighborhood), x is x_j for prey, x_c for swarm *or* x_{max} for follow behavior, x_i is optimizing variables, n is total number of AF / swarm size, n_f is number of its companions fellow in the current neighborhood S, δ is crowd factor ($0 < \delta < 1$), try_num is maximum number of chances that x_j being randomly choose.

AFSA IN ANN LEARNING

In optimizing the feed forward neural networks with AFSA, the network depends on the structure of AF. Each AF represents a feed forward neural network. The optimizing variables are weight matrix (w_1, w_2, … w_h), and bias (θ_1, θ_2), in the neural network. The inputs are (x_1, x_2, … x_n), outputs are (y_1, y_2, … y_m), inputs of hidden layer are (s_1, s_2, … s_h), output of hidden layer are (z_1, z_2, … z_h). The activation function used to calculate output for each neuron except input neuron is Sigmoid Activation/Transfer Function Equation as shown below:

$$f(x) = \frac{1}{(1+e^{-x})} \tag{9}$$

where, x = input

Let w_{ij} be the connecting weight between input and hidden layer, w_{i0} are the threshold values to hidden layer, v_{ki} be the connecting weight between hidden and output layer, w_{i0} are the threshold values to output layer. The computing formulas are:

$$s_i = \sum_{j=1}^{n} w_{ij}x_j + w_{i0} \quad , \quad 1 \le i \le h \tag{10}$$

$$z_i = f(s_i) \quad , \quad 1 \le i \le h \tag{11}$$

$$y_k = \sum_{i=1}^{h} v_{ki}z_i + v_{k0} \quad , \quad 1 \le k \le m \tag{12}$$

Overall, the output of feedforward NN will be:

$$y_k = \sum_{i=1}^{h} v_{ki} f\left(\sum_{j=1}^{n} w_{ij}x_j + w_{i0}\right) + v_{k0} \quad , \quad 1 \le k \le m \tag{13}$$

The feedforward NN training process is to get the minimum value of network error, E by adjusting the weights and biases values. The nonlinear error function chosen is Mean Square Error to quantify the error of the network. Suppose that the dataset for training in neural network is A where X^i is the input of the neural network and T^i is the desired/targeted output values:

$$A = \left\{\left(X^i, T^i\right) \middle| \, i = 1, 2, \ldots n\right\} \tag{14}$$

$$E = \frac{1}{2}\sum_{i=1}^{n}\sum_{k=1}^{m}(T_k^i - y_k^i)^2 \tag{15}$$

In enhancing the MLP learning using AFSA algorithm, each AF position represent set of weights in NN. The AF will adjust its position by evaluate current environment and select suitable behavior that has better improvement state to be executed. Food Concentration (FC) of an AF is obtained using the E value calculated from output of feedforward NN as:

$$FC = 1/(1+E). \tag{16}$$

If there are no companion AF around AF_i, randomly select states within visual position of AF_i in D-dimensional vector (X_i) as X_j. Let X_i be the current state, randomly generate a number, $Xj \in$ Visual. *try_num* is the maximum number of times that choosing Xj to compare its FC with Xi, if FC of Xj is higher than FC of Xi ($FCj > FC_i$), Xi moves towards Xj in the range of *Step* with the food searching behavior $AF\_prey(X_i)$ expressed as:

$$X_i^{(t+1)} = X_i^{(t)} + \frac{X_j - X_i^{(t)}}{||X_j - X_i^{(t)}||} \text{. Step.Rand(0,1)} \tag{17}$$

Otherwise,

$$X_i^{(t+1)} = X_i^{(t)} + \text{Step.Rand(-1,1)}, \tag{18}$$

After *try_num* times, if there are none of the X_j has higher FC compare its FC with X_i , the X_i move randomly in range of Step. When there are companion AF around the AF_i, it may

swarm spontaneously when swimming to share for food in the swarm. Assume that X_i is the current AF state and $X_{center} = \frac{\sum x_j}{nf}$, is the center position of the food concentration between X_i and its companion AF in *Visual*. If $\frac{FC_c}{nf} > \delta FC_i$ means that the companion center has more food (higher FC value) and is not very crowded. So, AF_i goes forward a step to the companion center and crowd together to share the same food.

The function for X_i to swarm is expressed as:

$$X_i^{(t+1)} = X_i^{(t)} + \frac{X_c - X_i^{(t)}}{||X_c - X_i^{(t)}||}. \quad (19)$$

Step.Rand(0,1), otherwise,

$$X_i^{(t+1)} = AF\_prey(X_j) \quad (20)$$

The *AF_Follow* has X_i as current state and $X_{max} = \max\{f(X_j) | X_j \epsilon S\}$ which is the AF with highest FC in visual range of AF_i. If $\frac{FC_{max}}{nf} > \delta FC_i$, means that the companion with highest FC with a surrounding which is not very crowded will lead the swarm to follow the AF which discovers more food to share with it. The next position of X_i can be expressed as:

$$X_i^{(t+1)} = X_i^{(t)} + \frac{X_{max} - X_i^{(t)}}{||X_{max} - X_i^{(t)}||}. \text{ Step.Rand(0,1)} \quad (21)$$

Otherwise, $X_i^{(t+1)} = AF\_prey(X_i)$ (22)

In applying the AFSA in enhancing the MLP learning, the parameter of Visual is set to provide the better convergence in whole area when its value is larger. Step parameter also can increase convergence rate when it has larger value, besides it is faster in preying optimization. For δ, it should be smaller to get better convergence in the whole area because less AF will be maintained in the area resulting lower competition of food.

EXPERIMENTAL SETUP AND RESULT

There are three core functions in AFSA, the AFSA_prey, AFSA_swarm and AFSA_follow. The experiments are tested on Scale, Cancer and Iris dataset. The results are validated by probing the best error convergence rate of all the iteration until it achieves optimal solution. The training stopping conditions are either Mean Square Error (MSE) that has reached less than minimum error of 0.005 or reached maximum number of iteration. The AFSANN gives stochastic output; hence 10 running times for training the dataset are simulated and recorded to get the average (refer to Table 1). The AFSA parameters used for training are 20 AF, each visual range (Visual) is 28.0, Step of 22.0 and delta is 0.05. From these tables, it show that AFSANN provides higher accuracy for all datasets accordingly.

Table 1. The average result of AFSANN on Scale, Cancer and Iris Dataset.

Dataset	Scale	Cancer	Iris
Convergence Time (s)	2.7	7.3	3
Learning Iterations	15.6	31.6	12.4
Correct Classification (%)	99.646	99.582	99.714
Error Convergence	0.003532198	0.003390274	0.003319926

This study aims to determine the efficient of AFSA compared to PSO and DE in enhancing the MLP learning in term of convergence rate and correct classification. As heuristic algorithms which hope for a solution that to be closed to optimal solution, result with higher correct classification is more likely to have actual output that is near similar to target

output. A fair comparison will be made through training using same network inputs of data, network structure, sigmoid activation function and target MSE value. As the three algorithms have stochastic performance, the best result between the recorded outputs is compared in Table 2. It seems that AFSANN yields better accuracy compared to PSONN and DENN for the all datasets.

Table 2. The average result of AFSANN on Scale, Cancer and Iris Dataset.

Dataset	Algorithm	AFSANN	PSONN	DENN
Scale	Convergence Time (s)	5	6	7
	Learning Iterations	20	141	18
	Correct Classification (%)	99.80	99.57	99.46
	Error Convergence	0.000223283	0.00494936	0.00127556
Cancer	Convergence Time (s)	25	17	14
	Learning Iterations	52	240	25
	Correct Classification (%)	99.95	99.49	98.23
	Error Convergence	0.00010583	0.00498231	0.0025403
Iris	Convergence Time (s)	3	4	3
	Learning Iterations	7	12	7
	Correct Classification (%)	99.79	99.43	98.69
	Error Convergence	0.00142662	0.00379363	0.000566319

Meanwhile, Figure 10 compares the classification percentage for all 3 datasets used to train on MLP feedforward neural network using those three algorithms. It gives a clear picture that AFSA is having higher percentage than PSO and DE in all dataset training. Calculated in average of correct classification, AFSANN gives 99.85%, PSONN achieved 99.50% and DENN has 98.80%.

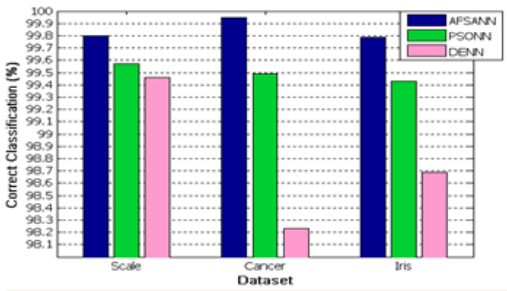

Figure 90. Classification percentage of AFSANN, PSONN and DENN.

CONCLUSION

Experiment results have demonstrated the effectiveness of AFSA in solving MLP neural network weight optimization problem. The progress of the experiment significantly shows that AFSA overcomes local optimal value problem and shows robustness in convergence error and classification accuracy compared to PSO and DE. The AFSA has more complex algorithm compared to PSO and DE, but it shows better in convergence rate and correct classification. Based on the analysis on comparison made, it can be conclude that AFSA algorithm is a robust method that can be effectively applied in MLP learning through weight adjustment and it achieves optimum in most cases. Besides that, AFSA algorithm converges faster in less iteration and with better correct classification compared to PSO and DE in enhancing MLP learning. AFSA also has 3 behavior that enable it to step out of local minima when optimizing weights if MLP in training process. Therefore, the dataset used and network structure generated in affecting the result of convergence time and iteration for AFSA is not

as critical as for PSO and DE in enhancing MLP learning. AFSA has good global astringency and population position initialized in the beginning of the training does not affect efficiency of AFSA in terms of convergence time and iterations, compared to PSO and DE algorithm, in enhancing MLP learning. Finally, AFSA has good stability because the average result on a set of training is near similar to all of the results, including best result in the experiments on each respective dataset.

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PREDICTION OF PHYSICAL PROPERTIES OF OIL PALM BIOMASS REINFORCED POLYETHYLENE: LINEAR REGRESSION APPROACH

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ABSTRACT. In recent years, there has been an increasing interest on renewable resources for consumer products and biodegradable materials. Traditional polymeric materials derived from petro-chemical sources do not degrade and disposal of such materials is a major concern in minimizing the environmental problems. Currently, experiments are carried out in laboratories to determine the physical properties of degradable plastics which include melt flow index (MFI), melting point (MP) and Density. Oil palm biomass (OPB) is used as bio-active components in the formulation with Polyethylene (PE). Alternatively, a different approach is required as to minimize the time consume, the cost of production and the cost of labor. In this study, Linear Regression model has been developed and used to predict the physical properties of degradable plastics. The ability of Linear Regression model is assessed by comparing the theoretical results with the actual lab results using correlation coefficient (r) and coefficient of determination (R^2). The result showed that the percentage prediction accuracy for MFI is 93%, 71% for the prediction of MP and 24% for the prediction of Density respectively using linear regression. The study proves that the use of Linear Regression model for predicting the physical properties of degradable plastics is highly feasible.

Keywords: Oil palm biomass (OPB), polyethylene (PE), Linear Regression

INTRODUCTION

Currently experiments are carried out in laboratories to determine the physical properties of degradable plastics which include Melt flow index, Melting point, and Density by using Oil palm biomass as bio-active components in the formulation. The whole process is very time consuming and costly. Thus there is a need for an alternative method of modeling the properties of fibre-reinforced polymer composites. Traditional mathematical equations derived provide a way for solving real world problems. A study by Sin *et al*. (2010) showed that Linear Regression method is capable of predicting the properties of fibre-reinforced polymer composites.

Fundamental of Linear Regression Model

Regression model is a statistical method commonly used for modeling relationships between variables. Introduced by Sir Francis Golton in 1985's, the idea of simple linear regression was later extended into other methods of regression such as multiple linear

regression, logistic regression and nonlinear regression. Linear Regression is a model with a response variable y that has a relation with single regressor x. A typical equation of Linear Regression is as follows:

$$y_i = B_o + B_1 x_i + \in_i , \qquad i = 1, 2, \ldots, n \tag{1}$$

where, y_i is the dependent variable, B_o is the intercept, B_1 is the slope and $\in_i$ is the error. The present study uses Linear Regression model in predicting the physical properties of degradable plastics. Linear Regression model is being used in this study since reports have shown that Linear Regression produces good prediction results through simple computation (Sin *et al*., (2010).

Background of Natural Fibres

Studies of natural fibre as filler in producing degradable plastics have attracted numerous researchers and academician in pursuing industrial research. Examples include the investigation of the mechanical and physical properties of degradable plastics (Mungara *et al*., 2002); studies on degradable plastics' thermal behaviour (Mangal *et al*., 2003) and the studies on the effect of treated and untreated fibers on degradable composites (Sreekala and Thomas, 2003).

Recently, there have been an increasing number of studies on oil palm biomass (OPB). Different types of oil palm biomass that can be used as fillers are oil palm empty fruit bunch and oil palm trunk wood flour (Badri *et al*., 2005; Zaini *et al*., 1994). The rationale behind the interest in using OPB as fillers is due to several benefits which include the renewable nature of OPB, OPB's lower density and its amenability to chemical modification as well as lower cost of accumulation (Badri *et al*., 2005).

Numerous mathematical models have been applied in the study of degradable plastics. such as regression model (Sin *et al*., 2010); ANFIS model (Lee *et al*., 2008); Fuzzy model (Muc and Kedziora, 2001); modified rule of mixtures (ROM) strength and simple ROM strength (Facca *et al*., 2007); micromechanical model (Facca *et al*., 2006) and, Tobias and Y. Agari model (Mangal *et al*., 2003). The present study focuses on the application of Linear Regression in predicting the physical properties of oil palm biomass (OPB) reinforced polyethylene (PE).

The objective of this study is to develop Linear Regression model for the prediction of MFI, MP and Density of degradable plastics. The ability of Linear Regression model in predicting MFI, MP and Density of degradable plastics will be assessed by comparing theoretical results with actual lab results using correlation coefficient (r) and coefficient of determination (R^2).

METHODOLOGY

Linear Regression model is developed and used to identify the suitable level of factors affecting the MFI, MP and Density of degradable plastics using MATLAB programming. The method of this study is divided into 3 steps as follows:

Step 1: Identify input and output values.

The results obtained from the Malaysian Palm Oil Board (MPOB) laboratories are used to develop the Linear Regression model. The two inputs are Polyethylene (PE) (%) and Oil palm biomass (OPB) (%).The outputs are the physical properties of degradable plastic composites namely the Melt flow index (g/10min), Melting point (^oC) and Density (g/cm^3). A resampling technique known as bootsrapping was applied to the data collected by MPOB to produce a sample of 220 data. The data were divided into two sets, the training and testing data sets with the partition of 50%-50%. The training data were used to generate Linear Regression formula

while the testing data were used to assess the ability of Linear Regression model based on the Corelation Coefficient (r) and the Coefficient of Determination (R^2) values.

Step 2: Generate Linear Regression formula.

To create Linear Regression equation, the parameter β_o and β_1 has to be estimated. Here, the method of least square was used such that the sum of the squares of the difference between the observation y_i and the straight line is minimized (Montgomery, 1991).

Let say $\hat{\beta}_0$ and $\hat{\beta}_1$ are the estimated values of β_o and β_1 respectively. Hence the predicted values, $\hat{y}_i$ is given as follow:

$$\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_i \tag{2}$$

The difference between the observations, y_i and the predicted value, $\hat{y}_i$ is called residual, e_i. The smaller the residuals, the better fitted value is achieved. The residual is given as:

$$e_i = y_i - \hat{y}_i = y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i \tag{3}$$

The least square criterion is

$$s(\beta_0, \beta_1) = \sum_{i=1}^{n} (y_i - \beta_0 - \beta_1 x_i)^2 \tag{4}$$

The least square estimator for β_o and β_1 , say $\hat{\beta}_0$ and $\hat{\beta}_1$ has to satisfy the condition below:

$$\frac{\partial s}{\partial \beta_0}|_{\hat{\beta}_o, \hat{\beta}_1} = -2 \sum_{i=1}^{n} (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i) = 0 \tag{5}$$

and

$$\frac{\partial s}{\partial \beta_0}|_{\hat{\beta}_0, \hat{\beta}_1} = -2 \sum_{i=1}^{n} (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i) x_i = 0 \tag{6}$$

Simplifying equations (5) and (6) gives

$$n\hat{\beta}_0 + \hat{\beta}_1 \sum_{i=1}^{n} x_i = \sum_{i=1}^{n} y_i \tag{7}$$

and

$$\hat{\beta}_0 \sum_{i=1}^{n} x_i + \hat{\beta}_1 \sum_{i=1}^{n} x_i^2 = \sum_{i=1}^{n} y_i x_i \tag{8}$$

Equation (9) is called the least squares normal equation. The solution for $\hat{\beta}_0$ and $\hat{\beta}_1$ are as follow:

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x} \tag{9}$$

and

$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n} y_i x_i - \frac{(\sum_{i=1}^{n} y_i)(\sum_{i=1}^{n} x_i)}{n}}{\sum_{i=1}^{n} x_i^2 - \frac{(\sum_{i=1}^{n} x_i)^2}{n}} \tag{10}$$

where

$$\bar{y} = \frac{1}{n} \sum_{i=1}^{n} y_i \quad \text{and} \quad \bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i \tag{11}$$

Now, $\bar{y}$ and $\bar{x}$ are the averages of y_i and x_i respectively. Thus from equations (9) and (10), $\hat{\beta}_0$ and $\hat{\beta}_1$ are the least squares estimators of the intercept and slope. Below is the fitted simple linear regression model:

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x \tag{12}$$

From equation (10), the numerator is the corrected sum of the cross products of x_i and y_i. The denominator is the sum of the cross products of x_i and y_i. These two quantities are repesented as:

$$s_{xx} = \sum_{i=1}^{n} x_i^2 - \frac{(\sum_{i=1}^{n} x_i)^2}{n} = \sum_{i=1}^{n} (x_i - \bar{x})^2 , \quad i = 1,2, \dots, n \tag{13}$$

and

$$s_{xy} = \sum_{i=1}^{n} y_i x_i - \frac{(\sum_{i=1}^{n} y_i)(\sum_{i=1}^{n} x_i)}{n} = \sum_{i=1}^{n} y_i (x_i - \bar{x}) \tag{14}$$

Thus, equation (10) can be rewriten as

$$\hat{\beta}_i = \frac{s_{xy}}{s_{xx}} \quad (15)$$

Step 3: Assessing Ability of Linear Regression.

This study assesses the ability of Linear Regression model in the prediction of the physical properties of degradable plastics based on the correlation coefficient (r) and the coefficient of determination (R^2) values calculated in MATLAB R2009a environment. The formulae of r and R^2 used are as follows (Wang and Elhag, 2008):

$$r = \frac{\sum_{i=1}^{N}(A_t - \bar{A})\,(F_t - \bar{F})}{\sqrt{\sum_{t=1}^{N}(A_t - \bar{A})^2 \cdot \sum_{t=1}^{N}(F_t - \bar{F})^2}}$$

Where A_t and F_t are the actual and predicted values, N is number of training and testing data set, $\bar{A} = \frac{1}{N}\sum_{t=1}^{N} A_t$ and $\bar{F} = \frac{1}{N}\sum_{t=1}^{N} F_t$ are the average values of A_t and F_t over the training or testing data.

And $\sqrt{R^2}$ = Absolute value of r

In general, the formula of r is used to investigate the strength of the linear relationship between X and Y (Pardoe, 2006). The larger value of r indicates the better performance of the model understudied (Wang and Elhag, 2008). On the other hand, R^2 is used to measure the goodness of fit of the model.

RESULTS AND DISCUSSION

In this study, Linear Regression models were developed using the training data set and used to predict the Melt flow index (MFI), Melting point (MP) and Density of degradable plastics based on two input parameters PE and OPB using the testing data set. The Linear Regression equations for the models developed using the training data set are:

MFI = -0.0066 PE – 0.0080 OPB + 0.7592

MP = 0.0986 PE + 0.1016 OPB + 119.6384

Density = 0.0027 PE + 0.0029 OPB +0.6469

The testing data set was then used to predict the MFI, MP and Density of degradable plastics using the three derived equations. The predicted results are then compared to the actual lab results. The discrepancies between the predicted results and the actual lab results are used to calculate the correlation coefficient (r) and the coefficient of determination (R^2). The correlation coefficient (r) and the coefficient of determination (R^2) values are tabulated in Table 1. The result reveals that, the prediction accuracy of Melt flow index is 93%, 71% for the prediction accuracy of Melting point and 24% for the prediction accuracy of Density respectively. The results indicate that the use of Linear Regression model for predicting the physical properties of degradable plastics is highly feasible.

Table 2. Correlation Coefficient (r) and Coefficient of Determination (R^2).

Physical Property of Degradable Plastic Predicted	r	R^2
Melt Flow Index	0.9656	0.9324
Melting Point	0.8422	0.7093
Density	0.4946	0.2446

CONCLUSION AND RECOMMENDATION

Linear Regression model has been developed to study the physical properties of degradable plastics (Melt flow index, Melting point and Density) with different percentages of PE and OPB. The findings from this study indicate the feasibility of Linear Regression model

as alternative tool to be used in predicting the physical properties of degradable plastics. It is also recommended that further research be carried out on other aspects of degradable plastics using others mathematical applications. The findings of this research will certainly benefit the industry related to biopolymer products.

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DETECTION A DESIGN PATTERN THROUGH MERGE STATIC AND DYNAMIC ANALYSIS USING ALTOVA AND LAMBDES TOOLS

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ABSTRACT. Understanding the legacy systems and its changed requirements is the main problem in software process. The legacy systems must be maintain to meet the needs of new computing environments or technology, and must be enhanced to implement new business request or to make it interoperable with more modern system or databases. Reverse engineering is the main idea in maintaining legacy systems throughout understanding the source code. This paper focused on developing an approach for merging static and dynamic analysis using Altova and LAMBDES tools. In addition to developed an automated tool for integrated the static and dynamic approach in one merged file. The approach used the new XMI file for modifying the legacy system requirement by extract the pattern. Then the tool allows the user to modify the requirement in graphical representation.

Keyword: Reverse Engineering, Legacy System, Design Pattern

INTRODUCTION

Software systems have been applied in many difficult and complex applications, from different environments. Each software system may contain thousands of source code lines, a fact which makes it difficult to manually walk through these software without aids tools. This problem becomes even more complicated when the developer uses a large software system. Several approaches had been developed in design pattern for legacy system. Erdos and Sneed (Erdos, and Sneed) suggest partial comprehension of complex programs. The approach contends that maintenance tasks require the comprehension of a relatively small portion of the program. This is done by developing an automated tool. This tool answers a set of programmer question automatically. This approach permits unfamiliar programmers with the purpose and function of the programs during maintenance. The approach used Fan-in diagram which is used along with Low level Data Flow Diagrams. Decision Trees are used to model complex conditional series of statements.

The supposed ease of comprehension of object-oriented programs is squarely denounced by (Sneed and Dombovari). Their paper deals with an ongoing research project that aims at the difficult task of comprehending complex, distributed, object-oriented software systems by approaching in a formal disciplined manner. Citing contemporary work in initiatives, the paper goes on to explain that if modeled properly and if similar supported by automated tools, even complex, object oriented systems can be comprehended formally. This approach also places emphasis on reverse engineering required only to the extent of maintaining software.
Mayrhauser and Vans approach is used for large scale programs. The approach reports on a software understanding study during adaptation of large-scale software. The study was

designed as an observational field study of professional maintenance programmers adapting software. The approach details the design of the study and discusses the results from the programmers. The goal was to answer several questions about how programmers approach software adaptations, their work process and their information needs. The programmers were found to work predominantly at the domain model level, adopting opportunistic and systematic understanding. A report on the general understanding process, the type of action programmers performed during the adaptation task, and the level of abstraction at which they work is included.

Antoniol et al present **a**n approach to recover object-oriented design patterns from the design and code (Antoniol et. al.). Design patterns are micro-architectures, high level building blocks. Design patterns are an emergent technology: they represent well-known solutions to common design problems in a given context. From the perspective of reverse engineering the discovery of patterns in software artifacts represents a step in the program understanding process. A pattern provides knowledge about the role of each class within the pattern, the reason for certain relationships among pattern constituents and/or the remaining parts of the system. Design patterns being a relatively young filed, there are currently few works that address design pattern recovery in the field of program understanding and design recovery.

A pattern description encompasses its static structure, in terms of classes and objects participating to the pattern and their relationships, but also behavioral pattern dynamics, in terms of participants exchanged messages. Five specific design patterns suggested in previous literature are chosen as samples for recovery.

Abd-El- Hafiz evaluates knowledge-based approach to achieve program comprehension. The approach mechanically documents programs by generating first order predicate logic annotations of their loops. A family of analysis techniques has been developed to cover different levels of program complexity. The knowledge based approach exploits the fact that there are certain stereotyped programming concepts that are heavily used in programs and detecting these can be easy using this approach. An attempt is made to prove that the knowledge base built using a specific program can help in understanding similar stereotyped programming constructs in other programs. The approach can be greatly enhanced by trying to create knowledge bases that are sufficient for specific application domains.

DeBaud et al. contend that instead of the current reverse engineering techniques that takes a program and constructs a high level representation by analyzing the lexical, syntactic and semantic rules, an approach that utilizes the relationship between the application domain analysis and reverse engineering can be used. A domain is a problem area and domain analysis is an attempt to identify the objects, operators, and relationships between what domain experts perceive to be important about the domain. A domain description will give the reverse engineer a set of expected constructs to look for in the code.

Another research trend of reverse engineering is design pattern recognition from source code. A design pattern (Gamma et. al.) is a reusable object oriented software design artifacts that solves a problem in particular context. Design patterns in an architecture making faster the understanding the design considerations of a software system. There are several different approaches to identify patterns in source code, design patterns can be identified by among others inter-class relationship in method call, data-flow analysis, by fuzzy logic, graph matching or formal semantic.

Pattern recognition is also suitable for measuring software quality (Brown et. al.), because not only design patterns, but also anti-patterns (Beyer and Lewerentz) can be detected in the implementation, thus, bad design considerations or weakness of the code can be discovered. Similarly to design patterns, anti-patterns are piece of reusable code, but applying these kinds of patterns shuld be avoided. CrocoPat e. al. tool does graph search, it processes RSF (Rigi Standard Format) files that contains the graph of a system that uses own imperative language

to find the predefined patterns between class inheritance relations and method calls. Columbus uses graph matching algorithms. Other methods are also available, such as PtideJ, which uses constraint solving or SPOOL (Nija and Olsson), which uses database query. PINOT (Hakjin et. al.) pattern inference and recovery tool reclassifies the GoF patterns and implements a lightweight static inter-class and data-flow analysis.

RELATED WORK

In Jing Dong et al, present an approach to discover design patterns by defining the structural characteristics of each design pattern in terms of weight and matrix. The system structure is represented in a matrix with the columns and rows to cover classes in the system. The value of each cell represents the relationships among the classes. The structure of each design pattern is also represented in another matrix. The discovery of design patterns from source code becomes matching between the two matrices. If the pattern matrix matches the system matrix, a candidate instance of the pattern is found. Also, they use weight to represent the attributes and operations of each class and its relationships with other classes. In addition to the structural aspect, the approach investigates the behavioral and semantic aspects of pattern discovery. The approach consists of three phases: structural, behavioral, and semantic analyses. The structural analysis phase concentrates on the structural characteristics of the system, such as classes and their relationships. The results of the structural analysis may include the detected instances that are actually not a design pattern. Although such instances satisfy the structural characteristics of a design pattern, they may not be the instances of such design pattern due to missing behavioral characteristics. Behavioral analysis checks the results from the structural analysis for false positives. In the semantic analysis there are certain closely related design patterns which are similar with respect to their structural and behavioral aspects but just different by their intent with which they were created. The approach is includes several analysis phases and based on matrix and weight to discover design patterns from source code. They need many steps and some time they repeat the same steps in behavioral analysis and need to execute the code, which is a time consuming step. And the behavioral patterns can't be detected in structural and behavioral phase, also, semantic analysis.

In Hakjin Lee et al proposed taxonomy of GoF design patterns that can guide the reverse engineering process. The approach applies a number of existing applications, such as PURE toolkit, JINI based home application system. The approach shows that using a static analysis only is very difficult to distinguish pattern among similar structure with high false-positive rate. Furthermore the approach shows that using dynamic analysis only needs too many searching space to read source code and requires the well-arranged testing environment. According to the inputs of the reverse process used in this approach source code is read first, and the next step is detect a static analysis of source code to generate the structure candidate instances. The next step is detects a dynamic analysis. These steps require more time because firstly, they apply static analysis, after that both static and dynamic analysis is applied to detect the behavioral patterns. Also, this process make the approach is difficult to integrate with other tools.

In Grose et al, they detect design patterns in legacy code combining static and dynamic analyses with required method. This approach analyses distinguishes between static and dynamic pattern restrictions or rules. The former restrict the code structure the latter the runtime behavior. Analyzing with the static restrictions, results in a set of candidate occurrences in the code. In practice this set is large and programmers hardly want to screen all of them to detect the actual instances. Therefore, they execute the program under investigation and monitor the executions of the candidate instances found by the static analysis with respect to the dynamic restrictions. The results of dynamic analyses depend on an execution of the candidate instances. The static analysis computes potential program parts playing a certain

role in a design pattern. The dynamic analysis further examines those candidates. In this approach the detection process is separated into two step , static analysis detection , and dynamic analysis detection with the need to executing the source code to detect the behavioral aspects of the source code, which is time consuming process because the two steps of detection, other limitation appears after the detecting of design patterns. They don't use the detected result in reengineering cycle, or benefits from these results.

APPROACH TAKEN

Reverse engineering aims to provide program descriptions on higher levels of abstractions, such an abstract level could be a program description using UML diagrams. These program descriptions facilitate the understanding of program structures and program behavior. This paper presents the Detection of Design Pattern through merge static and dynamic analysis (D2Pattern) as a proposed approach. The approach is shown in figure 1. The approach organized into five phases; the first two phases are generating a static and dynamic analysis. Altova Umodel 2010 is used in the first two phase to extract class diagrams and sequence diagrams of the design patterns respectively. Then, the third phase combines the static and dynamic furthermore the tool automatic generate an XMI file. In addition in this phase the tool verify the design pattern candidates that found during the static and dynamic analysis. The fourth phase is design pattern detection and classification using automated software tool called LAMBDES. In this phase the XMI file which contains the class and the sequence is used to process the necessary information for detecting the design pattern. The design pattern is used during understanding a legacy system requirement. The fifth phase is integrated result with legacy requirement which supported maintenance phase. In addition, the fifth phase recovers requirements from the reversed design patterns and integrating the patterns in requirements phase.

The result of the static analysis and dynamic analysis is merged and stored as XMI file, to be input in the detection phase, design pattern detected using LAMBDES. The tool build a pattern based on descriptive semantics a number of generators and a repository of design pattern specifications. It takes XMI file produced by Altova Umodel 2010 as input to perform logical analysis of the model and/or Metamodels. LAMBDES system translates the UML diagrams into their descriptive semantics and to decide whether the design conforms to a pattern. In addition facilitates reasoning about models through logical inference.

When the results of detect pattern is fully detected, we classify it according to GoF classification to creational patterns, behavioral patterns, and structural patterns as shown in figure 1. The classification output allows maintainer to add any new requirements easily by insert the code content into a class model. The enhancement based on the new requirements. For example, the new requirements concern on enhancing the graphical user interface, then, the requirements engineer must do his/her modification in the structural patterns.

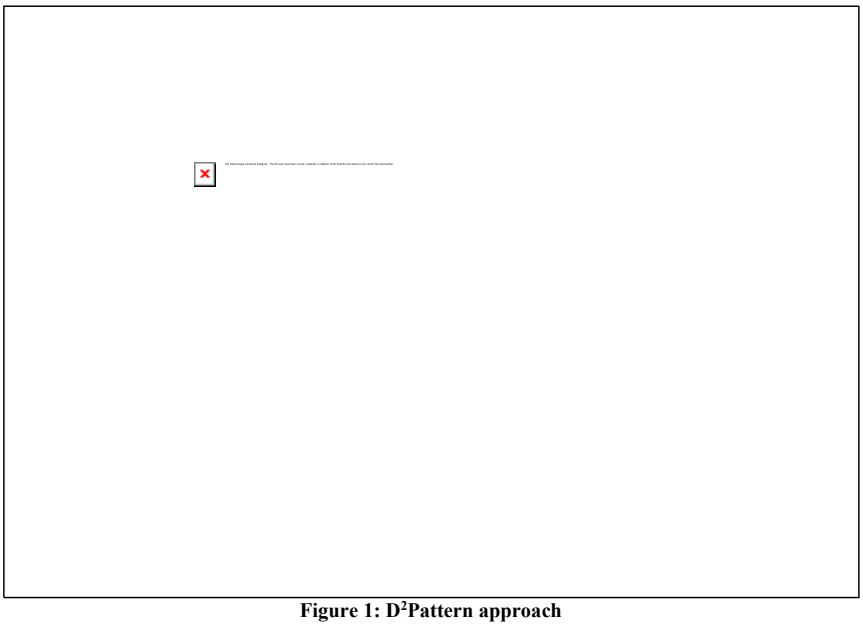

Figure 1: D^{2}Pattern approach

RESULT AND DISCUSSION

To evaluate the proposed approach we build a prototype system as shown in figure 1. the proposed system integrated Altova Umodel 2010 and LAMBDES tools in one system. The prototype firstly read the source code, also it perform a static and dynamic analysis; the result is used in detecting design patterns. The new system helps in understanding the legacy requirements.

The adapter design pattern used to demonstrate each stage of our approach. As a case study the new approach reads the a java code as a first step then generate class and sequence diagrams using Altova Umodel 2010 LAMBDES tools. During static analysis the source code is analyzed. Then the system extracts a class diagram and its relationships among the components were visually represented by a dependency relationship between them. Major packages were also identified in these diagrams; furthermore the graphical view is represented for simplify the viewer's time and effort to understand the architectural layout of the software.

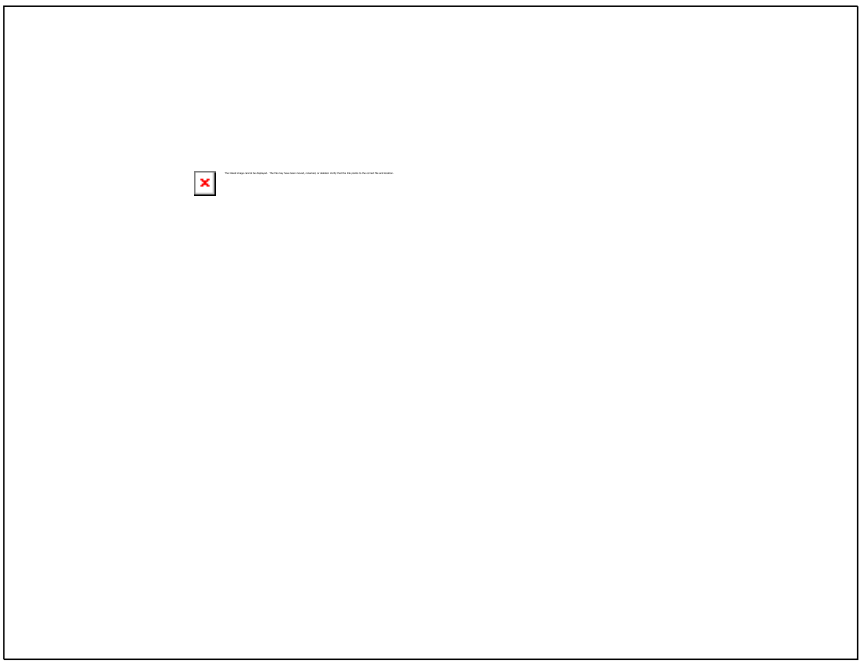

Figure 2: System Prototype

The proposed approach recovers requirements from the reversed design patterns. This done by integrated the new modification and enhancement requirement with the legacy code. Integration process is automatically done by this approach. The classification result by the prototype shown in figure 2. The result helps maintainer to answer question such as: what is redundant, what must be retained and what can be re-used. The new approach shows rationale of the necessity of eliciting requirements and proposed a modified model of existing model.

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DESIGN OF ACCOUNTING INFORMATION SYSTEM SALES

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ABSTRACT. The rapid development of science and technology led to the use of computers increasingly dominant and universal. Today the computer is very helpful in all aspects of human life, especially to facilitate the activity, especially at work. In the computer industry was indispensable in overcoming various problems. The ability of the computer in calculating and processing data, especially accounting data, so that it becomes useful information, easy to understand and accurately in a fast time, is needed to improve company performance. But in this case still needs to be supported by a reliable accounting information. Firms need a good sales system to handle various problems that occur in companies that include the recording of sales. The use of computers in processing sales transactions and speed up processing of sales transaction data into information. Sales transaction processing with a computer accounting system to change the sales into Accounting Information Systems Sales.

Keywords: Information Sales, Sales Accounting System, Accounting Information Systems Sales

INTRODUCTION

Today the information is important in all aspects of human life. For consideration in the decision-making needed information. The better the quality of information it will be more useful in decision making.

E life style as the current reality of life showed almost no one aspect of human life untouched electronic (computer) that includes already uses software applications (application software). This phenomenon is also adequate economics increasing corporate dependence on information systems. This also resulted in a field of accounting and auditing, the system is done manually shift to electronic-based information systems (computers) that uses software. Organizations that master the information will survive and win the competition in the era of economic informatics (Scott, 2003).

Information is one of the strategic resources of an organization, therefore, to support the achievement of the vision, mission and goals of an organization, information management becomes a key to success, without information there can be no organization.

Information through communication becomes the glue for an organization so that organization can come together to remember every decision based on information then the quality informai generated within an organization will greatly affect any decisions taken either by the management organization or by other organizational actors. Within an organization or wherever and for whoever plays as a medium of information that bridges all the events happening in the real world with human beings through the senses it has (Susanto, 2008).

The business world require different information. One of them is financial information that shaped the financial statements. The financial information generated from a transaction processing system which we are familiar with the term accounting system. At first the financial statements resulting from a recording process manually. The rapid development of technology to impact the business world in the process of transaction processing to produce financial reports.

In essence, Accounting Information Systems (AIS) is a system. The focus of the Accounting Information Systems (AIS) is the process data into information for all levels of Management. SIA presents financial information for management decision-making processes regarding corporate finance because financial data are very detailed data and is often performed by lower-level management. Sales is an important factor that determines the survival of the company mainly to trading companies, because the trading company is a company whose main activities are to purchase goods (finished products) and sell back to consumers. One of the related financial information in a company is selling goods as an activity within the company's activities.

Problem Formulation

The core of this research study is on Accounting Information System Sales. This problem is a force that needs to be developed. In more detail the scope of this research problem can be formulated in the following questions:

1. How much influence the use of Accounting Information System Sales of sales activity.

THEORY

Accounting Information System Sales basically/essentially is the system. Therefore, to understand what is meant by the Accounting Information System Sales must first understand what is meant by the System, Information, Information Systems, Accounting, Accounting Information Systems Sales, just next to understand what is meant by the Accounting Information Systems Sales.

System

The system is a collection/group of sub-systems/parts/components of any kind, either physical or non physical contact each other and work together in harmony to achieve a particular goal (Susanto, 2007).

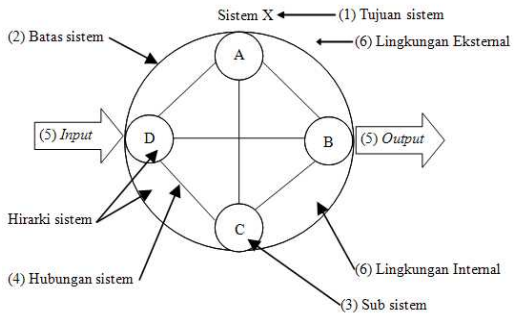

Figure 1. System Feature (Susanto, 2007).

In figure 1 A system exists because there are goals to be achieved. The purpose of the system is an end target or targets to be achieved by a system. System boundary is the line that separates abstraction between the system and its environment. Subsystem, that A, B, C and D

is a subsystem of components or parts of a system where the system is located. The relationship between subsystems with other subsystems at the same level is called the relationship system. Other characteristics of the system viewed its basic functions: input, process and output. System environment consists of internal systems and external environment of the system. Internal environment is the environment the system is in a system, while the external environment is environmental systems that are outside the system.

Information

Data are facts or anything that can be used as input in generating information. We must know in advance information about what data is needed, do not let a lot of data that do not contribute to process the information. So we can say that information is the result of data processing, but not all the result of processing can be information, only the results of data processing that gives meaning and benefits only. Azhar Susanto argues, information is the result of data processing, which gives meaning and benefits.

The information will give meaning and benefits if the meet certain qualitative characteristics. That information quality must have the following characteristics (Susanto, 2007) :

1. Accurate, means that information must reflect the actual situation.
2. On time, means that information is available or there at the time the information is required.
3. Relevant, means that information provided should be as needed.
4. Complete, means that information must be given in full.

Information Systems

Information Systems is defined as a collection of sub-sub-system of both physical and non physical are interconnected to one another and work together in harmony to achieve one goal, namely to process data into useful information. Information system process data into information using tools. Data into information-processing equipment is constantly experiencing growth. Appears as a computer as data processing equipment. Systems that use computers as a tool called a system of information processing. Information System has several components that group them into hardware, software, brainware, procedure, database, and network communication. Information systems within an organization acts as the glue between the components of the organization, because the information generated from an information system will be communication (Susanto, 2007).

Accounting

Accounting has evolved. Traditionally (first) accounting is defined as the art of how to record, summarize and report business transactions. AICPA defines accounting as the process of identifying, measuring and reporting economic information, to allow for assessment and a clear and unequivocal decision for those who use that information. In 1966 AAA defines accounting as an information system (Susanto, 2008).

Broadly speaking accounting grouped into two integral part of financial accounting and management accounting. Financial accounting processing of financial data into financial accounting information, users of financial accounting information is largely an external party organization, while management accounting data to process financial and non-financial services into information useful to the internal party organization or company.

Accounting Information Systems (AIS)

After learning the definition of Systems, Information, Information Systems and Accounting, then we can know what it is Accounting Information Systems (AIS).

Accounting information system can be defined as a collection (integration) of sub-sub systems/components of both physical and nonphysical are interconnected and work together harmoniously with one another to process transaction data related to financial issues into financial information (Susanto, 2008).

Accounting information system providing information to people who exist inside and outside the company. An organization implements policies and control procedures (internal control) with a view to maintaining the quality of information and operations (a series of activities) in the achievement of objectives.

Accounting Information System Sales

Accounting Information Systems Sales is one of the sub-system of Accounting Information Systems. Sales can be defined as a collection of components/parts/subsystems both physical and non physical are interconnected to one another and work together harmoniously to process cash sales into cash sales information required by the sales.

RESULTS

Design of Accounting Information System Sales

The performance has a significant positive effect on use of information systems means the interest of respondents believe that using the system will assist in improving performance (Handayani. 2007).

In the framework necessary to build a system for preparing accounting information system sales:

Table 1. Stages of Building Systems.

Stage	Results
Planning	Identify the problem Purpose and objectives The framework Estimated time and costs
Analysis	Analysis of resources Analysis needs Analysis of current system
Design	Develop logic system works Design data, tables, databases, relationships. Design input, process and output
Implementation	Installing Software Documentation
Maintenance	Overall system test Evaluation, improvement Training Further development

Context Diagram

Context diagram is the overall process that will be presented with a single circle that represents the whole system. AIS Sales context diagram is described as follows:

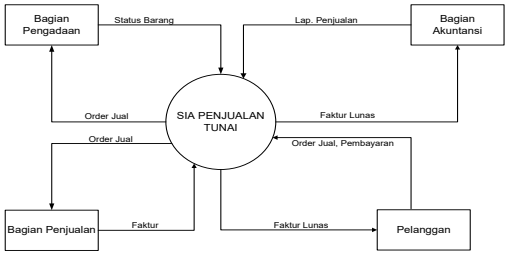

Figure 2. Context Diagram.

In the context diagram is described a data starts from customers who order and accepted by the sales and parts procurement, if the status of goods is the sales transaction and the customer also receives invoices paid in full. Part of accounting records and processing invoices to sales reports.

Data Flow Diagram

The sales AIS Sales data flow diagram data are:

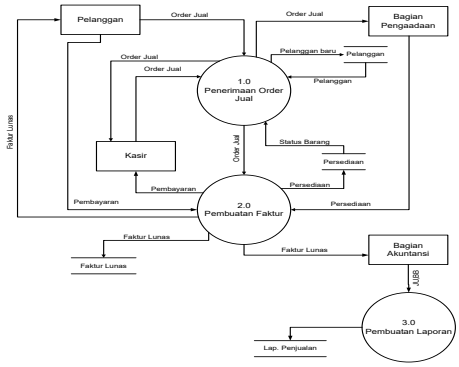

Figure 3. Data Flow Diagram.

At data flow diagram there are three processes: (1) sell order acceptance process is a process of receiving orders from customers and data delivery orders to the cashier and parts procurement, (2) invoicing process is a process if the order is received and the customer makes a payment, go to the data submitted in full invoice accounting, (3) the process of report creation is the process of making general journal, ledger and sales reports.

Main Menu

Further analysis of the working system is as follows: in Figure 4 represents the main menu contains 3 menu, namely: (1) menus to perform the procurement of supplies of goods available for sale, (2) menu is the creation of general ledger accounting, general ledger and reporting finance, (3) menu is part sales inputing sales data and sales reports.

Figure 4. Main Menu.

CONCLUSION

Based on the previous description, it can be taken several conclusions, Application Accounting Information System Sales helpful sales activity and AIS Sales Cashier This is a development so that there are elements that have not been incorporated into the design. At the bottom of Accounting Information System Sales have an important role in the company to generate useful information for internal and external parties and quality information so that the necessary tools of information and communication technology in its implementation.

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AN IxD SUPPORT MODEL WITH AFFECTIVE CHARACTERISTICS FOR DYSLEXIC CHILDREN'S READING APPLICATION

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ABSTRACT. This paper listed affective attributes of an interaction design for a reading application meant for dyslexic children. Different reading styles and unique reading approach of these specific children has long been a challenge for designers to come out with an acceptable interaction design (IxD). Emotional characteristics towards reading such as likes, dislikes, motivation, and satisfaction, which are very much related to affection, are essential in designing the suitable reading application to help them in learning to read and increase their interest in reading. A series of observation and unstructured interviews were conducted involving 28 dyslexic children, whose age range from 7 to 14 years old. The finding reveals that we can combine the affective attributes of the dyslexic children with the interaction model based on Norman's work to map specific requirements suitable to dyslexic children's reading ability. This inventive IxD model is proposed for readers with dyslexia. Additionally this paper shows how we translated such model into an automatic reading tutor for special need learners.

Keywords: Interaction design, affective engineering, interaction model, dyslexic children reading application.

INTRODUCTION

Reading, for dyslexic children (DC) is such a challenging task, even for simple words. Due to their difficulties in reading, dyslexia is perceived to be a deficit in the acquisition of sufficient skills for the aforementioned task due to phonological deficit theory (Lundberg, 1995; Shaywitz, 1996; Snowling, 2000; Wolf, 1999). Thus, significant efforts have been put forward to help them read from conventional teaching methods to computer-based application (Lundberg 1995; Lundberg & Olofsson, 1993; Olofsson, 1992; Olson & Wise, 1992). Since reading is such a challenge, having an automated reading tutor (ART) is therefore concerns very much on the affection of such tool to create interest and likable factors towards reading. Affective aspect of a reading tutor is the key that influence the positive emotion of these children (Te'ni, Carey, & Zhang, 2007). Hence, to ensure the effectiveness of an ART, the application must adapt interaction design model that fit specifically to these special need learners. The model should take into account the affective attributes of the children, prior to translating them into ART.

Theoretically, affect is referred to as a valence subjective experience involving positive or negative perception or pleasing or displeasing feelings (Desmet, 2007). The valence subjective experience serves as a basis of the core affect theory (Russell, 2003) as depicted in Figure 1. The hedonic dimension (horizontal line) represents pleasure and displeasure whereas the activation dimension (vertical line) represents activated or deactivated mode. In order to differentiate user's affection state towards a product, these two dimensions could be

combined to show either positive affect or negative affect depending upon which quarter in the core affect circle the user's state resides.

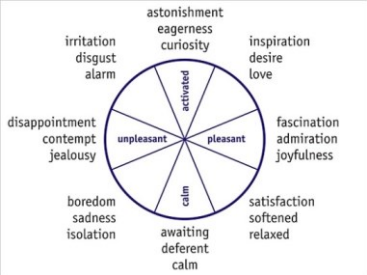


Figure 1: Core affect theory.
(Source: adapted from Russell, 2003; Desmet, 2007)

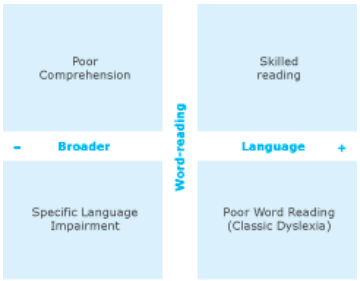


Figure 2: Reading model (Wright, 2010)

To ensure that the DC using ART reach the positive affect state, the ART is specifically designed by incorporating the children's affective characteristics towards reading as suggested by Fakhrul, Husniza, and Zulikha (2010). For that, affective engineering is used to elicit requirements that can create pleasure and activation to achieve the above two positive dimensions as shown in the core affect theory illustrated in Figure 1.

AFFECTION IN READING

The children's positive affect can be directly spotted when they are interacting with computer-based applications. However it can only be easy with a proper design of interaction in the application's user interface. Designing such interaction had always been far from perfect especially for DC due to the variability in their reading patterns. Figure 2 shows a model of reading which classify poor word reading as classic dyslexia. According to Wright, (2010) this model holds that reading is a function of one's ability to read the words (rw) on the page (p1…n) and the ability to apply linguistic (al) and reasoning skills (ar) to the decoded text, i.e. moving towards broader language skills in the model (*Reading = (rw) + skill (al + rs)).*

At word level, is there a way to bring in affective values into an ART? We believe that by incorporating instructional strategies into existing interaction model a more appropriate framework for effective ART can be obtained. Thus this work aimed at combining two well known interaction models namely Norman's Interaction Model and Abowd and Beal model. The models, supported by core affect theory will then be translated into interaction design (IxD) strategies in designing the user interface for an ART meant for DC.

THE INTERACTION MODELS

Norman's interaction model consists of a logical execution-evaluation cycle, mainly a method of conceptualizing the philosophy of computer interfaces. Figure 3 depicts the original Norman's model of interaction which breaks down the process of interaction between human and a computer-based application into seven phases. Beginning with forming the goal, an intention will be formed followed by specifying and executing action. After that, a user will perceive the state of the world, interpreting it and evaluating the outcome. Execution-evaluation loop will occur because users will take further action based on their evaluation.

Abowd and Beale (1991) expand Norman's model by giving a more realistic description of interaction. They include the system with its four major components namely User, Input, System, and Output (Figure 4).

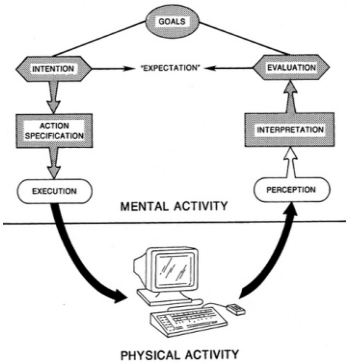


Figure 3: Norman's interaction model (Norman, 1986).

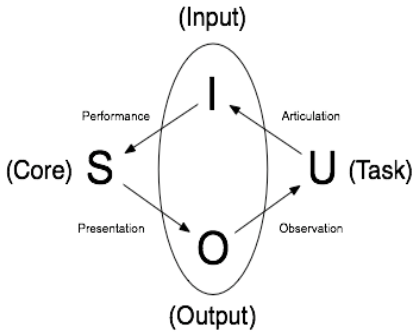


Figure 4: Abowd and Beale Model of interaction (Abowd & Beale, 1991).

Abowd and Beale (1991) indicated in their model the following interaction steps. The user communicates with the system via input/input devices (articulation). This is the process of describing request in the form of a language understandable by a task. The request is executed using a certain core language (performance) and then produce output to users in a presentation phase. The user may continue with observation on the results or start formulating new goals. Putting the interaction models into the DC's context, the interaction design should consider the impairments specifically the types of reading errors, fonts and colours. Embedding such design ensures that the ART is capable of giving maximum effect towards the performance of the children's reading. Effective interaction design of the ART's interface shall ease the dyslexic children (User) in reading aloud prompted words (Input) displayed on the screen. The read speech is then recognized (System) and the result is presented back to the user (Output). The children can observe the output i.e. the text produced and later decide what to do next (formulating new goal).

METHODS AND ANALYSIS OF STUDY

In Norman's model, the gap between physical and mental activity is actually the gap between 1) how the user want to act and how the system allows or support the users to take action; and 2) how the computer display its output and how the users interprets the output. To minimize the gap, the tasks in ART are supported by an IxD that addresses the DC's reading patterns, reading interactions and styles. The form, content, and behaviour dimensions of IxD are designed to reduce the cognitive load of the DC. The foundation of this design is based on the Abowd and Beale's interaction model.

In this context, we interviewed and observed 12 DC, aged between 7-14 years old, in an attempt to finalize goal decomposition and their reading task. The tasks are analyzed to an acceptable level, i.e. when the gap between physical and mental activity is eliminated. Focusing more directly on aspects that need to support the interaction of DC, each translation step in Abowd and Beale's model is examined so that affective characteristics and specific reading patterns can be mapped on to these translations. Figure 5 limns the model of the mapping and translation. Figure 6 shows the analysis on the children's impairment and the design results obtained after the observation and interview process. The figure is showing the analysis carried out in deciding the type of computer support, user interface screen objects, content, application behavior, and affective valence to be implemented in the ART. These are the types of IxD dimension and supports, obtained from the translation process from the DC's impairment (see column 3 and 4 in Figure 6):

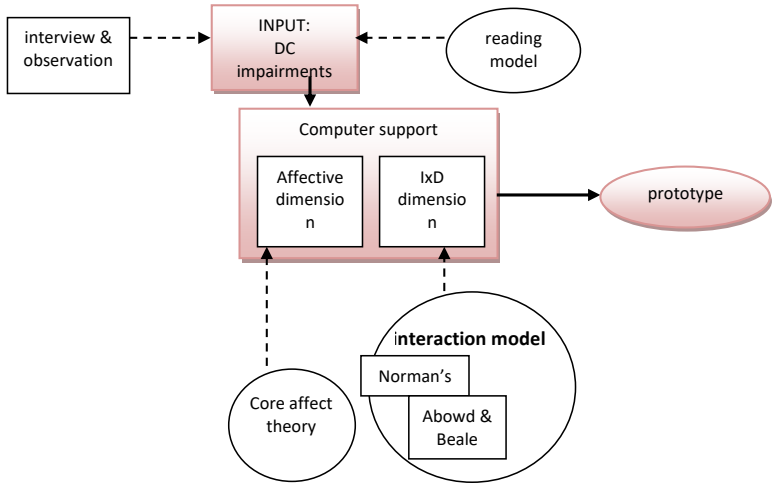
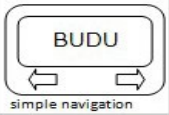
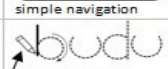


Figure 5: The IxD support model showing the mapping from Norman, Abowd and Beale interaction models.

- *Navigation* path is designed to overcome the problem of weak focus for coherence (or easily distracted) with minimum interface widgets (minimalist design), yet includes affective dimension of curiosity and relaxed.
- *Pen animation* that illustrates how to write an alphabet is proposed in order to support the limited cognitive load of dyslexic children. It has been observed that these children cannot handle reading a word due to the need for bigger cognitive load to accomplish the task. Therefore in order to read a word, the alphabet should be slowly crafted not just to illustrate the shape of the letter for easier identification but also for knowing the direction from where to start reading (as oppose to flash cards method). Affective dimension considered are curiosity, awaiting, and eagerness and the IxD dimension includes the level of words, the pen size, and the animation speed.
- *Coloured syllables* is used based on the fact that DC are highly affected by words and coloured background (Irlen, 2005). Hence, colours as suggested by Irlen are used for the background which can be changed easily by the children. The coloured syllables are based on the children's choice during interview and observation (the children are advised to choose their preferred syllable colours during reading exercise)
- *Fonts* and *typeface* handling are based on the observed reading errors made by the children. The most apparent reading pattern is they tend to substitute, eliminate or replace an alphabet with other alphabet. This suggests to a design of the similarly looking alphabet such as b and d not to mirror each other. Thus, the use of different typeface with different contrast is used to avoid the confusion. The children also have control over the type of fonts and choices of similarly looking words that they feel easier to read (and read them correctly!). Affective dimension included in such design are satisfaction and curiosity.

Using all 7 phases of Norman's Model and 4 components of Abowd and Beale.

Major* impairments (dyslexic children observed & interviewed)	**Computer support**	**IxD Dimension**	**Affective dimension to include**	**Design example (result)**
Easily distracted (weak focus for coherence)	- Limits distraction by simple interface design	**Form (F)**: large & minimum screen objects **Content (C)**: words to read **Bahaviour (B)**: - Choices for: 1. Word level 2. Number of words to display	- curiosity - relaxed	 simple navigation
Cannot take cognitive load	- Animation - Following the sequence while writing the word is easier than reading the word prompted as in the flash card.	**F**: writing animation **C**:words to read **B**: choices for: 1. Word level 2. Pen size 3. Speed of animation	- curiosity (have to wait, digest each alphabet...) - awaiting - eagerness	 pen animation
Very much effected with coloured words and background	- Utilize colour as adviced by Irlen Method for background colour - colour coded syllable	**F**: working with effective colours **C**:words to read, colour **B**: choices for: 1. Colour selection (background) 2. Syallabe 1st colour, 2nd colour is automatics from IxD theory of colour)	- joyfulness - astonishment - curiosity - fascination	**bunga** different coloured syallable
Alphabet confusion (consonant, vowel). Tends to substitute, eliminate, replace with other alphabets. e.g: b,d,p u,n,m,w Excellent with very different letters like k,t,g,s ... mostly consonant.	- Use carefully selected font type that don't mirror b ¦ d ← exact	**F**: layout, contrast, usage of white space **C**:words to read, colour **B**: choices for: 1. Font types not quirk ×a a✓ ×g g✓ don't mirror b d 2. Similar word selection	- satisfaction - curiosity	**badai** doesn't mirror b, and high contrast

*their minor impairments are not included in this paper due to page limitation

Figure 6: The analysis on the children's impairment and the design results obtained.

Figure 7: One of the screen interface of the ART.

CONCLUSION

A specific design of an ART is viewed important to cater for the children's needs – the need to have a carefully designed ART not only focusing on the reading tutor's engine but also the interface of such application. The interface design plays an important role to bring about the children's affection towards reading as well as the learning process. Special consideration on their need to have a suitable and adjustable background colours, different coloured fonts to highlight syllable boundaries in a word, as well as adjustable font types and

sizes, for example, would ease the learning process. Hence, the proposed model that combines two interaction models, Norman's and Abowd and Beale's models, caters for the need to 1) present the content or objective of an ART that meets the learners' goal, intention, and expectation; 2) ensure that the learning process is effectively delivered when the learners use the ART. Therefore, affective qualities, such as satisfaction, joyfulness, relaxation, and fascination, that satisfy the IxD dimension for dyslexic children need to be incorporated into the design of an ART. This proposed IxD model and interface design needs further study and an evaluation process is being carried out. It is not yet to be claimed as a pedagogically sound design that results in more effective reading tutor design for the special education context.

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AGILE SOFTWARE DEVELOPMENT PRACTICES THAT INFLUENCE SOFTWARE QUALITY: A REVIEW

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ABSTRACT. Agile software development (Agile) is being practiced in software industry nowadays as it fits the current business environment which focuses on delivering software to market as quickly as possible. In addition, Agile practitioners claim that it produces software with good quality. Thus, our research aims to identify Agile practices that should be followed in order to produce good quality software. Since many researchers report that the quality of people and process influence the quality of software product, this paper discusses on practices related to these two factors. The identified practices will be used for developing questionnaire in order to investigate current practice among Agile practitioners.

Keywords: Agile Software Development, Software Quality, Software Practice.

INTRODUCTION

Software quality has become a major strategic issue in software industry (Jamaiah, Fauziah, Aziz & Abdul Razak, 2005). This is because customers always expect that the software product, service and process to be good in quality (Lycett, Macredie, Patel & Paul, 2003), which meets their needs and follows certain standards (Krishnan, 1993). Besides, they also expect that software products can be developed faster (Verner, Liming, Babar & Ming, 2004). Generally, software with good quality has these criteria: 1) meets the expected requirements, 2) completed within budget, 3) completed on time, 4) completed in its entirety, 5) delivered together with a solid and thoroughly tested code, and 6) can be used easily (Nasution & Weistroffer, 2009). The quality of a software product highly depends on the people, organization and procedures used to create and deliver it (Fuggetta, 2000). However, according to Arthur (1993) and O'Regan (2002), there are three key elements need to be given attention in developing good software: 1) the quality of people involved, 2) the process performed and 3) the use of development technology. Nevertheless, Fauziah (2008) identified another two factors that influence software quality which are the working environment, and project condition. Besides, Hazzan and Dubinsky (2009) stated that human, technology used and organizational aspects should be considered in assuring software quality. Based on the literature mentioned, factors that influence software quality can be classified into five, which are process, human, working environment, technology and project conditon.

Realizing the needs for faster software development cycle and rapidly changing requirements, many organizations are shifting from conventional software development approach to Agile which is considered as a light-weight approach (Conn, 2004). However most Agile opponents argue that this software development approach is lack of

documentation, which leads to software maintainability problem. In addition, Turk, France and Rumpe (2002) mentioned some limitations in Agile, such as, limited support for distributed development environments and limited support for building reusable artifacts. They believe these limitations able to give impact on the quality of developed software. On the other hand, many Agile representatives claim that it fits the industrial needs (Beck, 2000) because it promises higher quality software (Sliger, 2006), higher customer satisfaction, lower defect rates, faster development times and becomes a solution to rapidly changing requirements (Boehm & Turner, 2003). Consequently, this paper reviews the literature related to practices of Agile development approach that must be performed in producing good quality software as part of our research work. Our research aims to construct a unified software process certification model which can be used to assess and certify software based the quality of development process no matter what approach was used either conventional, Agile or Web. However, discussion in this paper will focus on findings from literature about the required practices related to human and process factors of Agile based development. The structure of this paper is organized as follows: the next section discusses about Agile practices that influence software quality and finally future work and conclusion is provided.

AGILE SOFTWARE DEVELOPMENT PRACTICES THAT INFLUENCE SOFTWARE QUALITY

Agile is introduced recently as a consequence from the problems faced in conventional methodologies (Rico, Sayani & Sone, 2009) which are not flexible in accepting unstable and volatile requirements (Verner et al., 2004). It is aimed to produce higher quality software in a shorter period of time (Livermore, 2007; Sliger, 2006). Currently there are many Agile methodologies such as Extreme Programming (XP) and Scrum (Abrahamsson, Salo, Ronkainen & Warsta, 2002). These methodologies have similar values and practices, whereby they follow 12 principles, for instance: "Welcome changing requirements, even late in development" and "Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale" (Agile Manifesto, 2001). It also follows four values which are: 1) iterative, 2) incremental, 3) self-organizing and 4) emergent (Lindvall et al., 2002).

A survey conducted by Microsoft Researchers reveals the benefits of Agile as improved communication and flexibility, with faster release. Another survey conducted by IBM and Ambysoft shows that Agile adoption improves productivity, customer satisfaction and project success (Rico et al., 2009). The results of these studies show that Agile leads in producing good quality software. Therefore, there is a need to identify the Agile practices that influence software quality. Although factors that influence software quality can be classified into five, however as mention in previous section, this paper will only discuss two factors which are human and process.

Human

Agile implementation highly depends on human factor (Mnkandla, 2004; Lycett et al., 2003; Cockburn & Highsmith, 2001). Most literature highlight about team, project manager, developer and customer when discussing about human involved in Agile. Each of them needs to implement certain practices in sequence to ensure software quality. They are encouraged to be placed in a single space to facilitate intensive communication, because communication is emphasized for knowledge sharing (Pressman, 2005; Lycett et al., 2003; Highsmith & Cockburn, 2001). Besides, face to face communication is accepted as more effective to transfer idea compared to writing and reading documents (Highsmith & Cockburn, 2001). Smaller size team will encourage better communication, as more team members will cause the project to be 'less agile' (Abrahamsson et al., 2002). On top of that, most Agile methodologies does not work for large development teams. Thus, the suggested average

number of team member is nine (Highsmith & Cockburn, 2001). The practices that must be followed are listed thoroughly in Table 1.

Process

Software development process is important in producing good quality software, as stated by Deming (1982) "*the quality of product is influenced by the quality of process used to develop it*". Besides the development process, project management also plays an important role. Basically Agile has all fundamental software development phases, which are requirement gathering, design, coding and testing. However, instead of having the four phases one after another throughout development, Agile has these phases iteratively in shorter time (Beck, 1999). Besides that, the implementation is also different. Requirement gathering and design in Agile is done iteratively and incrementally rather than gathering all requirements and designing upfront. During the development process, Agile emphasizes practices which can promote quality and faster delivery, such as pair programming and test driven development. These practices are further listed in Table 1.

Table 3. Agile Practices that Influence Software Quality

Factor	Sub Factor	Agile Practice	Reference
Human	Team	High competence and expertise	Tsun & Dac –Buu (2008)
		Great motivation	Tsun & Dac-Buu (2008)
		Common focus	Pressman (2005)
		Communication is used as important mechanism for knowledge sharing	Coram & Bohner (2005)
		Self-organized	Sliger & Broderick (2008)
		Co-located	Misra, Kumar & Kumar (2009)
		Empowered to make decisions	Sliger & Broderick (2008); Lindval et al. (2002)
		Decisions made collaboratively but speedy	Highsmith & Cockburn (2001)
		Able to give constant feedback	Highsmith & Cockburn (2001)
		Mutual trust and respect exist among team members	Pressman (2005); Highsmith & Cockburn (2001)
		Able to deal with ambiguity	Highsmith & Cockburn (2001)
		Intense interaction exist among team member	Highsmith & Cockburn (2001)
		Average size of team is 9 people	Highsmith & Cockburn (2001)
	Project Manager	Engaged with daily activities	Schuh (2005)
		Responsible to ensure that news (bad or good) is spread between customer and team.	Schuh (2005)
		Knowledgeable in agile process	Tsun & Dac-Buu(2008)
		Has adaptive management style	Tsun & Dac-Buu(2008)
		Responsible to the overall project's progress	Schuh (2005)
		Responsible to maintain relationship with customers	Schuh (2005)
		Acts more like a facilitator than a foreman	Sliger (2006); Schuh (2005)
		Responsible to build team cohesion	Sliger (2006)
	Developer	Able to respond quickly (responsive)	Cockburn & Highsmith (2001)
		Able to socialize (amicable)	Cockburn & Highsmith (2001)
		Able to work in group and spread knowledge	Cockburn & Highsmith (2001)
		Must be competent	Lindvall et al. (2002)
		Must be willing to learn continuously and work in changing situations	Schuh (2005)
		Must be inquisitive in nature	Schuh (2005)
	Customer	Able to give constant feedback	Lan & Ramesh, (2008);
		Able to communicate with the team	Rico et al. (2009)
		Able to present on-site throughout the development process(dedicated)	Paetsch et al. (2003); Highsmith & Cockburn (2001)
		Empowered to make decisions on behalf of other stakeholders	Boehm & Turner(2003); Paetsch et al. (2003)
		Know the business domain and Knowledgeable	Schuh (2005); Boehm & Turner (2003)

		Do not feel afraid to be responsible to the decisions made	Schuh (2005)
		Willing to compromise	Schuh (2005)
Process	**Planning**	Done collaboratively with team members	Ambler (2010)
		Done continuously throughout the project at the beginning of each iterations and releases	Schuh (2005); Ambler (2005)
		Done according to features/ stories	Sliger & Broderick (2008); Schuh (2005)
		There exists daily stand up meetings among developers	Sliger & Broderick (2008)
		Release meeting is conducted at the beginning of project to create release plan	Sliger (2006); Schuh (2005)
		Iteration plan is created at the beginning of each iterations	Sliger (2006); Schuh (2005)
		User selects stories to be implemented in each iteration based on the estimates and velocity produced	Schuh (2005)
		Tasks estimation must be made by the developer who is going to accomplish the task	Wells (2009)
	Requirement Gathering	Iterative requirement engineering	Wells (2009); Lan & Ramesh, (2008)
		Face-to-face communication is emphasized instead of having written specification	Lan & Ramesh, (2008); Paetsch et al. (2003)
		High level requirements are written in user stories(XP)/ backlog(Scrum)/features(FDD and DSDM) for requirement gathering	Rico et al. (2009); Wells (2009); Lan & Ramesh, (2008)
		Detailed requirements are discussed in detail at each development cycle's start	Wells (2009); Lan & Ramesh, (2008)
		Information needed on user story: its name, the story and developer's estimation	Schuh (2005)
		The story written should be in simple and understandable language	Wells (2009); Schuh (2005)
		Prioritization to the user stories is done by user	Lan & Ramesh, (2008); Paetsch et al. (2003)
		Requirements can be reprioritized by user	Lan & Ramesh, (2008); Paetsch et al. (2003)
		Requirements can be added, removed or edited by users	Schuh (2005)
		Use prototype to validate the requirements	Lan & Ramesh, (2008)
	Design	Software is designed in small chunks and integrated in ongoing manner	Highsmith & Cockburn (2001)
		Agile Modeling is used to model high-level architecture of the system upfront	Ambler (2010)
		Unit tests which is implemented for Test Driven Development is used as detailed design artifact	Ambler (2005)
		Metaphor is used for determining architecture of the system	Rico et al. (2009)
	Coding	Implement collective code ownership	Ambler (2010); Rico et al. (2009); Wells (2009)
		Implement coding standards	Rico et al. (2009); Wells(2009)
		Implement pair programming	Rico et al. (2009); Wells (2009)
		Implement code and database refactoring	Ambler (2005)
		Unit tests are developed before the code is written	Ambler(2010); Wells (2009)
		Group and implement requirements with highest priority first	Leffingwell (2007)
		Ensure that the code produced is tested, working and integrated to system baseline	Wells (2009); Leffingwell (2007)
		Unit tests are developed before the code is implemented	Leffingwell (2007); Schuh (2005)
		Customer writes the user acceptance tests according to stories/features	Schuh (2005); Abrahamsson et al. (2002)

	Testing	User acceptance tests are used for requirements validation and verification	Lan & Ramesh, (2008); Paetsch et al. (2003);
		Continuous testing throughout development	Leffingwell (2007)
		Conduct review meetings to validate Requirements	Lan & Ramesh, (2008); Paetsch et al. (2003)
		Pair programming promotes peer review	Rico et al. (2009)

FUTURE WORK AND CONCLUSION

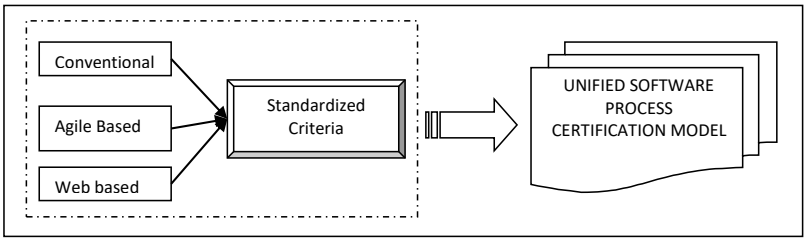

Figure 10. The Conceptual Framework for Unified Software Process Certification Model

Figure 1 shows the proposed conceptual framework of our research. As mentioned earlier, this study aims to construct a Unified Software Process Certification Model. One of the components in the model is the standardized criteria which act as a benchmark of the model. The standardized criteria will be constructed by identifying the best practices that must be performed in producing high quality software product. This study will identify and consider the best software development practices of conventional, Agile and Web-based software development. Since quality and rapid development process are treated as important goals to be achieved in software industry, Agile has been widely adopted by software developers. This paper presents the identified Agile software development practices that are related to human and process factors. Results of the literature found the practices emphasized for human factor are team work, effective communication, decision-making skills, and ability to work quickly. While for the process factor, the literature shows that Agile supports all fundamental software development phases although the implementation is different (refer Table 1). The importance of these practices will be verified by Agile practitioners through an empirical study. Only the practices which get high consideration from them will be included as the standardized criteria for our model. Moreover, during the empirical study, additional practices that might be suggested by the practitioners will be taken into consideration.

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E-LEARNING SYSTEM FOR AUTISTIC CHILDREN

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ABSTRACT. In general, children with autism may have with social/emotional relationships problems, problems with communication, trouble with surroundings, consciousness problems and cognitive problems. The purpose this study is to help autistic children learn alphabets in the early levels of learning. With this paper, we hope to propose an e-learning school-base system for autistic children of education ages between 4-6 years. In addition, our system will enable teachers to teach one or more children at the same time.

Keywords: autism, autistic, e-learning , ASD , alphabets

INTRODUCTION

"Autism Spectrum Disorders (ASDs) are a group of neurodevelopment disorders characterized by core deficits in three domains: social interaction, communication, and repetitive or stereotypic behavior."(Hailpern, 2007). For Children with ASD , it is known that they have strong attractions to objects, pictures and colors (Hirano, Yeganyan, Marcu, Nguyen, Boyd & Hayes,2010), objects and visual materials are the language that they understand , not words. However, each one of them differs from others in the "object" that he/she is most interested with. Many of specialists people (educators or therapists) in this field pointed that individuals with ASD have strong visual skills but straggle with verbal communication (Frith & Happe, 1994). That is why computer – assisted systems introduced for such children must include the visual materials as part of any learning strategy to develop their learning skills. Actually there is so much that assistive technology can do to help people with autism live functional lives(Elzouki, Fabri & Moore,2007) ; (Charitos, Karadanos, Sereti, Triantafillou, Koukouvinou & Martakos,2000) ; (Konstantinidis, Hitoglou-Antoniadou, Luneski, Bamidis, & Nikolaidou,2009).Also if we consider (Grandin,2002), as he was an autistic child, and gave interesting teaching tips for autistic children. One of the points given by him is, "Many autistic children have problems with motor controls of their hands. Neat handwriting is sometimes very difficult and this can totally frustrate the child. To reduce frustration and help the child enjoy writing is to let him type on the computer. Typing is often much easier".

Here we are proposing this E-learning school-based system ,which is designed for children between the ages of 4-6 years and we hope it can help autism children to develop their learning skills and at the same time to be an assistance tool for teachers in this field by reliance on visual colorful objects introduced by the system in a structured order that autism child need in all his/her activities because it can really improve their conditions and skills (Chang,2006). It is such a system that can give help to teachers to devote their time to a larger number of students and schedule each child's learning according to the database within the system which includes the medical background of the children as well with the possibility for parents access as well .This is done by using the special password of the child given to

his/her parent to keep track of their child's learning progress as well as coordinate with school by adding notes to the database of their child.

RELATED WORKS

Several studies and attempts had been proposed, within the field of teaching of ASD children, of the use of computers but they are not school-based systems to help teachers with their work to teach simple alphabetic for autism children.

One interesting system tried to improve the intelligibility skills of speech of autistic children through a special interactive e-learning game offering rewards for improvements. (Rahman,2010)

Another system designed courses for Autistic children by using multimedia skills. Courses had independent units with simple audio contents called environmental teaching mode to teach children topics of daily life(Chang,2006).

The Affective Computer-Aided Learning Platform for Children with Autism (ACALPA) , is a platform to enhance teacher-child education process by using interactive emotional avatar . this platform was introduced with several models ,to help children with autism identify and sequence images and emotions by visual expression with the help of an interactive avatar and supervision of teacher or educator (Elzouki, Fabri & Moore,2007)

Returning Home , scenario and a pilot phase of project for autism children . This scenario was designed in a simulated environment to address the everyday's tasks to autism children. This project include the special "MAKATONS" cards for autism children to guide the child for through the simulated virtual environments (Charitos, Karadanos, Sereti, Triantafillou, Koukouvinou & Martakos,2000).

E-LEARNING SYSTEM FOR AUTISTIC CHILDREN

E-learning system for autistic children is to help children with ASD of early school age between 4-6 years by way of teaching the alphabets with the help of visual objects or characters in an interactive way. Repeating the sound of letters with their shapes, accompanied by pictures, and giving the children chances to practice writing these letters under the supervision of expert or special teachers who have got to know the level of the children through a background database, will help the ASD children increase the possibility of learning (Konstantinidis, Hitoglou-Antoniadou, Luneski, Bamidis & Nikolaidou, 2009) ; McGee, & Lord, 2001). It will also be a tool for teachers to document each child's progress in the child's database.

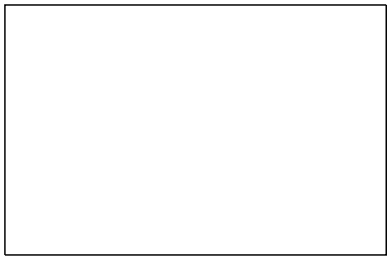

Figure 1. E-Learning System Interface.

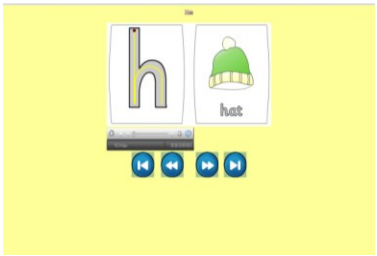

Figure 2. Letter with its appropriate object.

This system being a school–based system has been designed to be an e-learning assistance tool for teachers as well. A teacher can divide his/her time among three ASD children instead of concentrating only on one child. The system in its present form is divided into three levels to cover the twenty six English alphabets, with eight to nine letters per level so that the

repetitive hearing and writing of each letter can be utilized to its fullest. Also the teacher can show the child being taught, using the system, how each letter can be written by hand. This procedure is to be introduced to the child after the child had recognized the shape of a given letter. The child then uses his/her ability to move forward and backward to display the letters and how they had been written, if he/she wishes to do that.

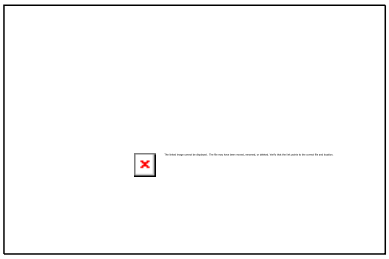

Figure 3. Teaching handwriting of letters .

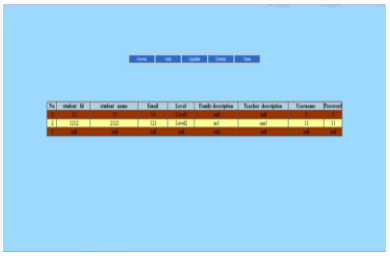

Figure 4. A database table containing child's information.

The system has been designed to give a simple test to a child after each level if the teacher wants to do so. This is to enable the teacher to note the child's learning capabilities and improvement and mark them in the child's database. This is to help the child in the event another teacher takes charge the child .

This system is a hopeful tool for parents as well. They have access to the system and can see the progress of their child, plus the ability of adding their own remarks and recommendation, to the database of their child to be considered by teachers.

ASD children will learn more easily and quickly with the aid of this system, because they are not forced right away to draw the letters on a paper as this is a difficult task for them to do so(Elzouki, Fabri & Moore,2007). Instead they just press the corresponding buttons containing the letters they are learning and make them appear on the screen. Seeing them on the screen will then encourage them to proceed on with the learning of other letters and words. By having control over the system, the teachers can then decide on a teaching movie to teach a child a selected behavior.

This procedure is not only entertaining but is helpful in teaching language materials between letters and behaviors. After each level the teacher can give a test, at the teacher's discretion, based on the background knowledge of the child.

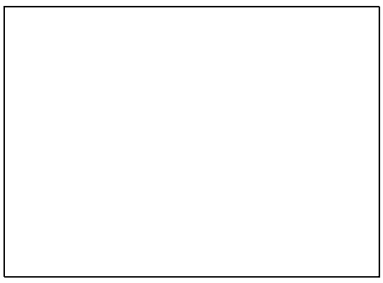

Figure 5. Teaching through a behavior movie.

SYSTEM IMPLEMENTATION

This system has been developed as an E-learning System using Java application with My SQL because of the strength of these two languages in the development of web pages. Browsing through the system, you will see that it consists of two main parts; the first part is for the use of the special teacher while the second and the other parts are to be implemented by the teacher supervisor. To enter the system the teachers must enter user names and predetermined passwords.

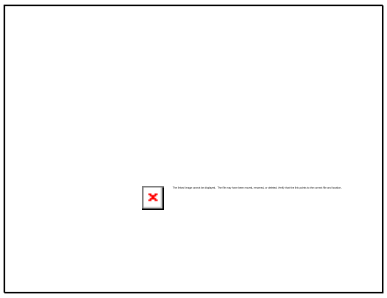

Figure 6. User name and password for teacher.

Figure 7. Page of teacher.

The reason for this is that there may be more than a teacher in the class and each teacher may have go through a preplanned page consisting of home, management student, exam, and logout. The management page consists of add, update, delete, and view data.

This exam button is selected by the teacher to determine the test level either for implementation or for entering the results into the database.

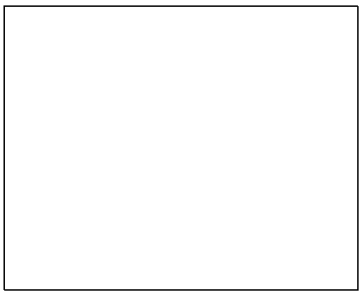

Figure 8. Table of data.

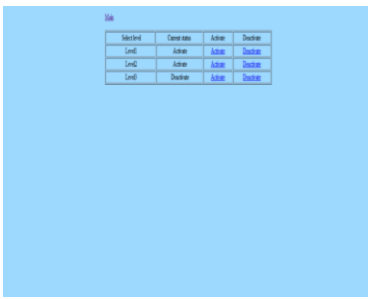

Figure 9. Table for exam.

The home page is for the purpose of monitoring the child at home by the teacher or the teacher supervisor of the child's family. To enter, the name of the child and the PIN number is entered. After that the child presses the login button to enter the system.

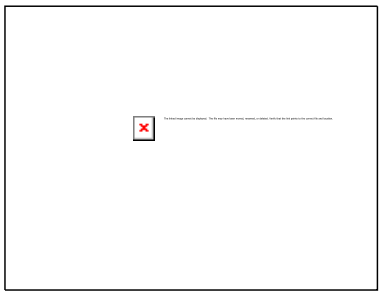

Figure 10. User name and password for student.

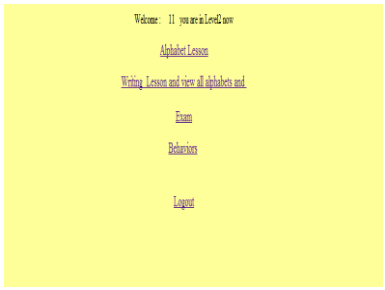

Figure 11. Writing lesson and viewing of alphabets.

This special education programs consists of lessons on the alphabet. The learning letters are divided into three levels. A letter is introduced with a sound and an object or a character. The character and the sound help the child to recognize the letter. This will be helpful during the writing lesson.

In a writing lesson an instruction will open a new letter. It will be spoken and after listening to the sound and viewing the character the child is expected to write the letter. If the answer is correct there will be a voice encouragement. However, if the answer is wrong a voice will request the child to retry writing the letter.

The accompanying test is in four stages. The first stage displays the characters as well as the sounds.

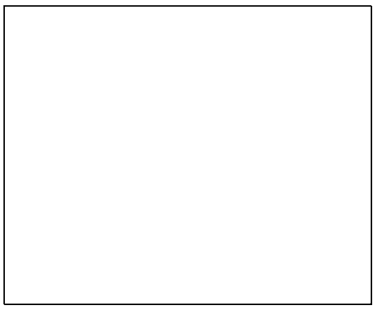

Figure 12. Sound exam.

Figure 13. Alphabet exam.

The child will choose the correct letter based on the sound and the character. In the next stage only the sound will be heard. The child is expected to write the particular letter based on the sound. If the child is successful here the child will be automatically transferred to the next level. This transfer will be verified in the database.

In addition to the foregoing, there is the behavior aspect where a video tutorial will guide the child through all aspects of customs and culture of the daily life of children.

Figure 14. Help With Autism.

Figure 15.Computer assist autism children.

CONCLUSION AND THE FUTURE

This paper presents an educational system designed for children with special needs. It focuses on the learning of the letters and words. The system can also be used for the teaching of numbers, games and behaviors. These many applications can help autistic children through the elementary school, lead to good results and create opportunities in the future.

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INTELLIGENT SOFTWARE QUALITY MODEL: THE THEORETICAL FRAMEWORK

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ABSTRACT. Globally, software quality issues has increasingly been seen as a common strategic response for achieving competitiveness in business. It has been seen very important as the usage of software become very demanding. Software quality includes quality control tests, quality assurance and quality management. Currently, software quality models available were built based on static measurements of attributes and measures. Previous study has indicated that to ensure the quality of software meets the future requirements and needs, the new dynamic and intelligent software quality model has to be developed. This paper discusses the development of intelligent software quality model based on behavioral and human perspectives approach which enhances from Pragmatic Quality Factor (PQF) model as a benchmark of the quality assessment.

Keywords: software quality model, intelligent quality model, software assessment, theoretical framework

INTRODUCTION

Nowadays, rapid development and diffusion of software quality and ICT related technologies in several industries worldwide, shows that the statistics for insufficiently understood requirements account pointed to 50% of all errors and followed by design incorrectly understood or incorrectly translated from requirements account for 30% of all errors. Hence, the programming error or misunderstood of system design contributes to 20% of all errors. Thus, Software Quality Assurance (SQA) is very important issue in software development for reducing the rate and associated cost of failure through poor product and services (Bevan, 1999).

In many organizations, software is considered as one of the main assets with which the organization can enhance its competitive global positioning. At the same time, software house companies are competing to produce software which are claimed to be good and fulfill user's expectation and requirements. The companies unable to provide any justification on the quality of their products to the users and users are left with uncertainties on the standard and quality of the software. Even though many quality models have been developed by several researchers, this issue is still in debate and the quality of software products are still questioned. It is because quality is believed as the eyes of the beholder. This paper presents the new software quality model with an intelligent aspect integrated and relevant in current

and future requirements. It presents the problem statement, research objective, literature review and methodology. The last section concludes the paper.

PROBLEM STATEMENT

Currently, the existing quality models have consistently highlighted as static models which have been develop to measure software product in term of time, budget and also correctness with efficiency to perform all the specified functions of requirements (Denning, 1992). However, these models have been developed to evaluate and measure software product based on technical aspects and theories but did not focused on human aspect (Yahaya, Deraman & Hamdan, 2008).

Software quality environment today is seems as fast changing in term of users requirements and needs to fulfill for current and future requirement in assessment. Previous study indicated that new attributes might be needed to be included in the assessment as well as in the model (Yahaya, Deraman & Hamdan, 2006). The new attributes could not be added in the current static quality models. The two problems mentioned motivates us to develop an intelligent software quality model with the new dynamic tool and technique by highlighting to the human aspects. As to control and maintain the quality of software product, this proposed dynamic model should capable to identify and recommend to the environment the new behavioral attributes which supposed to be maintained or included in the model. The proposed intelligent approach is based on Pragmatic Quality Factor (PQF) model which was developed by Yahaya, Deraman and Hamdan (2008). It will be known as a new intelligent software product quality model which includes the multi intelligent aspect in this model. The original version of PQF model does not include intelligent technique and based on static method.

RESEARCH OBJECTIVE

The main purpose of this research is to construct an intelligent Pragmatic Quality Factor (i-PQF) model with the proposed AI technique. This will be supported by the following objectives which are to investigate the quality and assessment problem in software product, to develop a theoretical framework for intelligent software quality model, to proposed Artificial Intelligence technique for software quality model based on PQF model and to test the model by prototype.

The scope of the study is to develop the intelligent software quality model based on the software behavioral and human factor by using Artificial Intelligence technique. Thus, this research is developing the quality model in multi intelligent aspect and to propose some enhancements in the original PQF model.

LITERATURE REVIEW

Software quality is defined as a set of quality attributes with different interest group express their needs of software. International Organization for Standardization (ISO) defined quality as the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs (Yamada, 1996). ISO/IEC9126 (1996) applies software quality as to extend the user needs are well defined. Hence, IEEE (1993) defines software quality as a software features or characteristics to assess the quality of a system or component. Software quality is also defined as the fitness for use of the software product and conformance to software requirements and to provide useful services (Tervonen, 1996). Thus, software quality also is defined as conformance to explicitly stated functional and performance requirements, explicitly documented development standards, and implicit characteristics that are expected

for all professionally developed software (Tervonen, 1996). In many organizations, software is considered as one of the main assets with which the organization can enhance its competitive global positioning in current economic era. The different perspectives of quality were referred to the transcendental view, user view, manufacturing view and value-based view. These perspectives influence the software product quality development in term of their final interaction with the final product.

The relationship of each quality attributes in software product provides an abstract or high level specification for the software product and the capability to fulfill the changes in the environment is important to be highlighted. Several software product quality models are available from literature and the most well known models are McCall, Boehm, FURPS, ISO9126, SQuaRE, Dromey, Systemic and Pragmatic Quality Factor (PQF) model. Each of these models measure and evaluate the quality attributes of software products from various dimension with different characteristics. It shows that the main quality characteristics found in majority of these models are: efficiency, reliability, maintainability, portability, usability and functionality, which are presented in more recent models. Most of these models are only focused on developer view rather than user's view in measuring and evaluating the quality attributes in software product. The existing model has been constructed with conformance to requirements and does not to focus on user expectations and satisfactions with including the theoretical and technical perspectives. Thus, these static models are lack of capability to fulfill the future requirements in this volatile environment (Yahaya & Deraman, 2010).

The development of PQF was intended to evaluate and measure software quality attributes by fully highlighted on software behavioral and human aspects. This new static model has showed and clearly defined the way to evaluate and measure quality attributes as well and improved the lack of mechanism and techniques of software assessment in existing models. It covered the behavioral aspects of the software and the impact attributes. This model supports a better software quality standard and procedures to fulfill user requirement and user needs. PQF has been applied in real industrial practices with involve several large organizations in Malaysia (Yahaya, Deraman & Hamdan, 2007; 2010).

From literature, several studies were implemented in software quality projects using Artificial Intelligence techniques for several purposes. Some of the studies were by Briand et al. (2000), Burgess et al (2000), Goa, Khoshgoftaar & Wang (2009) and Aguero et al. (2010). Several methods and techniques in AI approaches such as Feature Selection (FS), Artificial Neural Network (ANN) and Cased-Based Reasoning (CBR) has been investigated and reviewed. Feature Selection (FS) is a process of selecting a subset of relevant features for building learning models and it used to remove less important features from the training data set (Gao, Khoshgoftaar & Hulse, 2010). Feature Selection Wrapper-Based Feature Ranking technique which is a part of Feature Selection includes wrapper approach to assess the attributes individually and ranks the attributes according to their individual predictive power. Whilst, Artificial Neural Network (ANN) technique is created by presenting the network with inputs from many records and the function in this technique is not able to be used in calculating the weight of each attributes. The same reason also goes to another technique which is Case-Based Reasoning (CBR). CBR only adapts previous stored solutions that can been found to be effective in the solution of earlier problems (Khoshgoftaar et al., 2003). Therefore, CBR is not suitable to be used in construction the algorithm in our proposed intelligent quality model. In addition, both techniques are lack of capability to fulfill the current needs and the future requirement in development of the proposed quality model.

From the literature study, the Automatic Hybrid Search (AHS) and Hybrid Feature Selection (HFS) are the methods which using the wrapper approach in their processing

function and both methods have the capability in assessing and ranking each of the characteristics by their predictive power (Gao, Khoshgoftaar & Hulse, 2010). The wrapper approach is using the same learning algorithm that will be used for learning or classifying the domain represented with the selected feature subset for example Naïve Bayes, K-Nearest Neighbour (KNN), Support Vector Machine (SVM) or Logistic Regression (LR) (Khoshgoftaar et al. 2003). Both methods are suitable to be used compared to another proposed methods such as Kolmogorov-Smirnov (KS), Probabilistic Search (PS) and Rough Set (RS) due to it relevants to create the new algorithm as needed and achieved the objectives in this study.

METHODOLOGY

The research will be carried out in five main phases with the aim is to develop a new intelligent software quality model. The phases are:-

Theoretical Study

The purpose of this phase is to investigate the quality and assessment problems in the existing software product. The inputs from this phase will be books, journals, proceedings and any other documentations related to software quality. The deliverable from the study can support the researcher to generate the new ideas on identifying software quality attributes and models as well as their strengths and weaknesses in measuring the attributes.

Design of formal framework on intelligent software quality

This phase involves identifying the specific feature of software quality to be represented using AI approach. The formal framework can help the researcher to determine the study areas and also content considerations, research questions that need to be addressed and the methodology. Figure 1 illustrates the theoretical framework on intelligent software quality model.

The development of i-PQF will involve several components of static models by focusing the additional human aspects and multiple intelligent aspects. Two main issues will be studied which by means of model and component. Under these two issues, the details of available and relevant software quality models and associated components will be discovered. The third issues will be the dynamic aspect of software quality. This will cover the intelligence techniques and methods in developing the intelligent software quality model. Thus, the construction of the new dynamic and intelligent model is based on the PQF model as the based line in attributes assessment. The development of prototype will be used as a medium for running the proposed algorithm.

Identify and propose the AI technique for intelligent software quality model

Several methods and techniques will be studied in order to enhance the software quality model by using AI approach. The methods and techniques are described in previous section. In order to create the new algorithm with the intelligent function to measure the attributes in software quality, the Feature Selection Wrapper-Based Feature Ranking technique has been chosen to be applied in this model. Furthermore, this chosen technique also contained several methods to be integrated in the new algorithms which are Automatic Hybrid Search (AHS) and Hybrid Feature Selection (HFS).

Construction of intelligent software quality (i-PQF) and prototype

In this new intelligent model, the collection of the data will be inherited from the PQF model which is based on Likert scale of values 1 to 5. In addition to the collected data, PQF consists of ranking values of weighted scale that being assigned by the users to evaluate software product. Consequently, the data will be compiled by using the classifier such as C4.5, MultiLayer Perceptron (MLP), Naïve Bayes (NB), or Logistic Regression (LR) which are already included in WEKA tool. Thus, the concept, definition and the characteristics of the attributes still be inherited and the additional concept of intelligent system by using AI approach will be added. The algorithm will be integrated and embedded in a prototype that will be developed in this phase. During the experimental design on the algorithm, three main steps will be implemented: input, data processing and testing.

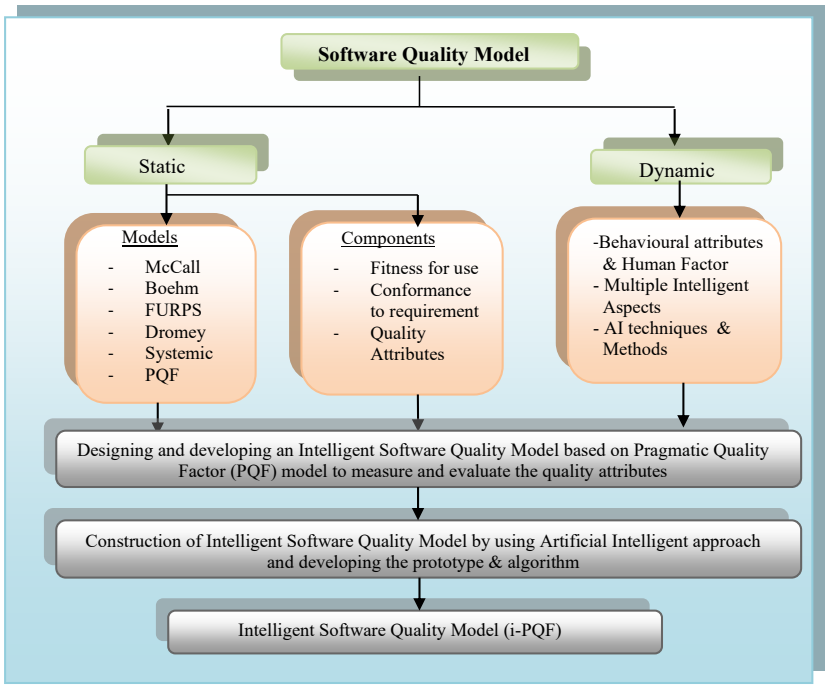

Figure 1. The Theoretical Framework on Intelligent Software Quality

Confirmation Study

In this phase the proposed model and the prototype will be tested and validated. In the testing process, two types of testing will be carried out which are alpha testing and beta testing. The testing will be done on the prototype and the new proposed algorithm will also be tested and validated to confirm the functionality of the new intelligent model.

CONCLUSION

The criteria of software assessment in software quality might change and always require additional new criteria to be included in future. The idea to enhance the static model to a dynamic model in software quality by using PQF model as a standard model become the main focus to be highlighted in this study. Thus, the intelligent toolset should be capable of adapting and noticing any changes in the environment. This can be done by integrating Artificial Intelligence techniques and methods. Furthermore, by attaching the intelligent system criteria in this new dynamic quality model can support the certification environment with a self-learning capability with capturing knowledge from previous certification processes and experiences. Thus, the new model can be used as a benchmark for another researches that relate to software quality and certification.

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CHALLENGES IN E-LEARNING: FROM REQUIREMENTS ENGINEERING PERSPECTIVE

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ABSTRACT. Nowadays, education offers great flexibility to learners in order to help them to succeed. E-learning as knowledge management tool gives service to learners in disseminating and sharing information. Therefore, there is a lot of interaction from users in E-learning community that helps them to solve tasks in E-learning application. There are challenges to sustain E-learning service because users might get bored and infrequently use it. Requirements Engineering (RE) takes the opportunity to strengthen RE process by investigating how socio-technical requirements such as lack of social presence, feeling bored and lack of motivation can be transformed as socio-technical requirements and are available to be implemented by developers as agreed by users. Therefore, RE process should manage to capture socio-technical requirements in order to allow consistent motivation among learners. Requirements elicitation, as the initial stage in RE process, may improve its mechanism in eliciting socio-technical requirements for collaborative application such as E-learning. Hence, RE process and E-learning components must be carefully studied to ensure RE as in Software Engineering field can assist collaborative application to improve elicitation process and come out with a set of requirements before E-learning is implemented. This paper describes challenges in social interaction issue for E-learning environment and how RE sees these challenges.

Keywords: requirements engineering, E-learning, requirements elicitation, collaboration, social aspect, socio-technical requirements

INTRODUCTION

Electronic learning (E-learning) is a Learning Management System (LMS) which is widely used by higher institution to provide learning facility for learners and instructors. It is used as a collaborative tool for knowledge sharing and gives support for its users by providing facilities such as review course activities online, assignment submission, online quizzes, online forum and discussion and other collaborative activities among users. This application is needed by learners to ease their learning activity regardless of time and place. Requirements Engineering (RE) is seen as one of the sub-disciplines in Software Engineering (SE) that involved with identifying accurate requirements according to users' demand. RE activities complement with E-learning environment since E-learning must be defined and improve consistently in order to fulfil request from users (Guido *et al*., 2008). For achieving desirable outcome, RE activity is essential to ensure users and developers understand the same problem domain and hence attain improvised value of social interaction as one of E-learning features.

MOTIVATION

This paper is produced to share some ideas on how RE process may fortify its process in establishing socio-technical requirements for collaborative application. E-learning has been selected as collaborative application in this paper to highlight the challenge of RE process. The process is essential in producing an accurate set of requirements which can support socio-technical requirements resides in online collaborative activities. Active collaboration among members during learning process helps them to learn mutually and actively participate in online activities (Alonso, López, Manrique, & Viñes, 2005). Distance learning is also related with social presence and user satisfaction while using the system. These factors play crucial parts in determine the E-learning usability. A study has pointed out that interaction among individual in online learning is contributed by social presence and collaboration (So & Brush, 2008). Hence, user and developer must understand these elements in order to influence interaction even though they are not having face to face interaction. These elements can be categorized as socio-technical requirements or social aspect which is considered as psychological aspects in developing information in order to create user's connectedness and bonding while involving with distance learning activities. There is another study stated that collaboration in E-learning is imperative since it creates social interaction to the group for knowledge sharing (Kreijns, Kirschner, & Jochems, 2003).

LITERATURE REVIEW

This section covers topics regarding the overview of E-learning and what is the relation with collaboration activities. The literature review explains the relation of collaboration in social interaction and also why is it important in developing E-learning. This paper also identifies what is social aspect based on selected case studies and the relation with RE activity.

Overview of E-learning and Collaboration Activity

A quality E-learning follows users' needs in order to meet its objective (Schewe et *al*., 2005). The system should be clearly presented in order to convey information to the user. In education, there are several collaboration categories like storytelling, open-ended discussion, focused discussion on certain topic or project work and also mentoring. Knowledge management technology allows learners to own knowledge from knowledge discovery and consequently create inventive finding throughout collection of knowledge that they have gained(Rongrong & Jun'e, 2008). The courage in collaborating among users can motivate achievement of E-learning operation and this can be accomplished by having good surrounding in the E-learning community itself. Instructor can help in giving guidance to students in collaboration by coaching them on how to collaborate, setting up boundaries towards the given task and be a moderator to invite, support those students. Students' attitude is important in collaboration since it is the indication whether learning community is active and participates in sharing and learning knowledge. A study has justified the best characteristics in online course are openness, flexibility and humour, honesty and willingness to collaborate (Palloff & Pratt, 2003) and online learning can give strength to collaborative activities among members. There is an issue regarding social interaction in E-learning which affects learners' motivation to work together with other members in online community. They feel less connected with online group which discourage them to involve actively with the task. Individual might differ with each other and this case different level of user acceptance towards the technology (Huang, Lin, & Chuang, 2007). Learners need interaction in the community so that they can learn new knowledge, experience new skill and attitudes towards the problem.

By improving social interaction in E-learning, user can improve satisfaction towards E-learning usage and this can only be done if users feel the connectedness or bonding among

members in the group. By increasing the level of connectedness, they can actually improve collaboration activities in E-learning. In this case, E-learning system must be carefully planned so that social interaction issue can be identified and thus can be solved by developer throughout implementation.

Overview of Requirements Engineering (RE)

RE is a sub-discipline of SE. "Requirements engineering (RE) is concerned with the identification of the goals to be achieved by the envisioned system, the operationalization of such goals into services and constraints, and the assignment of responsibilities for the resulting requirements to agents such as humans, devices, and software. The processes involved in RE include domain analysis, elicitation, specification, assessment, negotiation, documentation, and evolution" (van Lamsweerde, 2000). According to Lamsweerde, RE is not an easy task because the process deals with conflicting ideas of proposed system as well as vague requirements from the beginning of the system planning. The existing challenge in RE is the difficulty in defining requirements because each requirement available need to be considered, selected, prioritized and finalize the by resolving requirements conflict and construct acceptance criteria. Then, all requirements that have been examined are transformed into a set of complete requirements that gives solution for software that is going to be designed and implemented. RE will be challenging in terms of making technical and non-technical stakeholders to understand the same issue and finally establish the same goals, functions and specifications of software behaviour and their evolution over time as long as demands are required.

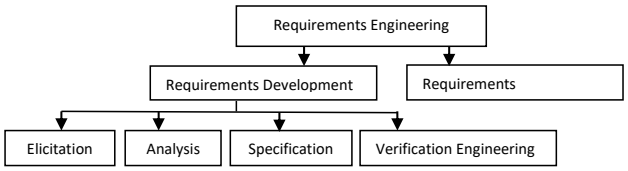

Figure 1. Subdisciplines of Requirements Engineering (Wiegers, 2000)

Figure 1 reveals that RE has been divided into requirements development and requirements management. Requirements development is further subdivided into elicitation, analysis, specification, and verification. Requirement development activity must result an agreement from project stakeholders upon product's features. Whereas requirements management part consists of activity that controls project changes in the requirements baseline and observes requirements implementation. In this paper, the author explains about elicitation process in RE and relates with the importance of elicitation in complementing with social interaction issue in collaborative application.

To elaborate, the four subdivisions of requirement development have their own target. Elicitation is considered as the first step in requirement development whereby product's business requirements along with user involvement initiate the process to gain requirements. Elicitation process follows by defining the project scope and justification of why the project is needed by the stakeholders. Then, each user will be assigned their tasks and quality attributes of the requirements will be defined to comprehend features to be put into the system. At this point, elicitation during RE is a very important process to ensure all stakeholders have the same agreement upon their proposed system. Next section covers the overview of requirements elicitation and examples of requirements elicitation model that may support social aspects that exist in corresponding system for five selected case studies.

Requirements Elicitation

"Requirements elicitation is the process of seeking, uncovering, acquiring, and elaborating requirements for computer based system." It is not just a gathering process but it is a process to understand the requirements that have been collected by going through activities with appropriate tools, techniques and approaches(Zowghi & Coulin, 2005). The requirements elicitation is essential to the success of software development projects (de Oliveira & de Mesquita Spínola, 2007).

Examples of Requirements Elicitation Model

There are elements in 'soft issues' that need to be identified during RE. These elements affect system development and also users that are going to use the application (Thew & Sutcliffe, 2008). The 'soft issues' are related with the social aspect elements that need to be taken into consideration into E-learning implementation. The study stated that sociability which is a desire to be part of a group is the value that exists in online community and RE should investigate how to analyze and come out with the requirements to add in this value. Five case studies have been reviewed in order to get ideas on how to extract social aspects requirements in the case studies and what model can best-fit the elicitation process for collaborative activities. There are elements like social interaction and RE activity that might match the process of developing five case studies. Case studies involved are considered based on social aspects elements that they can collect from the requirement engineering process. Case study handled by Liang *et al*. used AT-AC tool to identify social aspects and manipulate Unified Modelling Language (UML) to visualize requirements from multi-agent system(Liang, Ruo, & Bai, 2009). By having Activity Theory as the supported element in the model, both developer and user not only can gather technical requirements but also can see how the social levels interlinked in the system itself. Second case study used goal-driven approach to investigate based on information that they have gathered from organizational(Kavakli & Loucopoulos, 2003). This approach focuses on understanding the need for change in current organizational situation and collected it as goals to be achieved by the organization. However, they did not specifically focus on social aspect of the system that is going to be built.

The third requirement elicitation model is called phenomenographic study(Zhang & Han, 2008). It is about acquiring requirements through conversation that has been done with stakeholders. This study analyzed behaviour and how learners deal with social relations and eventually will discover three kinds of social relationship which consists of learner-learner relationship, learner-tutor relationship and group tension among the community. Whereas, affective requirements are needed while eliciting requirements for game enjoyment(Bentley, Johnston, & von Baggo, 2002). Affective factors for user experience are subdivided into satisfaction, game efficiency, and game effectiveness. This study considered affective requirements to be established as emotion in game setting and these requirements are analyzed using RE process. The fifth model is about identifying key users in order to forecast what is the role of users in system development(Yang & Tang, 2003). This model can handle requirements from users albeit one user is replaced by another user. The relationship between users is analyzed using social network analysis (SNA). According to Yang and Tang, this method helps to measure relationships between people, group and also organization in the company.

DISCUSSION OF LITERATURE

The first factor that motivates E-learning is collaboration issue. Collaboration allows users to involve in E-learning community and take part in a particular task based on roles that are given to them such as students, instructors or administrators. Collaboration allows active

cooperation among student in E-learning(Fetaji & Fetaji, 2007; Sun, Tsai, Finger, Chen, & Yeh, 2008). This highlights collaboration as social aspect requirement from stakeholders whereby stakeholders must clearly identify and they have to know things that they want in E-learning content. Requirements elicitation must be done not only to gather technical requirements but social aspect requirement in order to overcome collaboration issue and to encourage interaction issue in E-learning system. Collaboration is needed when users need to interact socially with others to unravel some tasks given by their instructors and the system has to help to improve social presence for E-learning community. Thus, requirement elicitation activity should play a role in uncovering what are the elements of collaboration needed in E-learning system. These elements might not obvious as functional requirements. Requirements elicitation activity must identify collaboration activities that are involved in E-learning.

The following challenge is interaction between user and E-learning application. Effective interaction is needed between user and the application to reduce time needed for user to understand user activity involved in the application. Thus, E-learning developer must produce accurate learner-centred design that suits learners since learners have various learning styles, behaviour and expectation towards the system. This can be achieved by having user support during interaction to maintain user activity. Requirements elicitation may help users in categorizing user's profiles in order to forecast level of users and this is important in determining user level of interest towards E-learning system. RE can adopt activity theory (AT) as suggested by Liang *et al.* in order to see social factors involve as well as components of tools, actors and sources needed for E-learning system. In a study done by Bentley *et al*., user's motivation in game to increase game enjoyment has been gathered through affective requirements which concern emotions of user while playing computer games. The enjoyment is motivation for them to sustain themselves in the game and continue the excitement of playing games. In E-learning, the concept of motivation is one part of psychological aspects. Developer must take into account on how to develop E-learning system that can eventually endorse motivation to users.

CONCLUSION AND SUGGESTED WORK

Social interaction issue in E-learning involve the improvement of collaborative activities. Effective social interaction can result from active collaboration among members. In order to ensure active participation, RE needs to gather information regarding effective content and also be able to capture social aspects in E-learning. Social aspects will be translated into RE as socio-technical requirements which may consists of soft issues such as motivation, connectedness, bonding. These requirements can therefore increase social interaction in E-learning. Social interaction can be improved by increasing social presence value in E-learning design which can be obtained by having desired requirements from users including requirement on how to have social presence element in E-learning. To conclude, content of E-learning and socio-technical requirements may help to increase social presence element of E-learning as a collaborative application. Currently, the author is doing the investigation on the appropriate requirements elicitation mechanism for capturing social aspects in collaborative application. According to the selected case studies, requirements elicitation process is used to capture social aspect by understanding stakeholders' roles, understanding learners' behaviour, identifying affective requirements and understanding the business process during system development. The appropriate requirements elicitation mechanism for collaborative application which is specifically for E-learning domain will be published on future papers.

Social presence has been identified as one of the elements to make user feels that they are welcomed in the group community. Existing requirements elicitation model can be investigated and analyzed in order to see whether those models considered social aspects as a set of

requirements as the outcome of requirements elicitation. Characteristics of social aspects should be further elaborated to give clear insight of what elements should be in E-learning. Collaboration features must also be identified in order to create effective collaborative activities in E-learning regardless of time and location. By having all these requirements, E-learning system is hoped to be supported by sufficient LMS infrastructure.

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THE DESIGN OF *F-CMS*: A FLEXIBLE CONFERENCE MANAGEMENT SYSTEM

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ABSTRACT. Conference management system (CMS) is designed to help the conference committee manages a conference well. The CMS which is available in market nowadays provides a well managed pre-conference function such as paper reviewing, paper submission, and participant registration system. However, payment module is not given priority by the existing CMS. This study argues that the payment management is importance ant to simplify the payment process, avoiding the unpaid paper being published in the proceeding. Also the conference committee can easily calculate the conference profit when the event ends. However, CMS is inflexible handling certain cases such as in case authors are unable to pay the fee before the conference day but need to submit the camera ready. Hence, this paper attempts to explain the design of a flexible conference management system (*f-CMS*). *f-CMS* is developed using RAD approach. It also includes the registration module during conference day. This paper presents the review of literatures and the early stages of the development of *f-CMS*.

Keywords: Conference Management System (CMS), f-CMS, RAD

INTRODUCTION

In a year, there are many conferences organized over the world. According to the ACM calendar of event 2011, there are approximately 25 registered conferences organized in January and February. Also known as symposium, workshop, or seminar; conference is organized yearly and some of them are in a series of two years. There are many motivations to attend conferences; in which they allow people to share research findings, seek new research areas, develop networking and meet experts (Abdul Wahab et al., 2007). To achieve the conference objectives, the conference committee needs to manage the event well starts from the beginning of the conference alert until the event ends. A good conference management is one of the criteria of the conference successfulness.

Currently, there are many conference management systems (CMS) available with the aim to help the conference committee organizing conferences systematically. With the accessibility of the Internet, most of the CMS are available in web-based environment. It eliminates the geographical boundaries. The examples of CMS are CyberChair (www.cyberchair.org), EDAS (http://www.edas.info), CONFIOUS (http://www.confious.com), ConfTool (http://www.conftool.net), (http://www.confmaster.net) and KMICe-eX (www.kmice.uum.edu.my). The CMS supports major conference activities

such as electronic paper submission, online paper reviewing and managing participant registration.

Generally, conference management works are divided into three phases; pre-conference, during-conference, and post-conference. The pre-conference phase involves conference alert, abstract and full paper submission, allocating paper to reviewer, notification to the authors, payment, and participant registration. During-conference phase refers to the day of the conference. In this phase, it includes managing the participant attendance, checking the participant payment, distributing the conference kit, and managing the conference session. Finally, when the conference ends, conference committee should conduct the port-mortem, finalizing payment, and produce reports. The final part is called the post-conference. Figure 1 summarizes illustratively the process of managing a conference as discussed in this paragraph.

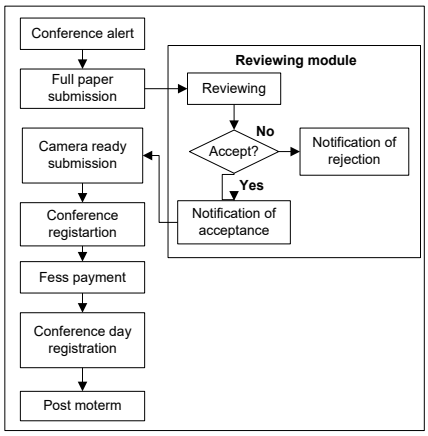

Figure 11: Activities in managing a conference

The most important activities in managing a conference fall in the pre-conference phase. The process starts from the conference alert, full paper submission, allocate paper to reviewer, notification to the authors and participant registration. Those processes are supported by most CMS in the market nowadays.

However, current CMS are moving forward to integrate the payment facilities. The automated payment management can help the conference committee simplifying the payment process as well as calculating the conference profit. From the literature, there are two types of payment methods; (1) by credit card and (2) wired transferred; and it must be paid before the conference day. The failure of authors to make payment before the due date will cause their camera-ready not submitted to the CMS. This function is helpful in eliminating the unpaid accepted papers from getting published in the proceeding. However in certain situations, this becomes inflexible. The problem arises with authors who are unable to pay before the due date. In certain countries such as Malaysia, the payments of sponsored authors are normally received during or after the event day due to their organization's payment policies. The payment method via cheque, invoice, company vote, or government order requires more time to process. It is usually received after the conference ends.

The inflexibility in managing fees payment mainly by the presenters will cause difficulties for the conference committee to select only the paid papers to be included in the proceeding.

The time concern in this stage is that it can delay the printing of proceeding. There is also a possibility that the unpaid paper will be included in the proceeding. On the authors' side, they cannot submit the camera-ready if their organization pays the fees late. In KMICe 2010, out of the 120 accepted papers, 28 papers were paid after the camera-ready submission date was due. To avoid this problem, the current practice by the conference committee is to use any CMS to manage the pre-conference task such as paper submission, paper reviewing, and registration. Then they use separate software such as spreadsheet to handle payment and participant registration during the conference day and manually prepare conference report when the event ends.

Therefore, a CMS with a flexible payment management and registration module called flexible Conference Management System (*f-CMS)* is designed. This paper presents the review of literatures and the early stages of the development of the *f-CMS*.

CONFERENCE MANAGEMENT SYSTEM (CMS)

There are many CMS available in the market. Most of the CMS are firstly developed for a specific conference purposed but later were commercialized for other conferences. Cyberchair is a free web based system and it is developed to support the review process of conferences, workshops, and journals. Developed in 1996 for Conference on Object Oriented Programming (*ECOOP*), Cyberchair facilitates the conference committee in pre-conference activities such as assigning paper for review, storing author registration, and automated paper acceptance notification (Stadt, 2010). It is also capable of comparing the reviews of multiple authors, points out conflicts and easy means of communication to resolve these conflicts. In addition, it can also facilitate the conference committee to select the best paper and prepared the table of content for the proceeding. However, there is no payment module in Cyberchair.

Then, Gol et. al. (2004) developed a CMS to manage international conference. The system supports the pre-conference activities without any module for payment facilities. The system was designed based on the requirement of University of South Australia.

Further, Chairman (Levocic, 2005) was developed. It is an open-source-based CMS that offers facilities as found in Cyberberchair but with payment facilities. Chairman paper management is more systematic compared to Cyberchair. It supports tasks in collecting full paper, assigning paper to reviewer, paper notification, participant registration, and payment management. Besides that, chairman provides flexible interaction capacities between the conference committee, reviewers, presenters, and session chairs.

Papagelis and Plexousakis (2007) developed CONFIOUS, a CMS which combines modern design, sophisticated algorithm and powerful engine to help the conference committee chairs to effortlessly accomplish complicated tasks and deliver the best experience to both reviewers and authors. Besides supporting multi-conference events, CONFIOUS has a good mechanism in managing papers for review. It has been used by several conferences and journal such as HDMS 2010, RCC 2010, S-ICT 2008, and Journal of Web Semantics. However, similar to Cyberchair, there is no payment facility in the system.

Besides, the Editorial Access System (*EDAS*) has also been developed. It also serves the needs of workshops and journals (Edas 2011). Users who want to use EDAS needs to register first. *EDAS* supports all functions which are covered by CONFIOUS and has capabilities to broadcast conference alerts to *EDAS* registered users with similar technical interests. It also supports multi conference registration whereby *EDAS* users may submit papers to more than one conference using the same login. In addition, *EDAS* is also integrated with the IEEE Submission System to manage copyright. Besides the well managed paper reviewing system,

EDAS also has advantages at handling the payment by participants. It supports telegraphic transfer and credit card which is connected to merchandizing bank. By using this facility, the authors must first pay the conference to submit the camera-ready otherwise the function is disabled to them. From the records until January 2011, there are nearly 250 conferences and workshops organized in the year 2011 utilizing *EDAS* as a conference tool.

The KMICe extended version (*KMICe-eX*) is purposely designed to manage the Knowledge Management International Conference (*KMICe*) in 2004 (Wan Hussain Wan Ishak & Syamsul Bahrin Zaibon, 2008). Under the requirement of Universiti Utara Malaysa, the system has been continuously improved for the use of *KMICe* conference series in 2004, 2008, and 2010. *KMICe-eX* supports dynamic features such as online registration, online paper submission, and online reviewing assignment. It is incorporated with an advanced feature, which is automated generation of abstract book and proceeding. This feature enhances the CMS and reduces a lot of works on the conference committee part. The success of the system has been attracted several conference organizers to use *KMICe-eX* such as, *ICOCI 2009*, *IVIC 2009,* and *RICTD 2010*. However, *KMICe-eX* does not support payment facilities.

Based on the models of CMS discussed in the paragraphs previously, this study found that the payment module is important in managing conference online. In fact, the payment module should be flexible to cater specific needs by people who are sponsored by their organizations. Hence, this study proposes a model of the CMS called *f-CMS*.

THE DESIGN OF *F*-CMS

The *f-CMS* is designed to assist the conference committee managing the pre-conference, during conference, and post-conference activities smoothly. It supports single conference registration. Similar to the other CMS, the target users of the *f-CMS* are the conference committee, reviewers, and participants. In detail, the participants are the presenter (author) and listener. In addition, *f-CMS* is a web-based application and the communication and notification with users are via e-mail. There are 5 main modules in the f-CMS; Paper Submission, Participant Registration, Reviewing, Committee, and Payment. Figure 2 summarizes the *f-CMS* modules illustratively.

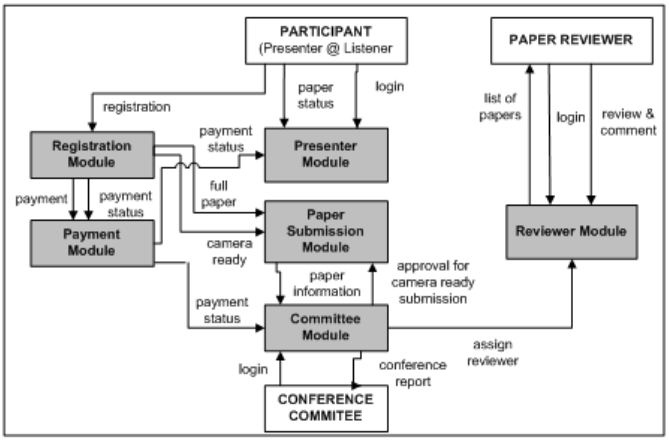

Figure 2: The *f-CMS* modules

Participant Registration Module

Each participant needs to register to the system like in EDAS. For presenters, they can upload the full paper after completed the registration. This module is used as reference during conference registration when the event begins. On the event day, the participants can mention their name or paper id for registration. However, if they have not paid, they cannot register and need to proceed to payment counter.

Presenter Module

This module is purposely provided to facilitate presenters managing their paper submission. Through this module, they can submit papers, view paper status, view payment status, submit camera ready file, and edit personal profile.

Submission Module

There are two types of submission – full paper and camera ready. The full paper submission is opened to all registered presenters and the camera ready file function is only active for those who have paid the conference fees. Otherwise, they must get approval from the conference committee. Presenters can upload and re-upload papers and is also allowed to submit more than one paper. Each paper will be given one unique id.

Reviewer Module

Reviewer module is developed to manage the reviewing process. The reviewers will be invited via email and their account will be created once they accept to be a paper reviewer. In this module, reviewers can edit their preference and view the list of papers to be reviewed. They are given the authority to decline or accept which papers to be reviewed. Once accepted, the reviewers can begin the review and fill in the online review form. Each reviewer is given 14 days and by default they will receive two papers to review.

Conference Committee Module

The conference committee module serves as the control unit of the *f-CMS*. It allows the conference committee to manage conference participant, reviewer, submission, committee, conference information, and report. In the conference participant module, the conference committee can view participant detail, view list of participant, view list of papers, and check the payment status. In reviewer section, the conference committee can create account reviewers' account, assign papers to reviewers, and set the number of days for reviewing. Besides that, the conference committee is also authorized to decide whether to accept or reject the paper after it has been reviewed. Then, the submission panel will let the conference committee to consider whether to allow any author to submit the camera-ready before the due date. Meanwhile in the committee and conference information module, the conference committee can create committee profile and update the conference information. Finally, there is a report page, in which the conference committee can generate report regarding the participant, reviewers, papers, payments, profits, and registration.

Payment Module

The payment module is to help the conference committee managing the payment. For presenter, all payments must be received before the conference day or they are unable to submit the camera-ready. However, they can request for approval to submit their camera-ready before settling the payment. To get the approval, they must send request by fill in a specific form, and then upload/fax the confirmation letter or the proof of payment to the conference committee. Once it has been approved, a notification will be sent to them. The types of payment include credit card, bank transfer, cheque, and general order (which is only

applicable for Malaysian only). In contrast, the listeners have options to pay either before the conference day (with discounted amount) or during conference day. Besides that, this module also includes the total fees calculation. Figure 3(a) and 3 (b) summarize the payment process in *f-CMS*. In detail, Figure 3 (a) represents the process of managing the payment and getting approval for camera ready submission while Figure 3(b) is the process of calculating the total fees.

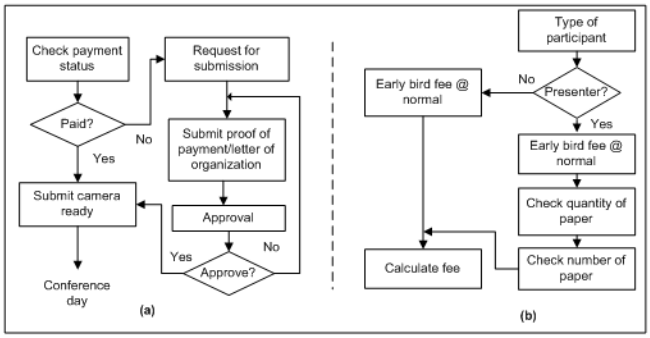

Figure 3(a): The process of payment management and getting approval for camera ready submission. Figure (b): The process to calculate the fees amount.

THE DEVELOPMENT METHODOLOGY

The *f-CMS* is currently in the early stage of development. It is developed using the Rapid Application Development (RAD) methodology, a software development methodology proposed by James Martin in 1991. It involves iterative development approach in the prototype development (Jerrey & Lonnie, 1998). RAD has four phases as outlined in Figure 4 that are analysis (defining the *f-CMS* user requirement), prototyping (designing the e *f-CMS* based on requirement), testing (verifying the requirements and formally refining the data and process model), and implementation (combining requirement and technical design to fully construct *f-CMS)*. *f-CMS* is developed using a combination of Active Server Page and Microsoft SQL Server 2000. The Figure 5 captures the preliminary interface design of the payment module.

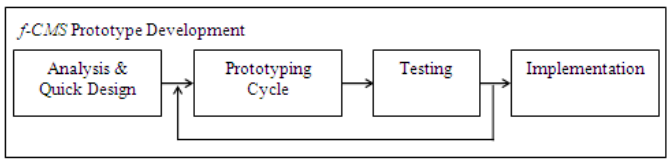

Figure 4: The RAD approach used in *f-CMS*

CONCLUSION

The *f-CMS* is currently in the development stage. The improvement will be conducted from time to time. Based on the limitations found in the existing models as discussed in previous paragraphs, many additional functions need to be included in the *f-CMS* such as selecting the best paper, schedule the paper presentation, integrating payment with bank merchant and creating online book of abstract.

It is expected that with the flexible design, the *f-CMS* could eliminate the problems in payment management. More importantly the *f-CMS* team looks forward to avoid the unpaid papers being published in the proceedings.

Figure 5: The preliminary prototype design of payment module

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GRADUATE ENTREPRENEUR ANALYTICAL REPORTS (GEAR) USING DATA WAREHOUSE MODEL: A CASE STUDY AT CEDI, UNIVERSITI UTARA MALAYSIA (UUM).

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ABSTRACT. Business Intelligence (BI) system using Data Warehouse (DW) technology is one of the important strategic management approaches in the organizations today. BI combines architectures, databases, analytical tools, and methodologies to enable interactive information access focused on analytical reports. Analytical reports, which affect the long-term direction of the entire company, are typically made by top managers. Decisions making in an organization is very difficult, especially if the organization has poor quality data and limited information. The management in the organization always depended on the past experiences and their instincts when making a decision making without support from the factual information. DW is a technology enable to integrate and transform enterprise data for strategic decision making. The organization, which is, responsible to manage entrepreneur activities need an analytical report for strategic decision making. This paper is focused how to design and develop Graduate Entrepreneur Analytical Reports called GEAR by using a DW model in Cooperative and Entrepreneur Development Institute (CEDI), Universiti Utara Malaysia (UUM) as a case study. This system has been tested through the system user feedback by using Computer System Usability Questionnaire (CSUQ), which measures satisfaction and consumer usability.

Keywords: Graduate Entrepreneur, Data Warehouse, Dimension Modeling, Business Intelligence, Analytical Report

INTRODUCTION

Cooperative and Entrepreneur Development Institute (CEDI) is a reference point for all aspects of entrepreneurship and cooperative development in Universiti Utara Malaysia (UUM). CEDI mission is to become a center to support the government's proactive and effective in their development and cooperation through innovative programs and creative. Furthermore, CEDI was also involved with the development of cooperatives as well as the need to generate revenue to the university. CEDI management needs a good strategic planning and decision making tools to archive their mission. Right now, CEDI doesn't have any analytical tools to monitor the channel of management, analysis, and monitoring the entrepreneur activities. Without analytical reports, it will be exhausted and difficult to manage a team to have a right picture about fundamental levels of information with the huge number of the operational database. The operational database lacks of effective organization, sorting of objective analysis, which is a very difficult use it to make a decision. The main problem for operational database that has not been able to meet the requirements of the manager that need an intelligent analysis tool (Tong et al., 2008). Turban et al., (2011) mentioned, the collection of data and the estimation of future data are among the most difficult step in the analysis for strategic information. Therefore, the management required concise, dependable information

about current operations, trends and changes in their organization. DW model is one of the BI technologies to extract, summarized, cleansing and transform data from various sources for developing the analytical report.

BACKGROUND

Business intelligence is a method of storing and presenting key enterprise data for the management easily can get the strategic and timely information. The process of BI is based on the transformation of data to information, then to decisions, and finally to actions (Turban et al., (2011). This technology collects the meaningful data from various sources in the given time and analyzes the data into meaningful and useful information by using data warehouse (DW) tools (Lida et al., 2007). One of the main functions of BI technology is the analytical report, which helps the management to take the right decisions in the organization. CEDI, UUM has a responsible to manage a graduate entrepreneur become an excellent business venture. An entrepreneur is the person who organizes, operates, and assumes the risk for a business venture. Furthermore, graduate entrepreneur refers to the university students or graduate students involved in a business venture. CEDI creates million bytes of data about all aspects of their business such as graduate profiles, business activities, course managements, and graduate entrepreneur funding. But for the most part, the data is locked up in the manual or computer system and exceedingly difficult to get. DW technology can help CEDI management to acquire meaningful information for CEDI management manages their activities and makes a good decision making. Therefore, CEDI management needs a system to manage graduate entrepreneur information for facilitating their management to make a decision making.

DATA WAREHOUSE MODEL

Inmon (2002) has defined DW as a database containing a subject oriented, integrated, time variant and non-volatile information used to support the decision making process. DW is a central managed and integrated database containing data from the operational sources in an organization. It may gather manual inputs from users determining criteria and parameters for grouping or classifying records. That database contains structured data for query analysis and can be accessed by users. The data warehouse can be created or updated at any time, with minimum disruption to operational systems. It is ensured by a strategy implemented in an ETL process. Data warehouse is a dedicated database which contains detailed, stable, non-volatile and consistent data, which can be analyzed in the time variant. Figure 1 below illustrates the software technologies and tools that are typically present or needed in the infrastructure of an end-to-end data warehousing solution. It also illustrates how the data flows from the sources to the targets in the process of creating and maintaining the data warehouse. DW repositories are available in different BI tools such as reporting service, dashboard, mashups, OLAP analysis, and data mining. The ETL tools are needed to automate the initial and periodic tasks of consolidating and summarizing data from the different data into the warehousing databases.

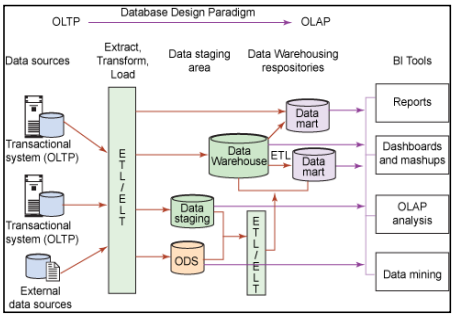


Figure 1. Overview of a typical Data Warehousing Infrastructure (IBM, 2009)

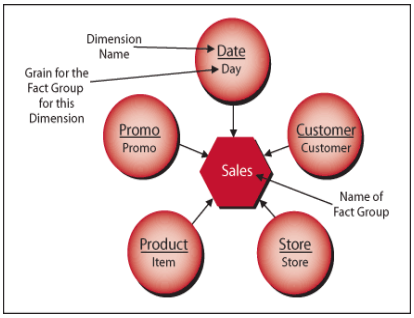


Figure 2. Fact and Dimension Table (Laura, 2003)

Dimensional Modeling is a design concept in DW for the designer to build the DW design. In a DW design model, all the data is stored in two types of tables call Facts table and Dimension table. Fact table contains the fact's measurements of the business, and the dimension table contains the context of measurement. Figure 2 shows the example of Dimension Modeling design which is containing the fact and dimension table. Each dimension that applies is included in the diagram and the specific grain is noted for each dimension. For DW requirement process, Shahbani and Norshuhada (2009) proposed ReCODS Model architecture is a way of representing the overall structure of the requirement process in DW for developing BI applications. Figure 3 shows the ReCODS architecture, which consists of a set of task component and actors involved for BI application development. This architecture is a guideline for the DW developer to gather a requirement for BI application, especially in the graduate entrepreneur subject area.

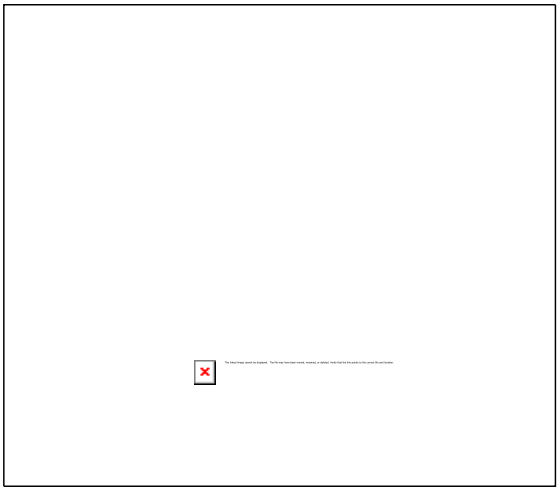


Figure 3. ReCODS Model Architecture for BI Requirements (Shahbani & Shuhada, 2009)

GEAR PROTOTYPE DESIGN AND DEVELOPMENT USING DW MODEL

This paper described how to design and develop Graduate Entrepreneur Analytical Reports called GEAR by using a DW model in CEDI organization. The task is started with

requirement gathering and analysis focused in developing CEDI analytical report. Table 1 shows the result of report requirements for GEAR prototype.

Table 1. Analytical Reports Requirement

No	Requirements	Priority
1	The system user needs **to determine the** BUSINESS PROFIT (RM) **categorized by business type and business category accordingly to time dimensions.**	High
2	The system user needs **to determine the** BUSINESS PROFIT (RM) **categorized by race, genders and states accordingly to time dimensions.**	High
3	The system user needs **to determine the** PERCENTAGE PROFIT (%) **categorized by business type and business category accordingly to time dimensions.**	Medium
4	The system user needs **to determine the** PERCENTAGE PROFIT (%) **categorized by race, genders and states accordingly to time dimensions.**	Medium
5	The system user needs **to determine the** TOTAL ENTREPRENEURS **categorized by business type and business category accordingly to time dimensions.**	High
6	The system user needs **to determine the** TOTAL ENTREPRENEURS **categorized by race, genders and states accordingly to time dimensions.**	High
7	The system user needs **to determine the** ENTREPRENEURS PERCENTAGE (%) **categorized by business type and business category accordingly to time dimensions.**	Medium
8	The system user needs **to determine the** ENTREPRENEURS PERCENTAGE (%) **categorized by race, genders and states accordingly to time dimensions.**	Medium
9	The system user needs to determine **TOTAL NUMBER** of Graduate Entrepreneur Status (Active, Non-Active and KIV)	High
10	The system user needs to determine **TOTAL NUMBER** of Graduate Entrepreneur Type (Siswaniaga and Graduate Entrepreneur)	High

CEDI management requires multiple data sources to build an analytical report. However, the data are not integrated and located in different locations. GEAR, using DW model for developing analytical reports consists of data sources, integration services, DW layer, analysis services, and presentation layer. The ETL tools such as SQL Server Integration Service (SSIS) was used to integrating, cleansing, aggregate, and summarize the data. This process involves to extract, transfer and loading the data from several data sources to DW. Dimensional model is used to design GEAR DW based on a Star Schema which is consisting of dimension and fact tables. The fact table contains business facts, measures and surrogate keys, which are referring to primary keys in the dimension tables. Dimension tables hold descriptive data that reflects the dimensions, or attributes, of a business domain in entrepreneur profile such as a business type, business category, gender, state, race, and time dimensions. With the large number of the reports' requirements, the Online Analytical Processing (OLAP) was appeared to provide CEDI management with deeper understanding and knowledge about many aspects of their organization data through fast, consistent, interactive access to a wide variety of possible view of the data. Figure 4 shows the star schema and OLAP of a data warehouse model for GEAR prototype.

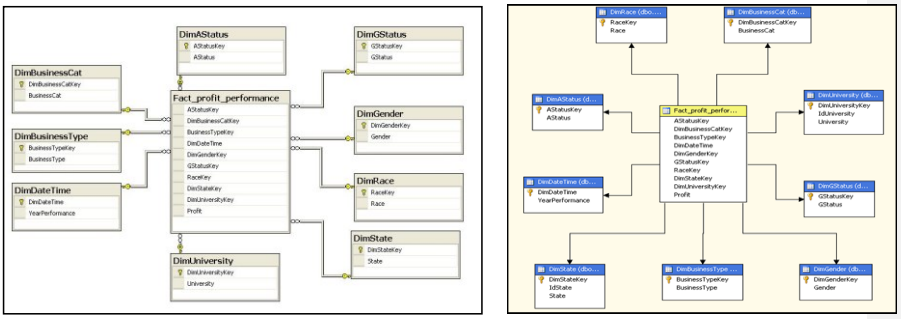


Figure 4. Star Schema and OLAP for GEAR

SQL Server Analysis Services (SSAS) was used to create the GEAR OLAP cube. OLAP cube is defined as the capability of manipulating and analyzing data from multiple perspectives due to some limitations of relational databases (Mundy et al., 2011). For a presentation layer, SQL Server Reporting Services (SSRS) was used to create GEAR analytical reports. SSRS is a server-based reporting platform that provides comprehensive reporting functionality for a variety of data sources. It used to determine the data set, type of chart for each report and create flexible analytical reports. Figure 5 shows the examples of GEAR analytical reports and presenting in the web based application.

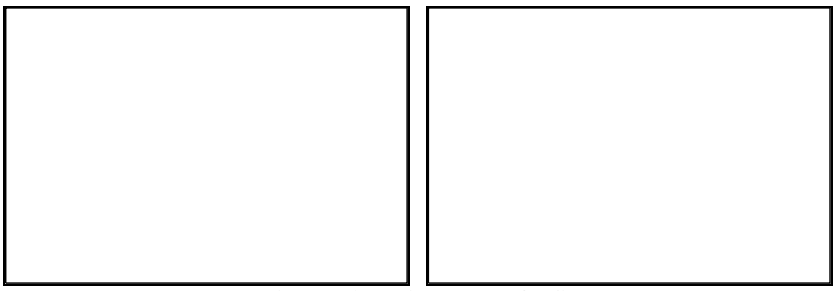


Figure 5. Analytical Reports for CEDI

The process to develop CEDI analytical reports started with identifying data sources, ETL process, build DW and OLAP storage, create report services and present the information. Figure 6 below illustrates the process to develop analytical reports in CEDI. GEAR assisted CEDI management to make better decision making and provide more understanding about the graduate entrepreneur profile. The important task in GEAR is to integrate data sources from multiple sources and transform to DW model, which is, enable to present an analytical report from many dimensions.

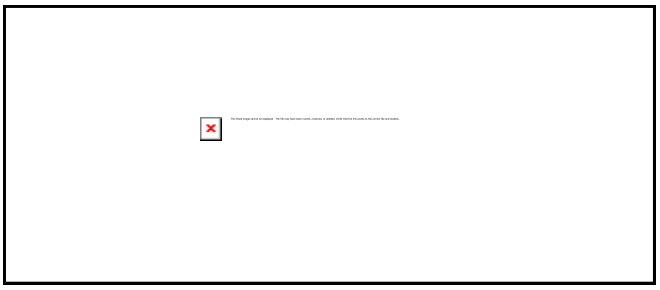
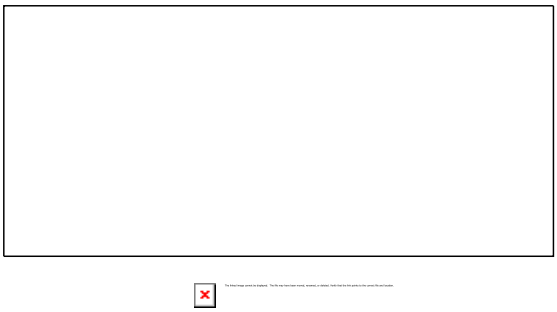


Figure 6. The process to develop GEAR for Analytical Reports

EVALUATION

GEAR prototype has been tested through the system user feedback by using Computer System Usability Questionnaire (CSUQ), which measures satisfaction and system usability. The questionnaire is adopted from Lewis (1995), contains of 19 questions and 7 degrees of likert scale (1-strongly disagree – 7-strongly agree). Descriptive mean statistics for GEAR evaluation result shows in Table 2.

Table 2. Descriptive Mean Statistics



CONCLUSION

In conclusion, DW model is a solution for CEDI management to build an analytical report for their organization. In graduate entrepreneur subject area, the information is concerning about graduate profile, business type, business performance, seminars, funding, and business transaction history. The CEDI operational data is integrated from various data sources and transform into analytical data storage to become a quality and meaningful information. The raw data in the operational system is clean, aggregate and summarize by using ETL process. Then, the data is the transfer to the DW and convert to the OLAP cube. Finally, CEDI management can access a strategic and analytical report based on report requirements without referring to the operational system. In additional, graduate entrepreneur analytical reports developed in CEDI are about entrepreneur profile, business profile and business performance. The reports are presenting in periodical time, using an analytical format and can be select by numerous dimensions. This paper shows the process how to design and develop analytical reports by using DW and BI applications in entrepreneur subject area. This process also can be a guideline to develop other analytical reports in a different domain. DW is an appropriate and excellent technology to develop analytical reports for the management in the organizations. The case study in CEDI, UUM shows that by using DW model to develop analytical reports is satisfactory for the users and useful for their management.

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INTELLIGENT PROFILE ANALYSIS GRADUATE ENTREPRENEUR (iPAGE) SYSTEM USING BUSINESS INTELLIGENCE TECHNOLOGY

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ABSTRACT. The increase use of information in Malaysia Ministry of Higher Education (MOHE) is resulted from the process of huge and complex data in several stages and at different locations. This situation leads to the difficulties of data management and problematic usage for decision making. Business Intelligence (BI), which is, the process of collecting, analyzing, and transforming data using Data Warehouse (DW) is seen as one of the growing approaches to provide meaningful information. The MOHE is responsible for managing various activities to promote the graduate entrepreneurs to venture into the business and ensure the country has many successful entrepreneurs. Therefore, systematic and accurate information needs to be available for planning, implementation, and monitoring entrepreneurs' performances. This paper proposes the modeling and designing of the graduate entrepreneur profile application called Intelligent Profile Analysis Graduate Entrepreneur (iPAGE) using BI technologies and supporting by a DW approach. Two main methodologies were used namely: Requirements Centric Operational Data Store (ReCODS) and Rapid Application Development (RAD) to develop this system. The iPAGE system was validated and evaluated by iPAGE users and DW experts. It is used to be a guideline for the development of an entrepreneur information system in the future.

Keywords: Graduate Entrepreneur, Business Intelligence, Data Warehouse, Operational Data Store, Rapid Application Development

INTRODUCTION

Today's Ministry of Higher Education (MOHE) business environment requires quality information to evaluate the performance of the ministry, understand the needs of customers, competitors and identify the ability to make decisions within the organization. The use of information technology is seen as advantages for MOHE to manage the information by developing various application systems to support the operation of the business. Thus, more and more application systems have been developed to lead MOHE to manage large amounts of data and the wealth of information in organizations. In addition, the data is processed in the current application system consists of several stages, various applications and placed in different departments. This situation will lead management difficulty and problematic to acquire accurate information for making decisions within the organization (Mohanty, 2006; Rainer et al., 2007). One of the crucial information is student entrepreneurs in Institution of Higher Learning (IHL).

The MOHE has set a target to make the students of the Institution of Higher Learning (IHL) to be excellent in academic and become a successful and knowledgeable entrepreneur after graduation. It is important for entrepreneurs to compete where they have the knowledge

to plan and manage the business well to face the business world that increasingly complex and competitive. Consequently, MOHE has set up entrepreneurial units, committees, councils and cooperation between the universities to conduct entrepreneurial culture programs such as Graduate Entrepreneurship Program (GEP) and the Student in Free Enterprise (SIFE). Currently, the MOHE did not have complete information for the analysis of entrepreneurial profiles that determines the success or failure of the entrepreneur programs. In addition, the MOHE must monitor entrepreneurial units in more than 20 universities that have different organizational structure, scope and entrepreneurship programs. In Universiti Utara Malaysia (UUM), this unit is Cooperative and Entrepreneurship Development Institute (CEDI). Therefore, the objective of this paper is to present the development of the Intelligent Profile Analysis Graduate Entrepreneur (iPAGE) system by using BI approach.

RELATED LITERATURE

The study involved a number of theories related to information processing in organizations such as Organization Information Processing Theory (OIPT) and A Systems Theory of Business Intelligence. These theories were used as the basis of this study to understand the relationship between an organization, information processing activities and the importance of information in an organization. Based on these theories, the research is conducted and includes all the entities that exist in an environment of resource information systems in an organization, regardless the internal or external sources of data. Importantly, understand the environmental conditions and methods for connecting these system entities need to be considered to ensure the developed system can run smoothly and achieve the organizational goals. ODS, DW and BI technology is innovation that resulted in a complex process in which information technology can be contributed to the OIPT for information creation and dissemination within the organization.

Business Intelligence

BI is an approach used by organizations today to get a better quality and strategic of information to predict the future trend. Gartner (2010) predicts by 2012 more than 35 percent of 5,000 large companies fail to make the right decisions related to business and marketing due to insufficient information. Additionally, in the same year, 40 percent of the overall information technology budget will be invested in BI applications to obtain accurate business information. There are many studies discussed the implementation of BI applications in the organization. In the health sector, BI is used to integrate the objectives of the organization with information technology as a component of an integrated management model in health care. Generally, the coordination between business and information strategy in a banking sector is to help the banks more competitive. Moreover, BI projects are implemented in the areas of utilities such as electricity, gas and water supply.

Operational Data Store (ODS)

Inmon (1999) defines the ODS as "an architectural construct that is subject oriented, integrated, volatile, current valued, and contains only corporate detailed data". In different angle of system development, Baragoin et al. (2001) define as "an environment where data from a different operational database is integrated." Many researchers have included ODS in the operational data integration to provide integrated information to the user community within the organization. Kimball and Ross (2002) also said the ODS is a data component that can be positioned along the DW system development. The approach that combines the ODS and DW technology have successfully provided a BI environment to support strategic and tactical information within an organization. This research focused on the ODS approach in modeling and designing the BI system for graduate entrepreneurs in IHL.

Graduate Entrepreneurship

Graduate entrepreneur is an entrepreneur who plans, manage and develop individual business or group in the context of the entrepreneur university program. This entrepreneur refers to two categories: graduate entrepreneur and *Siswaniaga* entrepreneur. *Siswaniaga* entrepreneurs are university students who are studying in university and conducting business under the monitoring and supervision of the university entrepreneur units. The encouragement of a graduate entrepreneur aims to develop knowledgeable entrepreneurs who can support economy as well as business culture among graduate students. Among the programs organized by the government are the Graduate Entrepreneur Scheme (GES), the Graduate Entrepreneurs Fund (GEF), Student Entrepreneur Training (SET), Student Entrepreneurial Program (SEP), and Graduate Development Program (GDP). SEP is supported by the University Entrepreneur Unit and University Student Entrepreneurship Council Malaysia (MAKMUM), which was established to coordinate and monitor the implementation of the Small Medium Business Enterprise (SMEs) at the university level.

ODS MODEL FOR iPAGE

iPAGE application development is focused on the use of the ODS data model in BI application development approach. ODS data model capable of integrating data from heterogeneous data sources and structure that can facilitate the construction of the operational, tactical and analytical reporting. Thus, analysis of requirements and development of iPAGE applications require a suitable model to ensure the objectives of BI applications are achieved. There are two main methods used: Requirement Centric Operational Data Store (ReCODS) to determine the needs of iPAGE applications and Rapid Application Development (RAD) that used to design and develop iPAGE system.

ReCODS Model

ReCODS model that focuses on the analysis requirements of BI is using the ODS data model to develop this iPAGE application. In this model, the requirement analysis was divided into two phases: Organization Level Requirements and ODS Level Requirements (Shahbani & Norshuhada, 2009). In each phase, the activity was involving requirement gathering process and analyzing information. The organizational level requirements' phase begins by defining the business domain and ends with the requirements' specification of the organization. Meanwhile, the ODS level requirement's phases were determining which of the subject areas and producing the ODS requirement's specification. For requirement gathering, three orientation approaches were used: business-oriented, data-oriented and consumer-oriented. These approaches are presented in ReCODS model as shown in Figure 1.

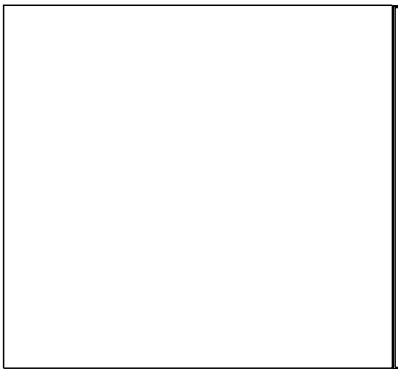

Figure 12. ReCODS Model

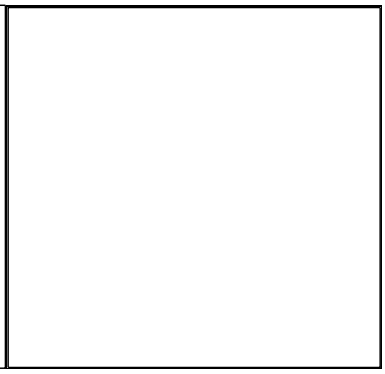

Figure 2. ReCODS Architecture

In ODS requirement phase, the collection and analysis requirements were focused on the subject areas that have been set from the previous phase. This phase involves five steps: determining the subject areas, requirement gathering of subject areas, the analysis of subject areas, determine the ODS operation, and specify the ODS requirements' specifications. In this phase, requirement gathering and analyzing are more focused to develop iPAGE applications.

ReCODS Architecture

ReCODS architecture describes the process of getting a whole requirement to develop iPAGE applications that focused on the structure of the ODS data as illustrated in Figure 2. This architecture begins by determining the community involved in the iPAGE applications, such as the MOHE, CEDI, MAKMUM, entrepreneurs, and developers. These communities involved in the application development are interacted by manual or online communications to discuss about the application requirements. In addition, this architecture also is connected to the existing applications to be integrated into the structure of iPAGE data. Furthermore, the functions of extract, transform, load (ETL) begins with data collection from various sources, interpreting and entering data (load) into the ODS component. The updating of data sources from transaction systems should be coordinated with the data in the iPAGE application to ensure the information is accurate within the given time variant. Clearly, the architecture focuses on the presentation of information in the form of a pyramid of information, which is classified the information into an operational, tactical and analytical report.

RAD Methodology

The methodology used to develop iPAGE application is RAD that utilized to support the development of two main applications of iPAGE: Web Portal Entrepreneur Profile and Entrepreneur Profiles System. RAD chosen to develop iPAGE because this methodology provides a systematic plan for system development life cycle, which combines two techniques of evolutionary prototyping and development phases. These techniques are combined with ReCODS model to support the need BI components as depicted in Figure 3.

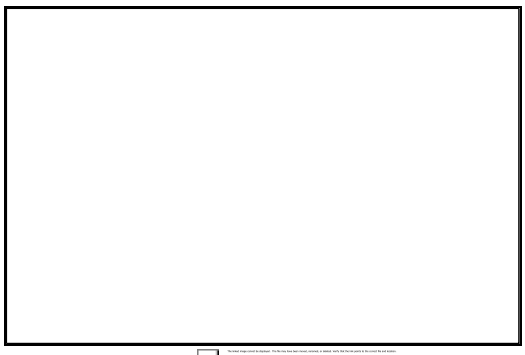

Figure 3. RAD Methology with ReCODS Model

In summary, the development of graduate entrepreneur's BI system, the ReCODS model that specializes in BI development methodology is combined with RAD system that known in agile software development methodology. This research was using the advantages of RAD and applicability of ReCODS model for planning, modeling, designing, developing, testing, and implementing the iPAGE applications successfully.

iPAGE SYSTEM DEVELOPMENT

The development of iPAGE prototype is the main result of this study, which based on the ReCODS model. The prototype is based on *vertical prototype* approach that provides the

functions for inserting and storing data in a database, and displays the data through the screen inquiries and reports. iPAGE has two main system components that focus on different functions and roles to users, namely: Web Entrepreneur Profile that contains the functions for managing and accessing entrepreneurs profiles, and Portal Entrepreneur Profile, which act as dispersal agents for entrepreneur information to entrepreneurs, universities, MOHE, and public.

Web Entrepreneur Profile

The design of web entrepreneur profiles is conducted in steps: requirements analysis, process design, database design, interface design, and reports or queries design. In requirements analysis, the requirements are identified as entrepreneur profile, academic profile, fund profile, business profile, and entrepreneurship program. In short, part of the design process is shown in the Use Case diagram model shown in Figure 4.

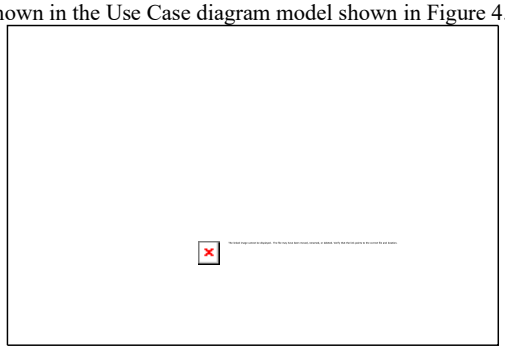

Figure 4. Main Use Case for Entrepreneur Profile

Process flow for each use case is represented by the activity diagram. The activity diagram for inserting and verifying the entrepreneur profiles data begin by reviewing the data received from the entrepreneurs of each university. This process is continued for all the requirements specified. The database design strategy is based on attributes that exist for every entity from the requirements analysis and represented by class diagram model.

Portal Entrepreneur Profile

This application serves to disseminate entrepreneur's information more easily and understood by users. The information presented is based on an entrepreneur raw data that processed and analyzed entrepreneurs through BI functionalities. The information is accessed through the portal personalization features and the latest security system. Importantly, the raw data is provided in *dimension modeling*, which focused on fact, dimension, and measure as shown in Figure 5. To allow data sources available for the DW entrepreneurs, an important process ETL is implemented. ETL process that involves drawing, cleaning, merging, conversion, and other activities conducted accordance to the design of ETL processes that determined by the developer. The ETL processes design is defined by a Logical Data Map (LDM) method.

The types of reports in the portal can be classified as a simple, detail, statistics, and analysis. These reports are generated from the data warehouse architecture by BI functionalities. The examples of report design are shown in Figure 6. Formative testing was conducted to ensure the iPAGE function is working properly, particularly in terms of usability, easy to use and meet the needs of the users. In addition, the assessment for iPAGE in the BI environment is also made by involving iPAGE users, DW experts and entrepreneurship subject domain expert.

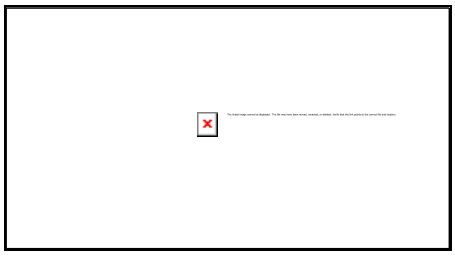

Figure 5. Dimension Model for Entrepreneur Profile

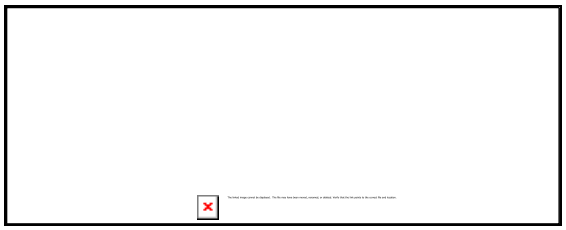

Figure 6. Example of Graduate Entrepreneur Business Performance Report

CONCLUSION

The development of web entrepreneur profile and web entrepreneur portal has been successfully implemented and used to be implemented in a real environment. Both were incorporated in iPAGE system that complements the concept of operational system and BI in an information system. Information provided may be directly accessible by users through the various stages of portal facilities. Testing and evaluation system has been shown that iPAGE is very suitable for applications in a BI environment that is based on data warehousing technology. However, user feedback is important to ensure conformity with the requirements analysis and reporting of the information required. This has been proven in iPAGE validation and evaluation.

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A FRACTIONAL NUMBER BASED LABELING SCHEME FOR DYNAMIC XML UPDATING

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ABSTRACT. Recently, XML query processing based on labeling schemes has been proposed. Based on labeling schemes, the structural relationship between XML nodes can be determined quickly without the need of accessing the XML document. However, labeling schemes have to re-label the pre-existing nodes or re-calculate the label values when a new node is inserted into the XML document during the update process. In this paper, we propose a novel labeling scheme based on fractional numbers. The key feature of fractional numbers is that infinite number of fractional numbers can be inserted between any two unequal fractional numbers. Therefore, the problem of re-labeling the pre-existing nodes during the XML updating can be solved if the XML nodes are label by the fractional numbers.

Keywords: Dynamic Labeling Scheme, Fractional Number, XML Updating

INTRODUCTION

Recently, XML as a de facto standard has obtained a popularity for representation and exchanging the data over the Internet (Bray, Paoli, Sperberg-McQueen, Maler, & Yergeau, 2008). With the growing popularity of XML, a large range of XML documents appeared on the web. In order to manage these documents, it is required to store and query the XML data efficiently. Several query languages like XPath (Clark & DeRose, 1999) and XQuery (Boag et al., 2007) are designed to process XML data. These query languages are based on regular path expressions to query XML data. The path expression locates nodes within the XML tree. In order to query XML data efficiently, the structural relationships between nodes have to determine quickly without the need of accessing the XML documents. Several researches have been proposed to label the XML tree nodes in such a way that the structural relationships between any two nodes can be determined directly (Amagasa, Yoshikawa, & Uemura, 2003; C. Li & Ling, 2005; Q. Li & Moon, 2001; O'Neil et al., 2004; Silberstein, He, Yi, & Yang, 2005; Tatarinov et al., 2002; Wu, Lee, & Hsu, 2004; Zhang, Naughton, DeWitt, Luo, & Lohman, 2001).

In general, labeling schemes can be categorized into two groups: static labeling schemes (Q. Li & Moon, 2001; Tatarinov et al., 2002; Zhang, Naughton, DeWitt, Luo, & Lohman, 2001) and dynamic labeling schemes (Amagasa, Yoshikawa, & Uemura, 2003; C. Li & Ling, 2005; O'Neil et al., 2004; Silberstein, He, Yi, & Yang, 2005; Wu, Lee, & Hsu, 2004). Static labeling schemes are adequate where XML documents are not updated while dynamic labeling schemes are more adequate where XML documents can be updated. The advantage of using static labeling schemes is that they need small memory space. However, inserting a new node to the XML tree may require re-labeling a large number of pre-existing nodes. In

dynamic labeling schemes, re-labeling the pre-existing nodes is avoided or at least smaller than static labeling schemes but the length of labels increases dramatically when new nodes are inserted to XML tree.

In this paper, we propose a novel XML labeling scheme based on fractional numbers. Our proposed labeling scheme is able to remove the need of re-labeling during XML updating process.

FRACTIONAL NUMBER BASED LABELING SCHEME

In order to easily understand the fractional number generation algorithm illustrated in Figure 1, we first give an example to illustrate how fractional numbers are assigned to a set of ordinal decimal numbers. Table 1 shows fractional numbers assigned to 20 ordinal decimal numbers. We choose 20 as an example but our proposed method can assign fractional numbers for any set of ordinal decimal numbers.

Table 1. Fractional Numbers assigned to 20 Ordinal Decimal Numbers

Decimal Number	Fractional Number	Decimal Number	Fractional Number	Decimal Number	Fractional Number	Decimal Number	Fractional Number
1	1/32	6	1/4	11	1/2	16	¾
2	1/16	7	9/32	12	17/32	17	25/32
3	1/8	8	5/16	13	9/16	18	13/16
4	5/32	9	3/8	14	5/8	19	7/8
5	3/16	10	7/16	15	11/16	20	15/16

The following steps illustrates the details how to assign fractional numbers to a set of ordinal decimal numbers.

Step 1: In order to assign the fractional numbers of 20 ordinal decimal numbers, we assume there is one more number before 1 which is 0 and one more number after 20 which is 21.

Step 2: We firstly assign the middle fractional number between (0, 1) to the middle decimal number between 0 and 21. The middle fractional number between (0, 1) is ½ where it is calculated with [(0 + 1) / 2] and the middle decimal number between 0 and 21 is 11 where it is calculated with 0 + [(21 - 0) / 2].

Step 3: Next, we calculate the middle decimal number between 0 and 11, and between 11 and 21. The middle decimal number between 0 and 11 is 6 (0 + [(11 - 0) / 2]) and the middle decimal number between 11 and 21 is 16 (11 + [(21 - 11) / 2].

Step 4: Next, we assign the middle fractional number between (0, ½) which is ¼ to 6 and the middle fractional number between (½, 1) which is ¾ to 16.

Step 5: Next, we assign the middle fractional number between (0, ¼) to the middle decimal number between 0 and 6, the middle fractional number between (¼, ½) to the middle decimal number between 6 and 11, the middle fractional number between (½, ¾) to the middle decimal number between 11 and 16, and the middle fractional number between (¾, 1) to the middle decimal number between 16 and 21. In this way, fractional numbers can be assigned to a set of ordinal decimal numbers.

The algorithm illustrated in Figure 1 is proposed to generate the fractional numbers for a set of ordinal decimal numbers between 1 and *N*.

FNG-Algorithm (*N*)
Input: A Positive decimal Number *N*
Output: A set of fractional numbers for decimal numbers 1 to *N*

1. Suppose there is a number before the first number which is 0 and a number after the last number which is *N* + 1;
2. Define an array *fractionalNumberArray*1[0, *N* + 1] to store numerators and an array *fractionalNumberArray*2[0, *N* + 1] to store denominators;
   // the size of each array is *N* + 2 and initially the arrays are empty;

3. *fractionalNumberArray*1[0] = 0;
4. *fractionalNumberArray*2[0] = 1;
5. *fractionalNumberArray*1[*N* + 1] = 1;
6. *fractionalNumberArray*2[*N* + 1] = 1;
7. EBFN (*fractionalNumberArray*1, *fractionalNumberArray2*, 0, *N* + 1);
8. Discard the 0th and (*N* + 1)th elements of *fractionalNumberArray*1 and *fractionalNumberArray2;*

EBFN (*fractionalNumberArray*1, *fractionalNumberArray*2, *leftPosition*, *rightPosition*)
// EBNF is a recursive procedure;
middlePosition = *leftPosition* + **round((***rightPosition* - *leftPosition)* / 2);
if ((*leftPosition* + 1) < *rightPosition*) **then**
Begin
*fractionalNumberArray*1[*middlePosition*] = (*fractionalNumberArray*1[*leftPosition*] * *fractionalNumberArray*2[*rightPosition*]) + (*fractionalNumberArray*1[*rightPosition*] * *fractionalNumberArray*2[*leftPosition*]);
*fractionalNumberArray*2[*middlePosition*] = 2 * (*fractionalNumberArray*2[*leftPosition*] * *fractionalNumberArray*2[*rightPosition*]);
//gcd return greatest common denominator;
gcdValue = gcd (*fractionalNumberArray*1[*middlePosition*], *fractionalNumberArray*2[*middlePosition*]);
*fractionalNumberArray*1[*middlePosition*] /= gcdValue;
*fractionalNumberArray*2[*middlePosition*] /= gcdValue;
EBFN (*fractionalNumberArray*1, *fractionalNumberArray*2, *leftPosition*, *middlePosition*);
EBFN (*fractionalNumberArray*1, *fractionalNumberArray*2, *middlePosition, rightPosition*);
End

Figure 1. Fractional Number Generation Algorithm

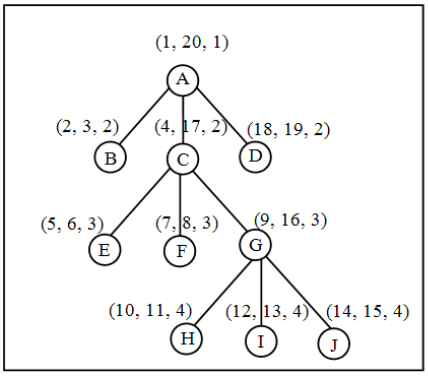

Figure 2. Region Number Labeling Scheme

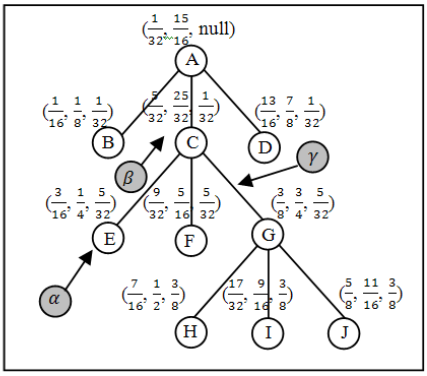

Figure 3. Fractional Number Labeling Scheme

Our proposed scheme which is based on fractional number is applied to the region number labeling scheme with the intention to avoid re-labeling the pre-existing nodes during XML data updating. Therefore, in this way, we are able to keep the order of XML nodes and determine the structural relationships between two arbitrary nodes.

As shown in Figure 2, the level value is added to each node label in order to determine the Parent-Child (P-C) and the sibling relationship between nodes in the region number labeling scheme. However, such information is sensitive in the dynamic XML environment because the level must be modified when a node is inserted into or deleted from the XML tree as a parent (an ancestor) node. Thus, in our proposed labeling scheme, the parent's start value is added to each node label instead of level value. The parent's start value needs more storage space than level value but it is not changed when internal nodes are inserted into or deleted from the XML tree. In addition, using the parent's start value instead of level value eliminates the comparison process of start and end values in order to determine the Parent-Child and the sibling relationships. Hence, the performance of XML query processing can be improved. An example of XML tree labeled by fractional number is illustrated in Figure 3.

When a leaf node or a sub-tree is deleted, re-labeling the pre-existing nodes is not required. In the case of internal node deletion, only parent's start values of its children must

be changed by its parent start value while start and end values for any nodes do not need to be modified. The problem of XML data updating is in insertion. In the following, we present the process of node insertion at different positions of the XML tree.

Generating an Inserted Fractional Number

The MakeNewFractionalNumber algorithm shown in Figure 4 generates a new fractional numbers between two pre-existing fractional numbers.

MakeNewFractionalNumber $(\frac{LFN1}{LFN2}, \frac{RFN1}{RFN2})$
Input: $\frac{LFN1}{LFN2} < \frac{RFN1}{RFN2}$
Output: $\frac{MFN1}{MFN2}$ such that $\frac{LFN1}{LFN2} < \frac{MFN1}{MFN2} < \frac{RFN1}{RFN2}$
Case 1: insert a fractional number before the first fractional number
1. $\frac{MFN1}{MFN2} = \frac{RFN1}{2 \times RFN2}$;
Case 2: insert a fractional number after the last fractional number
2. $\frac{MFN1}{MFN2} = \frac{LFN1+LFN2}{2 \times LFN2}$;
Case 2: insert a fractional number between two fractional numbers
3. $MFN1 = (LNF1 \times RNF2) + (LNF2 \times RNF1)$;
4. $MFN2 = 2 \times (LNF2 \times RNF2)$;
5. /*gcd returns Greatest Common Denominator*/
6. gcdValue = gcd(MNF1, MNF2);
7. $MNF1 = \frac{MNF1}{\text{gcdValue}}$;
8. $MNF2 = \frac{MNF2}{\text{gcdValue}}$;

Figure 4. MakeNewFractionalNumber Algorithm

The Process of Insertion

There are three kinds of insertions in XML tree according to the positions in which nodes should be inserted: insertion a node as a child of a leaf node, insertion a node as a sibling node, and insertion a node as a parent node. The algorithm illustrated in Figure 5 is devised to insert a node as a child of the leaf node *targetNode.*

$Algorithm\ InsertChildOf(\frac{start1_{targetNode}}{start2_{targetNode}}, \frac{end1_{targetNode}}{end2_{targetNode}}, \frac{parentStart1_{targetNode}}{parentStart2_{targetNode}})\{$
$\frac{start1_{new}}{start2_{new}} = MakeNewFractionalNumber\left(\frac{start1_{targetNode}}{start2_{targetNode}}, \frac{end1_{targetNode}}{end2_{targetNode}}\right);$
$\frac{end1_{new}}{end2_{new}} = MakeNewFractionalNumber\left(\frac{start1_{new}}{start2_{new}}, \frac{end1_{targetNode}}{end2_{targetNode}}\right);$
$\frac{parentStart1_{new}}{parentStart2_{new}} = \frac{start1_{targetNode}}{start2_{targetNode}};$
$Insert\ a\ new\ node\ as\ the\ child\ of\ targetNode\ with\ label\ (\frac{start1_{new}}{start2_{new}}, \frac{end1_{new}}{end2_{new}}, \frac{parentStart1_{new}}{parentStart2_{new}})$
$\}$

Figure 5. InsertChildOf Algorithm

In our propose scheme, we assigned to each node label its parent's start value instead of level value. Therefore, the following rules should be satisfied for the new inserted node:

- $\frac{start1_{targetNode}}{start2_{targetNode}} < \frac{start1_{new}}{start2_{new}} < \frac{end1_{new}}{end2_{new}} < \frac{end1_{targetNode}}{end2_{targetNode}}$.
- $\frac{parentStart1_{new}}{parentStart2_{new}} = \frac{start1_{targetNode}}{start2_{targetNode}}$.

For example, in Figure 3, node α is to be inserted as a child of the leaf node *E*. Therefore, we have:

- $\frac{start1_{\alpha}}{start2_{\alpha}} = MakeNewFractionalNumber\left(\frac{3}{16}, \frac{1}{4}\right) = \frac{7}{32}$
- $\frac{end1_{\alpha}}{end2_{\alpha}} = MakeNewFractionalNumber\left(\frac{7}{32}, \frac{1}{4}\right) = \frac{15}{64}$
- $\frac{parentStart1_{\alpha}}{parentStart2_{\alpha}} = \frac{3}{16}$

The algorithm illustrated in Figure 6 is proposed to insert a new node as the next sibling of the *targetNode*.

$Algorithm\ InsertSiblingAfter(\frac{start1_{targetNode}}{start2_{targetNode}}, \frac{end1_{targetNode}}{end2_{targetNode}}, \frac{parentStart1_{targetNode}}{parentStart2_{targetNode}})\{$
$\frac{next1}{next2} = \frac{start1}{start2}$ *of the nearest following − sibling of targetNode;*
if there is not any following − sibling of targetNode then
$\frac{next1}{next2} = \frac{end1}{end2}$ *of targetNode's parent;*
$\frac{start1_{new}}{start2_{new}} = MakeNewFractionalNumber\left(\frac{end1_{targetNode}}{end2_{targetNode}}, \frac{next1}{next2}\right);$
$\frac{end1_{new}}{end2_{new}} = MakeNewFractionalNumber\left(\frac{start1_{new}}{start2_{new}}, \frac{next1}{next2}\right);$
$\frac{parentStart1_{new}}{parentStart2_{new}} = \frac{parentStart1_{targetNode}}{parentStart2_{targetNode}};$
Insert a new node as the sibling of targetNode with label $(\frac{start1_{new}}{start2_{new}}, \frac{end1_{new}}{end2_{new}}, \frac{parentStart1_{new}}{parentStart2_{new}})$
}

Figure 6. InsertSiblingAfter Algorithm

For example, in Figure 3, node β is to be inserted after node *B*. Therefore, we have:

- $\frac{start1_{\beta}}{start2_{\beta}} = MakeNewFractionalNumber\left(\frac{1}{8}, \frac{5}{32}\right) = \frac{9}{64}$
- $\frac{end1_{\beta}}{end2_{\beta}} = MakeNewFractionalNumber\left(\frac{9}{64}, \frac{5}{32}\right) = \frac{19}{128}$
- $\frac{parentStart1_{\beta}}{parentStart2_{\beta}} = \frac{1}{32}$

The process of inserting a new node before a node is similar to the process of inserting a new node after. Therefore, the explanation on this process is omitted here.

Insertion a node as a child node or sibling node has been supported by other dynamic labeling schemes but the advantage of our proposed scheme is in the case of parent node insertion. Our proposed scheme is able to handle parent node insertion without re-labeling the pre-existing nodes. The algorithm illustrated in Figure 7 is designed to insert a new node as a parent of *targetNode*. The position of new parent node of *targetNode* (*new* node) is between the previous and next sibling nodes of *targetNode*. Therefore, start and end values of *new* node are between the end value of the previous sibling node of *targetNode* and the start value of the next sibling node of *targetNode.* In case that the preceding-sibling (the following-sibling) of the *targetNode* does not exist, the start (end) value of parent's *targetNode* can be used.

$$Algorithm\ InsertParentOf\left(\frac{start1_{targetNode}}{start2_{targetNode}}, \frac{end1_{targetNode}}{end2_{targetNode}}, \frac{parentStart1_{targetNode}}{parentStart2_{targetNode}}\right)\{$$
$$\frac{previous1}{previous2} = \frac{end1}{end2}\ of\ the\ nearest\ preceding - sibling\ of\ targetNode;$$
$$if\ there\ is\ not\ any\ preceding - sibling\ of\ targetNode\ then$$
$$\frac{previous1}{previous2} = \frac{start1}{start2}\ of\ parent's\ targetNode;$$
$$\frac{next1}{next2} = \frac{start1}{start2}\ of\ the\ nearest\ following - sibling\ of\ targetNode;$$
$$if\ there\ is\ not\ any\ following - sibling\ of\ targetNode\ then$$
$$\frac{next1}{next2} = \frac{end1}{end2}\ of\ parent's\ targetNode;$$
$$\frac{start1_{new}}{start2_{new}} = MakeNewFractionalNumber\left(\frac{previous1}{previous2}, \frac{start1_{targetNode}}{start2_{targetNode}}\right);$$
$$\frac{end1_{new}}{end2_{new}} = MakeNewFractionalNumber\left(\frac{end1_{targetNode}}{end2_{targetNode}}, \frac{next1}{next2}\right);$$
$$\frac{parentStart1_{new}}{parentStart2_{new}} = \frac{parentStart1_{targetNode}}{parentStart2_{targetNode}};$$
$$\frac{parentStart1_{targetNode}}{parentStart2_{targetNode}} = \frac{start1_{new}}{start2_{new}};$$
$$Insert\ a\ new\ node\ as\ the\ parent\ of\ targetNode\ with\ label\ \left(\frac{start1_{new}}{start2_{new}}, \frac{end1_{new}}{end2_{new}}, \frac{parentStart1_{new}}{parentStart2_{new}}\right);$$
$$\}$$

Figure 7. InsertParent Algorithm

For example, in Figure 3, node γ is to be inserted as the parent of node *G*. Therefore, we have:

- $\frac{start1_{\gamma}}{start2_{\gamma}} = MakeNewFractionalNumber\left(\frac{5}{16}, \frac{3}{8}\right) = \frac{11}{32}$
- $\frac{end1_{\gamma}}{end2_{\gamma}} = MakeNewFractionalNumber\left(\frac{3}{4}, \frac{25}{32}\right) = \frac{49}{64}$
- $\frac{parentStart1_{\gamma}}{parentStart2_{\gamma}} = \frac{5}{32}$

In the region number labeling scheme, level value is added into node label to find the Parent-Child relationship between two nodes. Therefore, after inserting a node as a parent (an ancestor) node, the level value of all the descendants should be updated. But, in our proposed scheme, parent's start value is kept instead of level value. Therefore, if a node is inserted as a parent (an ancestor) node, the parent's start values of all descendants are still unchanged except the parent's start value of the child of the inserted node. Consequently, our proposed scheme avoids the need of re-labeling for the three kinds of insertions as presented in this section.

CONCLUSION AND FUTURE WORKS

In this paper, we propose a novel XML tree labeling scheme based on fractional number. Our proposed scheme is able to avoid the need of re-labeling the pre-existing node in XML tree during the update process. When a node is inserted, the new fractional number is the middle value of the two neighbor fractional numbers. Therefore, it makes the updating process very easy. As a future study, we intend to evaluate our proposed scheme with different dynamic labeling schemes using different XML datasets.

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SKYLINE QUERIES OVER INCOMPLETE MULTIDIMENSIONAL DATABASE

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ABSTRACT In recent years, there has been much focus on skyline queries that incorporate and provide more flexible query operators that return data items which are dominating other data items in all attributes (dimensions). Several techniques for skyline have been proposed in the literature. Most of the existing skyline techniques aimed to find the skyline query results by supposing that the values of dimensions are always present for every data item. In this paper we aim to evaluate the skyline preference queries in which some dimension values are missing. We proposed an approach for answering preference queries in a database by utilizing the concept of skyline technique. The skyline set selected for a given query operation is then optimized so that the missing values are replaced with some approximate values that provide a skyline answer with complete data. This will significantly reduce the number of comparisons between data items. Beside that, the number of retrieved skyline data items is reduced and this guides the users to select the most appropriate data items from the several alternative complete skyline data items.

Keywords: skyline queries, flexible query operators

INTRODUCTION

The preference queries are significant and mostly used in various application domains, like multi-criteria decision making applications (Chee-Yong C., et al, 2006(a); Chee-Yong C., et al, 2006(b); Man L., Y., & Nikos M., 2007), where many criteria are involved in the query statement to select the most suitable answer that fit the user requirements. Another domain that applied the preference queries is the decision support system or recommender system, where these systems combine various interests to help users by recommend a strategic decision. Restaurant finder (Mohamed F. M., & Justin J. L., 2009) are typical example that show the importance of preference queries. Furthermore, E-commerce environment is also a significant area that involves preference queries. For example helping customer to make a trade off between the price, quality, and efficiency of the products to be purchased. Due to the importance of preference query results that obviously appeared in many database applications, a various number of preference evaluation techniques have been proposed in the literature (Stephan B., et al, 2001; Donald K., et al, 2002; Jan C., et al, 2003; IIaria B., et al, 2006; Man L. Y. & Nikos M., 2007).

One of the popular and most frequently used of preference query type is the skyline queries. Many approaches which applied the concept of skyline technique have been proposed (Stephan B., et al, 2001; Donald K., et al, 2002; Jan C., et al, 2003; IIaria B., et al, 2006; Man L. Y. & Nikos M., 2007). Most of the previous techniques assumed that all the values of attributes (dimensions) are present and the database state is complete (no missing values) for all data items of the database (Stephan B., et al 2001; Kian-Lee T., et al, 2001; Donald K., et

al, 2002; Jan C., et al, 2003; Jian P., et al, 2005; Parke G., et al, 2005; IIaria B., et al, 2006; Man L. Y. & Nikos M., 2007; Man L. Y. & Nikos M., 2009). However, this assumption is not always true particularly in the real world with large database and high number of dimensions (attributes) as some values may be missing. Further, the incompleteness of data introduces new challenges in the skyline queries. The missing values will influence negatively on the process of finding skyline data items leading to loss the transitivity property, cyclic dominance, and high overhead, due to exhaustive comparison between the data items to determine which data items are the skyline. Besides that, the skyline answers become insignificant in some cases as the size of skyline answers increased dramatically when the missing rate is high (Mohamed E. K., et al, 2008).

Another important issue is that the skyline data items are retrieved answers according to the current state of the database which is incomplete without imputing the missing values. In many cases users are more concern about the values in these missing dimensions, and the obtained skyline answers may not satisfy the users' demands. Therefore, an approach is needed to estimate these missing values in the skyline data items. These estimated values for the missing dimensions (attributes) in the skyline answers help in the process of identifying the skyline answers by further minimizing the size of the skyline answers. Most importantly, the estimated values help users to select the most suitable data items from several alternative skyline data items.

This paper presents an approach for retrieving skyline queries in incomplete database where some values of one or more dimensions do not exist in the database. Our approach utilizes the bitmap representation to divide the initial database into a set of distinct clusters in which every cluster stored the data items that have missing values at the same dimension(s). Thus, a significant number of unnecessary pairwise comparisons between data items would be avoided. Moreover, a set of groups is created for each cluster depending on the highest value in any of the dimensions of the data item. This process aims to reduce the number of comparisons in each cluster in retrieving the cluster skyline. To reduce the size of skyline answers and the number of comparisons between the selected cluster skyline of the whole database, a set of virtual skyline named *k-dom* is derived based on the common complete dimensions among the clusters and these virtual skylines are inserted at the top of every cluster.

Since the user may obtain a set of skyline data items which have more than one missing values for a given query operation, therefore a strategy to impute the missing values by replacing them with some plausible values in the skyline results is required. In this work, a strategy is proposed to estimate the missing values by employing the relationship between the dimensions (attributes) of the database and the current available values in the set of skyline results and later optimize these results to further reduce the size of the result by retrieving only the most relevant data items. We believe that this strategy can improve the performance of processing skyline queries in incomplete database system since prevents many unnecessary comparisons between data items, reduces the size of the skyline results, and provides complete answers to the user.

This paper is organized as follows. In the next section, the previous works related to this research are presented. Then, the basic definitions, and notations, which are used in the rest of the paper, are set out. The following section describes our proposed approach with some examples to clarify the approach. Conclusions and further research are presented in the final section.

RELATED WORKS

Many types and variations of skyline preference evaluation techniques of preference queries have been described in the database literature. Most of these skyline techniques aim to improve the search performance by terminating the process of searching the data items as

early as possible in obtaining the "best" answer that satisfies the conditions as indicated in the submitted query. In the following we present the most important types of preference queries that utilize skyline techniques in complete and incomplete databases.

The first work of skyline preference evaluation technique of query processing in the database field is proposed by Stephan B., et al. (2001). They have proposed two algorithms, namely: BNL (Block-Nested-Loop) and DC (Divide-and-Conquer). BNL produced the skyline data items by repeatedly read the set of data items, and when a data item *p* is read from the input; *p* is compared to the other items in the dataset. The second algorithm, DC, divides the dataset into two equivalent sets. Then, it finds the skyline sets and combines the output of the two skyline sets to further perform comparison to eliminate those data points which are dominated by the skyline data items.

Kian-Lee T., et al. (2001) presents two incremental algorithms (Bitmap and Index) to produce the skyline data items of the database. Donald K., et al. (2002) proposed an online full space skyline computation technique NN (Nearest Neighbor) to collect the skyline data items. Jan C., et al. (2003) proposed SFS (Sort-Filter-Skyline). SFS employed the concept of presorting on BNL Skyline technique (Stephan B., et al., 2001) in order to produce the skyline query data items in an efficient manner and well behaved in a relational setting.

Dimitris P., et al. (2003) proposed BBS (Branch-Bound-Skyline) method to find the set of skyline data items. BBS is aim to optimal the I/O costs. Parke G., et al. (2005) proposed an external algorithm which is called LESS (Linear Elimination Sort for Skyline) which is inspired from SFS (Jan C., et al., 2003). LESS works on non-indexed data and does not require any additional preprocessing steps. Furthermore, Ilaria B., et al. (2006) presents an algorithm named SaLSa (Sort and Limit Skyline algorithm) by exploiting the concept of SFS method to pre-sort the data points first and then selects a subset of dataset to examine the skyline data items.

However, in incomplete database systems, query processing is challenging as in many cases a significant part of query answer may be neglected from the final answer due to the missing values in some dimensions (attributes). In addition, preference queries have not received much attention in incomplete database applications in which to evaluate the query, exhausted comparison needs to be performed in order to determine the best data items in the database that meet the query conditions. Preference queries in incomplete database are fundamentally different than the conventional preference queries in complete database because the transitivity property of preference techniques is no longer hold.

To the best of our knowledge the only work that tackled the issue of skyline queries in incomplete database is contributed by Mohamed E. K., et al., (2008). Mohamed E. K., et al., (2008) proposed *Iskyline* algorithm that handles the skyline queries in incomplete relational database by dividing the initial database into distinct nodes depending on the missing dimensions and then applying the conventional skyline technique to retrieve the local skyline in every cluster. *Iskyline* method conducts two optimization techniques that reduce the number of local skyline in every cluster. However, *Iskyline* is time consuming as in each node there are many pairwise comparison need to be performed to find the local skyline. Most importantly, large amount of missing data in the skyline results does not give any insight to help user in selecting the most appropriate data item.

PRELIMINARIES

Our approach has been developed in the context of relational databases. A database consists of a finite set of relations (R_1, R_2, …, R_m). A relation is denoted by $R(A_1, A_2, \ldots, A_n)$ where R is the name of the relation with n-arity and A_i's are the attributes (dimensions) of R. We denote the missing value in the attribute A by a (*) to indicate the incomplete attributes. For example the data item $a(4, *, 7)$ indicates that the first and third attributes have values 4,

7, respectively. While the second attribute is unknown (*). To divide the initial database into a set of comparable data items we employed the principle of *bitmap representation* that collects the whole data items which have missing values in the same attribute into the same cluster. For example data item *a*(4, *, 6) and *b*(*, 4, 3) are represented by the bitmaps *P.a*=101 and *P.b*= 011, respectively. Our approach is applicable for the complete and incomplete databases. Due to space limitation, only incomplete database is used in the examples.

OUR PROPOSED METHOD

Our technique produces the set of skyline queries that are not dominated by any other data items in the whole database. Splitting the data items into set of clusters would avoid the problem of cyclic dominance by neglecting the incomplete dimensions (attributes). To further reduce the number of comparisons between data items in each cluster and save a significant amount of processing time, each cluster is further divided into set of groups. The groups are created recursively depending on the highest value in any of the dimensions of that data item. If the highest value in the remaining data items of a cluster is less than or equal to the lowest value of the created group, then, we stop the process of creating groups as no other data items may be considered as a skyline. For example data items *a*(*, 4, 3, 8) and *b*(*, 3, 8, 2) are collected in the same group as the highest value in both data items is 8. The aim of this step is to avoid an exhaustive comparison between data items and eliminate the problem of cyclic dominance. Figure 1 shows three different clusters that are created based on our example database. *d*1, *d*2 and *d*3 consist of the dimensions (attributes) of a data item in the database.

A*i*	*d1*	*d2*	*d3*
A1	*	5	3
A2	*	1	1
A3	*	3	3
A4	*	6	6
A5	*	2	6
A6	*	4	5
A7	*	3	2
A8	*	5	5
A9	*	6	4
A10	*	2	1
A11	*	2	2
A12	*	3	5

Cluster 1 = 011

B*i*	*d1*	*d2*	*d3*
B1	4	*	5
B2	3	*	2
B3	7	*	6
B4	5	*	3
B5	2	*	1
B6	2	*	2
B7	7	*	4
B8	5	*	5
B9	1	*	3
B10	7	*	5
B11	3	*	3
B12	3	*	5

Cluster 2 = 101

C*i*	*d1*	*d2*	*d3*
C1	2	3	*
C2	3	6	*
C3	4	5	*
C4	1	3	*
C5	2	2	*
C6	6	3	*
C7	1	1	*
C8	5	3	*
C9	6	4	*
C10	2	1	*
C11	5	4	*
C12	3	5	*

Cluster 3 = 110

Figure 1: Clusters

Now, we create a set of groups for each cluster by gathering the data items which have the same highest value in any of the complete attributes. Figure 2 illustrates the concept of grouping technique. The shaded data items are the local skyline of the cluster.

Group 1			
A*i*	*d1*	*d2*	*d3*
A4	*	6	5
A5	*	2	6
A9	*	6	4
Group 2			
A8	*	5	5
A6	*	4	5
A1	*	5	3
A12	*	3	5

Cluster 1

Group 1			
B*i*	*d1*	*d2*	*d3*
B3	7	*	6
B10	7	*	5
B7	7	*	4
Group 2			
B8	5	*	5
B12	3	*	5
B4	5	*	3
B1	4	*	5

Cluster 2

Group 1			
C*i*	*d1*	*d2*	*d3*
C9	6	4	*
C2	3	6	*
C6	6	3	*
Group 2			
C11	5	4	*
C3	4	5	*
C12	3	5	*
C8	5	3	*

Cluster 3

Figure 2. Groups and Local Skylines

Notice that, in Figure 2 some data items of the clusters are removed before applying the skyline technique. For example, A2, A3, A7, A10 and A11 are removed from Cluster 1 since to the highest value of these data items is less than the lowest value of the created group. Also, B2, B5, B6, B9 and B11 are removed from Cluster 2 for to the same reason. This process aims to reduce the number of data items before applying the process of pairwise

comparison to find the cluster skyline data items. Next, we create a set of virtual skyline *k-dom* from the cluster skyline based on the complete dimensions between different clusters and put them at the top of every cluster. Then, we conduct a *mapping policy* among the virtual skyline data items by merging the *k-dom* data items as a single data item. The mapped *k-dom* is composed the cluster skyline. This process aims to eliminate as early as possible from the candidate cluster skyline before considering them in the final answer.

Figure 3 shows the mapped virtual skyline after deriving the virtual skyline *k-dom* and applying the mapping policy. For example *k-dom* in Cluster 1 comes from the mapping of cluster skyline of Clusters 2 and 3 by considering the highest value in each dimension. That means local skyline Cluster2 and Cluster 3 produced the *k-dom* (*, 4, 6). The mapping process will significantly reduce the number of comparisons. Instead of comparing two virtual skylines (B3 and C9) independently with the local skyline of Cluster 1, we insert this *k-dom* data item into the Cluster 1 and start the skyline process to eliminate the dominating local skyline from further processing. Notice that, the value of the first dimension in the *k-dom* is *, this is because in Cluster 1 the incomplete dimension is the first dimension and will not be used in the comparison process. While, for dimensions 2 and 3 we replaced the * symbol with the highest value of that dimension. Also notice, because A4 is better and not worse than *k-dom*, A4 will be further considered to be as a global skyline. *k-dom* removes A5 from further processing because *k-dom* is better than A5 in all the complete dimensions.

Inserting *k-dom* to local skyline of cluster 1

k-dom	*	4	6
A4	*	6	5
A5	*	2	6

Cluster 1

Inserting *k-dom* to local skyline of cluster 2

k-dom	6	*	5
B3	7	*	6

Cluster 2

Inserting *k-dom* to local skyline of cluster 3

k-dom	7	6	*
C9	6	4	*
C2	3	6	*

Cluster 3

Figure 3. Effect of *k-dom* on The Candidate Skyline

Finally, after performing the mapping policy a set of candidate skyline is retrieved from each cluster. Then, we further conduct pairwise comparison to select the global skylines that are not dominated by any data items in the database. Figure 4 shows the global skyline of our example database.

Global skyline

B3	7	*	6

Figure 4 The Global Skyline

From the result we conclude that there are no data items in any of the clusters that are better than the global skyline. Lastly, the missing values of the global skyline data items are imputed before returning them to the user. This process is achieved by referring to the current available data items and the relationship between data items to estimate the values of the missing dimensions.

CONCLUSION

The process of skyline is expensive due to the exhaustive pairwise comparison at the dimension (attribute) level between data items to select the skyline query results. The searching space is the most important critical factor that affects the performance and the speed of skyline process. In this paper we have presented and discussed skyline queries in incomplete database. We proposed an approach that manipulates the incomplete database to retrieve the skyline results. Our approach tends to perform the process of skyline queries with the aim of reducing the searching space by avoiding the unnecessary comparison between data items. The clustering and grouping with the concept of virtual data items *k-dom* are used during the process of generating the set of skyline answers for a given query operation. We

intend to simulate our approach to measure the number of comparisons between data items and the time taken during the skyline process.

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DOMAIN-BASED DISTRIBUTED MEDIATION SYSTEM FOR LARGE-SCALE DATA INTEGRATION

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ABSTRACT. The increasing use of computers and the development of communication infrastructures resulted in abundance of information on the networks and extremely need for querying and integrating data from large number of data sources, especially for scientific applications. Distributed mediation system performs this task fragmentally, where each mediator in the system architecture responsible for querying subset of data sources. To make such type of systems success in large scale, we must deal with two issues: logical distribution of the data sources and mediators in the system architecture, and logical interaction between the mediators. To handle these issues, this paper proposes a domain based distributed mediation system called Multi-Mediators System for Large scale Data Integration (MMSLDI). MMSLDI enables the reducing of the general query response time by eliminating unnecessary visits to the data sources that do not contribute to the answer of the query. Moreover, it satisfies the requirements of adaptation to various kinds of domains, decentralized control, and automation of its processes.

Keywords: data integration, Distributed mediation system, Multi-Mediators System for Large scale Data Integration (MMSLDI)

INTRODUCTION

Data integration is the process of combining heterogeneous data residing at different sources in order to provide the user with a unified view of these data (Fowler et al., 2004). Mediation architecture (Halvey et al., 2003) was proposed as a solution to integrate heterogeneous data sources in a specific domain by adding a layer between the application layer and the data sources in the system. A mediation layer handles the responsibilities of accessing the heterogeneous data sources and presents the integrated data to the user (Ezenwoye et al., 2004).

As the number of data sources increases, the centralized mediator architecture becomes an administrative and performance bottleneck. It has been identified in earlier research on mediator systems (Bassem & Samir, 2009) that distributed mediation architecture is necessary in order to avoid these bottlenecks while providing modularity, scalability, and reuse of specification in the integration process (Du & Shan, 1995).

In the distributed mediation architecture, the integration process is distributed among many mediators where mediators can access other mediators. The challenge in making such a system succeed at a large scale is twofold (Gardarin, Dragan, & Yeh, 2008). First, we need a simple concept for logical distribution of data sources. Second, we need efficient mechanisms

for logical interaction between the mediators with respect to distributed query routing and execution that capable of handling well costly computations and large data transfers.

In data integration, the variation in the meaning of data sources content will affect the amount of useful data that can be obtained. Accordingly, there is a need to address the issue of Logical distribution of the data sources from the content perspective, which aid in eliminating unnecessary visited to data sources that cannot contribute to the answer of the query in order to reduce the query execution time, network load, and resource consumption.

Two methods exist for logical interaction between mediators. The first one uses one mediator to query other mediators such as in (Aboulnaga, El Gebaly, & Wong, 2007). This method is not preferable because the distributed mediation architecture is to avoid having any component that constitutes a central point of failure and when the numbers of mediators increase it reproduces the problem of single mediator, especially for large number of data sources. The second method uses P2P fashion to route the query between mediators such as in (Ezenwoye et al., 2004).

Current P2P routing techniques, however, are either unscalable, unrelaiable, slow response time or lack robustness. Usually they are based on one of the following techniques: pure p2p (Jurczyk, Xiong, & Sunderam, 2008), central index (Katchaounov, 2003), distributed index (Ege et al., 2004; Gardarin, Dragan, & Yeh, 2008; Huebsch et al., 2005), and super peer (Halvey et al., 2003; Loser et al., 2003; Beneventano et al., 2005). The description of these techniques and their drawbacks as follows.

In pure P2P, each peer floods the query to the directly connected peers, which themselves flood to their peers, until the request is answered or a maximum number of flooding steps occur. This may result in many redundant computations performed by each of the underlying peer, as well as in many redundant network accesses and data transfers.

The objective of peer indexing is to allow peers to select from an index the best neighbor to send a query to, rather than flooding or random selection. In a centralized index, a single server keeps references to data on many peers. The drawback of this method is when the node that holds the central index fails, the system will crash.

Distributed index techniques, such as Distributed Hash Table (DHT) algorithms are based on maintaining some knowledge by each node about some other nodes (but not all). The general purpose of these algorithms is to map a value onto a key using a hash function. Also this method has drawbacks when each peer joins the system needs to add DHT and when a data source joins the system needs to add new index to DHTs. Thus, each join or leaving of even a single peer requires considerable overhead in reorganization for all tables.

Super-peer is a node that acts as a centralized server to a subset of clients peers. Clients submit queries to their super-peer and receive results from it. Moreover, super-peers are also connected to each other, routing messages among them, and submitting and answering queries on behalf of their clients and also interconnected super-peers (Yang & Garcia-Molina, 2003). Super-peers introduce a single-point of failure for its clients, and still there is a need to make them more reliable.

Based on the proposed query routing techniques and their drawbacks, we come to a conclusion that additional research is needed to address the issues of query routing in large scale data integration systems, and to present a new solution that improve the efficiency and fault tolerance of query routing techniques for such systems.

This paper provides a description of the proposed data integration system (MMSLDI). The logical distribution of data sources and mediators is given in the next section. The details of the logical interaction between the mediators, and the query routing mechanism are presented in the latter sections.

LOGICAL DISTRIBUTION OF DATA SURCES AND MEDIATORS IN MMSLDI

Our proposed integration system (MMSLDI) which illustrated in **Figure 2** is a distributed mediator system that consists of a set of sub-systems called mapping systems and a set of data sources. The mapping system is a mediator that facilitates querying of a set of heterogeneous data sources that are distributed over multiple sites. This set of sources is called the domain of the mapping system. The mapping system provides the required components to process user queries that their results are obtained from its domain.

Each domain consists of a mapping system called Sub-Main Mapping System (SMMS) that acts as a header of the domain, and a set of Sub-Domains (SD) that organize data sources. Each sub-domain encompasses a Mapping System (MS) as a header and a set of data sources.

The header of each domain acts as a method of interaction of its domain in the integration system. The interaction refers to the forwarding of a specific set of user queries that their answers can be obtained from the other domains, or the forwarding of the answers that can be obtained from the domain to the other domains. In this architecture, initially, the set of all data sources of a particular field (e.g. biological field) are registered and then are grouped into SDs. The grouping is performed based on the topics that are provided by the sources.

The direct communications with the data sources for submitting queries and obtaining their answers are performed by the MSs of the sub-domains. The user interacts directly with the MSs for posing queries.

The different domains are linked together through the Main Mapping System (MMS) that acts as an intermediate system for forwarding a set of user queries that do not have answers in the domains where they are posed to the other domains, and returning the answers of these queries to their original domains. The MMS has the widest view of all domains in the integration system in that it stores the metadata of a full version of the domain's schema, the information about the data sources that are included in each domain, and the set of correspondences between the universal schema and the data sources schema. Both SMMS and MS store only the metadata that are related to their domains.

Based on the above description of the architecture, we can formally define MMSLDI as follows.

Definition. MMSLDI is a 5-tuple $<S, M, D, I, U>$, where:

$S = \{s_1, \ldots, s_n\}$ is a finite set of available data sources of a particular field.

$M = \{m_1, \ldots, m_m\}$ is a finite set of mapping systems that are required to facilitate the processing of the user queries. This set contains the following categories of the mapping systems:

- MSs that have direct communications with the users and a specific set of sources.
- SMMSs that are responsible for a particular set of MSs to facilitate their interactions.
- MMS that acts as the main medium for the interaction between SMMSs.

$D = \{d_1, \ldots, d_l\}$ is a finite set of domains that group together subsets of the elements of both S and M. Each domain has an element of M as a header and a set of sub domains.

$I = \{i_1, i_2, i_3\}$ is a finite set of mechanisms of interaction between the elements of M after they are grouped in the elements of D.

$U = \{u_1, \ldots, u_n\}$ is a set of users that interest in obtaining specific information from the particular field. Each user interacts directly with specific elements of M for query posing.

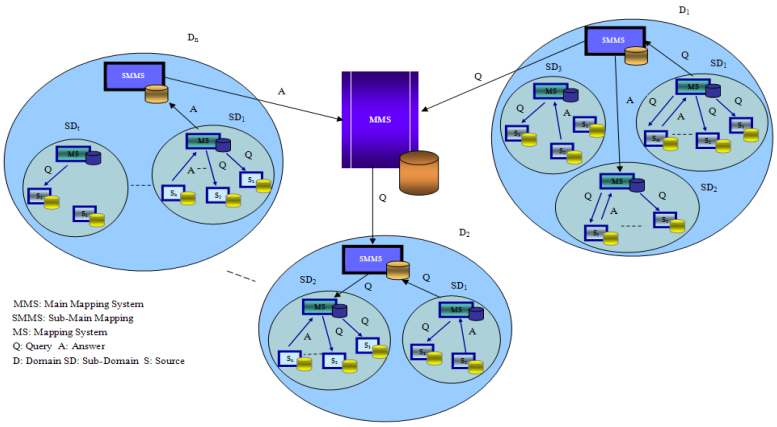

Figure 13.The Architecture of MMSLDI

LOGICAL INTERACTION BETWEEN MEDIATORS IN MMSLDI

The interaction between the different mapping systems in MMSLDI is performed through routing the query between them. For this purpose, domain based query routing mechanisms are proposed. In these mechanisms, the query is written using the ordinary query writing method as follows:

Select attribute_name(s)
From source_name
Where condition

Each MS receives a query from the user, extracts the query subject from the *Select* clause, and translates the query into a tentative query form without location operators (From clause). Then it forwards this query to other MS based on the routing algorithm. The receiver MS of the tentative query, checks the query subject against its local data. In the case that the answer exists, it fills the holes in the *From* clause by identifying a location operators containing potentially relevant data.

The routing mechanism to the other mapping systems is determined based on a similarity measure between the query subject and the domain schema. The user posts the query to any MS then the MS calculates the similarity (r) between the query subject and the domain schema. Based on the value of $r\ (0 \leq r \leq 1)$, the query can be forwarded from a MS to its parent or the child or the neighbors. For example, If r equals the highest value ($r=1$), this indicates that the answer can be fully produced from the domain where the query is posted. Otherwise, the query can not be fully answered in its domain and it must be either fully ($r=0$) or partially ($0< r <1$) forwarded to the MMS to forward it to its neighbors. If the answer cannot be fully produced from the neighbors, SMMS forwards the query to MMS that forwards it to the domains where it can be answered.

If the query answer can be fully produced from the same domain, the interaction between the MSs can be realized through direct communications in a P2P manner. In order to implement this method, an **Inter-Domain Routing algorithm (IDR)** is designed. This algorithm allows peers that belong to the same domain to find the answer independently from their SMMS, This to avoid performance bottlenecks and single points of failure in SMMS.

If the query can not be produced from the same domain where the query is posted, the query must be forwarded to the SMMS to search between domains. To implement this

method, a **Cross-Domain Routing Algorithm (CDR)** is designed. In this algorithm, super domain peers (SMMSs) are grouped together and allowed to find the answer independently to avoid performance bottlenecks and single points of failure in MMS.

Inter Domain Routing Algorithm

Each domain in our proposed system has its own schema. This schema is represented by a list of its attributes. If we assume D_1 schema has 20 attributes (A_1,…A_{20}), we can classify these attributes into groups according to their occurrences together. For example (G1:first name ,last name , G_2:professor name ,filed of study ,department).

Accordingly, D_1 schema can be represented as groups of attributes as follows:

G_1:A_1,A_2,…A_6

G_2:A_7…A_{10}

Each new joined node in the network sends its own schema information to the header of the domain. The header determines the attribute groups that belong to this node. Accordingly for each node in its domain, the header records the following information about the attribute groups:

N_1: G_1, G_3

N_2:G_4, G_2

Based on this information, the following facts can be deduced (~ means appear in):

G_1~N_1, N_5, N_{10}

G_2~N_4, N_8, N_3

Accordingly, additional interconnected groups of nodes are produced inside each domain (e.g. D_1 (G_1, G_2, G_3,….)). For each produced group, a coordinator is elected. This coordinator has a link to its group's nodes and the SMMS.

Each node when it joins the system, it will have links to the coordinators of the groups and the SMMS. When the node tests the incoming query against its domain schema, it can determine the attribute groups that the query belongs to in order to forward the query to the selected group coordinators.

Cross-Domain Routing Algorithm

This algorithm is dedicated to the SMMSs. In this algorithm, each group of SMMS nodes is organized into a ring topology. Each node has associated number *NN* (1<*NN*<*n*), where *n* is total number of nodes in each super domain. *n* is associated with the last node in the series and 1 is associated with the first node.

Each node has knowledge only about the contents of the two direct neighbors (i.e. the successor and predecessor) and stores only one address for remote node called *partner node*. Each node has two types of links: Direct-neighbor-link (DL) and Partner-link (PL). DL is used to link the node with its direct neighbors and the PL is used to link the node with its *partner node*. The message forwarding between *partner node*s will be in one direction, i.e. the anticlock wise direction.In the following, we illustrate how to compute the direct successor (*DNs*) and predecessor (*DNp*) neighbors and partner neighbor (*PN*) for each header node:

$DNs = \lfloor NN+1 \rfloor \bmod n,\ 1<NN<n$

$$DNp = \begin{cases} |NN-1| \bmod n, & 1 < NN \le n \\ n, & NN = 1 \end{cases}$$

$PN = \lfloor NN+3 \rfloor \bmod n$

Based on the aforementioned description, the CDR routing mechanism is as follows.

1. Each node receives the query, it determines the source of the query
2. If the query comes from MMS, the node checks it against its local schema only and then forwards it to its underline mapping system.

3. If the query comes from MS, the node checks its local knowledge about the neighbor schemas. If it can be answered, then it directly forwards it to the specific direct neighbor. Else it will be forwarded through the partner link.
4. If the source of the query is one of its neighbors, the node must check its local schema and neighbor schemas to determine if the answer can be provided. Otherwise, the partner link will be followed.

To strictly guarantee that the query forwarding is not exceeding number of hops in the worst case, the Descending Factor (DF) is proposed. Before the first forwarding for the query through the current level, the query must be tagged with DF and the value of DF is decreased by one in each forwarding for the query in this level. The value of DF is calculated as follows.

DF=round $\lfloor (N\text{-}1)/3 \rfloor$, where N is number of nodes in the ring.

CONCLUSION

To cope with the problem of integrating data from large number of heterogeneous data sources, the paper presented MMSLDI that represents a multi-mediators architecture for large scale data integration. MMSLDI encompassed mapping based architecture for logical distribution of data sources and mediators, and routing mechanisms for the interaction between the mediators. MMSLDI eliminates unnecessary visits to data sources that do not contribute to the answer of the query through forwarding the queries only to the appropriate mediators. This enables the reduction of the resources consumption and the network overhead, improving the response time of the queries, and supporting the scalability of the system.

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COLLABORATIVE MIND MAP TOOL TO FACILITATE REQUIREMENT ELICITATION

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ABSTRACT. Requirements elicitation is a crucial task in any software development process. It is notable as a major contributor to the project failure. To minimize and subsequently improve the process, folding Mind Map concept in the elicitation process and implementing it collaboratively is being proposed in this study. The aim of the study is to study the impact of the Mind Map and groupware in facilitating requirements elicitation. A prototype based on *PowerMeeting* is developed to illustrate the idea of mind map groupware called Collaborative Mind Map Tool (CMMT) which to be analyzed its impact towards requirement elicitation process.

Keywords: requirements elicitation, folding Mind Map, Collaborative Mind Map Tool (CMMT)

INTRODUCTION

Requirements elicitation is a process of identifying the requirements of the problem to be resolved by gathering, uncovering and understanding the needs of stakeholders. It involves the process of extracting and understanding the needs of stakeholders, and defining the application domain and problem context with explicit and precise descriptions. Requirements are obtained from the stakeholders as the primary resources, careful analysis of the organization, the application domain and business process where the system will be deployed (Kotonya, et al., 1998). Obviously those activities require intensive communication, collaboration and cooperation between stakeholders and requirement engineers. During this process, it is essential to capture the "right" understanding of the problem and interpret it correctly in agreeing representation. It has well been recognized that requirements elicitation is the most crucial and important aspect in any software development prior to analysis and specification stage.

Despite its crucial process, it is notable that requirement gathering is a major contributor to the failure in any software development project (Macaulay, 1996; Bohem, 1981; Rahman, 2004). Studies indicate that among the main problems in the requirements elicitation process are: gaps in communication and understanding, inadequacy of management; lack of knowledge and skilled people in approaching the requirement process; and process with wrong techniques and methods (Al-Rawas, et al.,1996; Weigers, 2003; Tsumaki, et al., 2005).

To overcome the situations, a Mind Map, which is a thinking "tool" that reflects how the information is stored and retrieved in a more organized and systematic way inside a human brain, will be bring into the requirement elicitation. Mind Map is a technique which uses graphical illustration in expressing thoughts and idea based on the concept of Radiant Thinking- a natural function of human mind (Buzan, et al., 1995). The subject of attention is placed in a central image, and radiates the ideas from the central image and hierarchically expands and associates the branches and its sub-branches with keywords. Information is categorized and classified, and subject is layout in a "snapshot" and organized way.

Furthermore, incorporating objects which are more stimulating than words such as shapes, images and colors in Research done by Ralph Haber, and later by R.S. Nickerson, have proven that images are more stimulating than words and thus generate more creative ideas and encourage better memorization. The Mind Map is used widely by many individuals and organizations and can be applied in most activities or situations, i.e. in decision making, analysis, problem solving, to-do list, note taking, brainstorming, presentation or even to write down simple notes.

Exploitation of Mind Map will generally multiply individual personal creative capabilities when collaborate in a group (Buzan, et al., 1995). Psychologically, group mind map encourages information sharing and teamwork (Morris, et al., 1998). It generates the sense of contribution which then encourages the team members to commit on job execution by viewing and understanding ultimate objective of the subject matter. This is essential criterion in teamwork to have same vision and mission (Hughes, 2008).

Greater exploitation can be achieved when incorporates the group mind map into groupware. Groupware is a technology that supports systematic and structured group collaboration (RAMA, et al., 2006). Generally, groupware is categorized into two primary dimensions of perspectives; the time and the space. The time illustrates the collaboration happens at same time (synchronous) or different time (asynchronous), whereas the space view on the perspective of where the collaboration is executed; whether it is in the same place (co-located) or different place (none co-located).

There are many significant advantages of groupware compared to a single user system, i.e. 1) To facilitate communication; make it faster, clearer and more persuasive 2) As a mechanism to transfer and share knowledge 3) To help in motivating individual to perform better 4) To collaborate a group of people of the same interest 5) A way to form structured group coordination and proactive collaboration 6) To save time and cost.

However, building groupware system is considered to be more challenging compared to individual system due to distinguish features in groupware system such as 1) presentation of groupware- high level of usability criteria; easy to learn, easy to use, error tolerant and subjectively pleasant, 2) collaboration and communication mechanism-classify the private and sharing information and maintain the consistency of the data throughout the instance, 3) work coordination- a defined process to be followed to encourage work accomplishment 4) openness- easily be integrated with other applications 5) group composition- management and control of the accessibility of groupware participants (Wells, 1996; Volksen, 1992)

COLLABARATIVE MIND MAP TOOL (CMMT) IN FACILATATING REQUIREMENT ELICITATION

Many studies have been done to find ways in improving requirement elicitation mainly due to the cognizance of the requirement engineering as one of the crucial factors contributing to the success of a software project. The process is more about people, communication and collaboration. A few studies and attempts to use Mind Map tool in various phase of software development process has been encountered (Eric T. Blue, 2006). However, very little usage of Mind Map in requirement activities as compared to project management activities. One convincing example that practically uses Mind Map in requirement elicitation is by Kenji Hiranabe. In his article, he has outlined few benefits and illustrated the example with specific template in using Mind Map in requirement process. He also provides a way on how to map mind map into UML diagrams using JUDE-a design and communication tool (Hiranabe, 2007; Change Vision, Inc, 2006).

Surveyed by Chucked Frey (2007) shows that collaboration is the most beneficial feature in Mind Map tool, and according to Nikos Drakos, a Gartner Inc. analyst, Mind Map will become more interesting and beneficial if it is move towards collaborative online (Gilhooly,

2006). This indicates that collaborative Mind Map tool has potential significant impact to people and the process of software development in particular.

Requirement and Specification

Conceptually, the proposed CMMT hybrid the features from Mind Map theories and the distinguish features of groupware system; with the objective to improve the current problem facing in requirement elicitation.

The following are features proposed to be in CMMT:

Presentation of the tool: Inherited from the concept of Mind Map, the tool should tag with high level of usability. Conceptually, Mind Map is a simple and easy concept as it is based on how our brain works. Thus, the tool should be easy to integrate into practice and simple to use. Additionally, color, shapes and images will be used to trigger information which make the tool more attractive and motivate users to use it.

Communication mechanism: Radiant concept of mind map should articulate the information in a better way and present them in a more structure, clearer and more focus. With categorization and prioritization of information help to better understand the requirement and reduce ambiguity and inconsistency of requirements. Enriching the value of the tool, it should support both "synchronous" and "asynchronous" features. Having these features, existing requirement elicitation techniques (e.g. introspection, task analysis, brainstorming, laddering, requirements workshops, goal-based approach, scenarios, viewpoints and etc) can easily blend with mind map.

Collaboration mechanism: Information can be classified as private or sharing depending on the scenarios. A control mechanism is provided to manage the accessibility of information among the participants with centralize architecture to maintain data consistency. Nowadays, increasing in globalization has demanded multisite software development organizations (Damian, et al., 2003). Making the tool as a web based, it able to support distributed geographical requirement gathering activities which obviously save time and cost.

Work coordination: A floor control or session control is used to control the session and to ensure the process is executed in defined and structured manner. It also controls the accessibility of the participants in each elicitation session. This is to make the elicitation process more systematic, focus and efficient.

Requirement elicitation specific features: 1) Data Dictionary – A feature where crucial term or glossary can be defined. One of the problems in requirement elicitation is not sharing common understanding of concepts and terms. This ensures all crucial terms and concepts can be defined and agreed between stakeholders. 2) Record and Playback - A feature to record and replay each of the session. This can be used to further understand and review on the agreed requirements or decision. 3) Attachment Uploading – A feature where each requirement/information can be attached with supporting resources (e.g. organization plan, business process, legacy system manuals and etc.). This is to cater for which requirements may originate from different sources and formats. 4) Prioritization and Status updates – A feature where each requirement can be attached with priority number and status. This is to prioritize on the crucial requirements and to set the status of requirements (e.g. to revisit and decide on the specific requirement.). 5) Chat – A feature where users can discuss on any issues rose during the requirement elicitation session.

Implementation Strategy

The prototype of CMMT is built on top of *PowerMeeting* framework. *PowerMeeting,* a work-piece (on going research) by Dr. Weigang Wang (2008), is a web based synchronous groupware framework which offers flexible, customizable and extensible groupware development environment. It basically provides with basic collaborative functionalities such

as floor session control, user management, transaction management, text messaging, voice chat, session control, and also other existing groupware plug-in tools such as calendar tool, pincardboard and presentation slides.

From a high level technical point of view, the *PowerMeeting* framework is modeled based on Model (Shared Model) – ViewController (MVC) architecture and transactional replicate architecture employed from CommonGround toolkit, to provide with the basic groupware services such as user management, session and group management, replication and transaction management and persistence management (Wang, 2008). The implementation is built using AJAX technologies offered by Google Web Toolkit (GWT). AJAX is used to gain the benefit of instantaneous and faster response time, asynchronous partial updates and other rich user experience characteristics.

The flexibility and collaborative features furnish by *PowerMeeting* framework has made the prototype implementation and deployment of CMMT easier. Figure 1, illustrates the CMMT on the *PowerMeeting* interface.

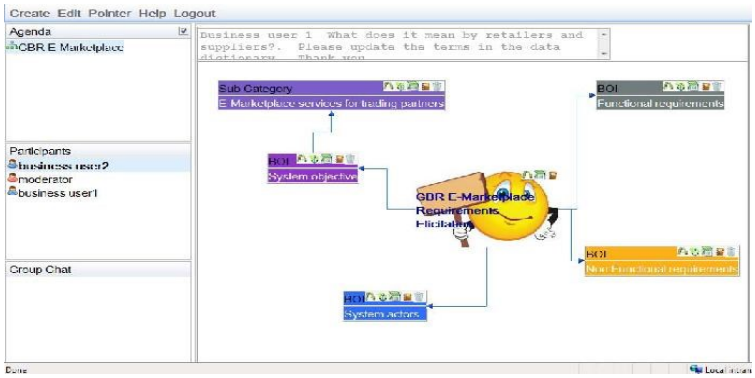

Figure 14: CMMT on *PowerMeeting*

Mind Map Tool Architecture

Mind Map tool is plugged-in into the *PowerMeeting* framework through the creation of Model/Shared Model objects and View-Controller objects. Model objects are used to hold and process the data and information in CMMT while the View-Controller objects hold the responsibilities to interpret the events initiated by the users, convey the instructions to the model for data processing or application specific processing and notify the view of any changes in the model object.

Below figure shows the object models of CMMT.

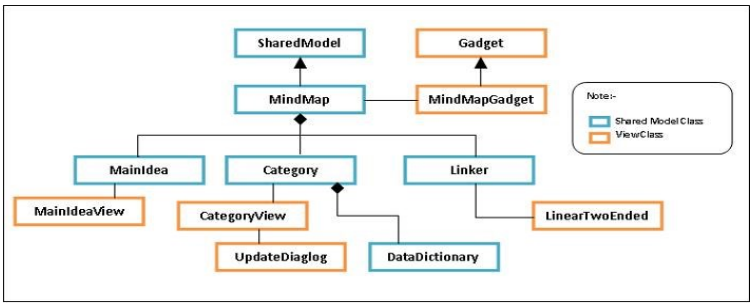

Figure 15: CMMT Object Model

Model objects are defined mainly on the basis of mind map theory by which it has the central subject matter (MainIdea) and radiates the idea into branches (Category) through associations (Linker). CMMT model objects need to extend SharedModel object provided by the framework to inherit the services to handle replication and transaction. Having this, CMMT model object instances can be made available and shared by all users in real time.

Evaluation and Analysis

The prototype-CMMT was successfully built which furnishes with three basic essential elements outlined to be achieved i.e. features that supporting requirement elicitation activities, Mind Map concept, and collaboration. A scenario of a software project development is given to a small group of participants to be executed for evaluation. The selected participants are those who are already familiar with elicitation process but having minimal background knowledge on mind map. Having this focus group we aim to get more reliable insight on the impact of CMMT towards elicitation process.

Feedback and comments were gathered through questionnaire at the end of the elicitation activities. The goal are to capture responses on usefulness of CMMT in requirement elicitation, the effortlessness in using CMMT, the layout and the performance of CMMT. Scale of 1(Strongly Agree) to 5(Strongly Not Agree) were used in capturing the responses. As an addition, participants can also plainly comments on a free text space provided.

More than 70% of participants agree that CMMT overlays a structured way of capturing requirements resulting to better understanding of the gathered requirements. However, only 30 % of respondents agree that CMMT promotes group work and encourages more detailed requirements capturing. In terms of the layout, over 60% responses in the group agree that the CMMT layout is easy to use and learn yet they are not sure on the effectiveness of the layout to generate creativity and memorization. On the other hands, the response time of CMMT is generally bearable to the participants. Since it was only tested by a small group of people, this finding would not be a strong claim to support the hypothesis. However, the work presented has provided an insight for future works in collaborative groupware and requirement engineering field.

CONCLUSION AND FUTURE WORKS

Observing the result from the evaluation and analysis, we believe that CMMT has demonstrated its potential capabilities in supporting requirement elicitation process.

In future, CMMT prototype is to be tested and validated in real software development project situation in order to get an actual insight of CMMT in terms of the significance offered and the improvement towards elicitation process. Also, further refinement should focus on implementing all the proposed features and subsequently extending the feature list so that it can fit to other requirement engineering processes; i.e. requirement modeling and analysis, requirement validation and requirement management.

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A PRELIMINARY STUDY ON TEACHING PROGRAMMING AT MALAYSIAN SCHOOL

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ABSTRACT This paper presents a study on teaching and learning programming in a Malaysian school. The study attempts to identify all possible relations of student's background and attitudes towards learning programming. The motivations for this study comes from the fact that introductory programming in Higher Learning Institutes face a high rate of under achievers. Since the feeder to these institutions are schools, it is felt that if the teaching and learning of programming in schools are strengthen the above mentioned problem can too be greatly reduced. This study attempts to find all possible relations that would help in proposing a more effective method of teaching and learning programming in school and at Higher Learning Institution.

INTRODUCTION

In these last decades, computers have become prevalent tools of life. In making the computers useful as tools of its intended use, it will need to be programmed. Programming courses are usually done at tertiary education. However the teaching and learning of introductory programming in tertiary institutions face the problems of high failure rates and under achievers in producing good programmers (Susan, et. al. 2004). Failure rates are usually high and the inability of students to complete small programming tasks upon completion of introductory units is not unusual (Robins *et. al*., 2003). For that reason most schools have now embed the teaching of computers in their curriculum so students are exposed to computer and programming earlier. There are students who have learned programming prior to college but still find it hard to cope with the programming subjects in college. In developing a program, the parts that are considered as the most difficult is associated to task which requires certain skills such as problem design and strategy. Hence, a research need to be done to identify the factors of why most of the college student still fail to get good grade in programming although they've learned it before in school. This leads to the objectives of this research which are to identify the factors that might affect programming skills, the degree of subject understanding and student's interest towards the subject in school. A strategic teaching framework will be proposed based on an analysis of the finding.

Learning to program is never as easy task. According to Gomes and Mendes (2007), the problems surrounding programming can be categorized into five which are the teaching methods, the study methods, the student's abilities and attitudes, the nature of programming and also psychological effects. For teaching methods, problems arisen are teaching is not personalized, teacher's strategies do not support all student's learning style, the teaching of dynamic concepts through static materials and teachers focusing too much on programming language and syntactic. For learning problems, students sometimes don't work hard to acquire programming competencies. They think that learning programming is enough by reading a text book and attending the class. When this happened, student cannot comprehend the problem given and visualize the process of the program. There are also problems in student's abilities and attitudes towards programming for example, student don't know how to solve problems because of they don't read and interpret the problem description first. Apart from the problems on account of the teaching and learning methods, there are also problems reflected by the nature of the programming itself. First, programming language demands a high level of

abstraction whereby skills like generalization, transfer and critical thinking are needed among the programmers. Second, programming languages have a very complex syntax in where student need to focus on syntactic rules and algorithm construction so that the program works as planned. These might result in psychological effects, whereby students don't have any motivation and interest in learning programming.

Naturally, students' personal learning strategies and motivation affect their success in learning programming strategies. If the students have no interest in programming, they will be in denial state of becoming an active learner. Those traits are probably created because of the problems from teaching pedagogy which then contributes to the problems of learning. To sum up, most of the novices came from school students because ICT or programming subject already commenced at secondary school (Byrne & Lyons 2001; Wilson & Shrock 2001). There is an urge here about the effectiveness of school lesson in preparing these novices for the tertiary level of programming.

METHODOLOGY

This research is conducted using the two major phases, which are data collection and analysis. The analysis done on the data collected will identify and answer a few research questions that would help in the recommendation of an effective method of teaching and learning programming. Data are collected in two ways which are through interviews and questionnaires. Interview covered ten open ended questions focusing on the teaching materials besides problems faced by the teacher while questionnaire used seven questions measuring the ICT activities, interest, perception, students' understanding towards the subject and also personal info. As for the reliability of the questionnaire, the author have made reviews from other research papers and case study focusing on problems and factors that affect the performance in programming such as Kristi (2003) and Bergin & Reilly (2004). Hence, most of the questions are derived from the reviews of other case study and adjusted to suit the school feel. The questionnaire forms are then analyzed using Microsoft Excel.

The survey was conducted at Sekolah Menengah Kebangsaan Bandar Baru Salak Tinggi (SMKBBST). The school was chosen not only because of its vicinity, which is half an hour away from University of Tenaga Nasional, but also because the school have been teaching ICT for Form 4 and Form 5 students for several years now. Thirty-one students took part in filling up questionnaire forms which on average takes about 10 minutes to fill-in. However, three survey forms are considered invalid since its incomplete, where only twenty-nine forms left to be evaluated. The students were enrolled in Information Technology and Communication (ICT) subject for Sijil Pelajaran Malaysia (SPM). Eighteen out of twenty nine respondents were from Form 4 while eleven respondents were form 5. Fifteen students were male and fourteen were female. The majority of the students came from Science Technology stream and only five of them were from Commerce stream. Almost all students have computer/s at home and some of them were taking the subject as a requirement of their course or out of personal interest.

RESULT AND ANALYSIS

The background questionnaire used seven questions measuring the ICT activities, interest, perception, students' understanding towards the subject and also personal info. Five questions were close-ended and two questions used Likert scale. Question 6 consisted of nine sub-questions with three Likert scale and Question 7 consisted of twenty sub-questions with five Likert scale. A summary of the result is presented in Figure 1 and Figure 2. Figure 1 consisted of thirteen sub-questions describing the degree of understanding among school students in programming subject, a mix between question 6 and 7. While Figure 2 consisted of seven sub-questions describing student's interest and perception towards programming subject, a mix between question 6 and 7.

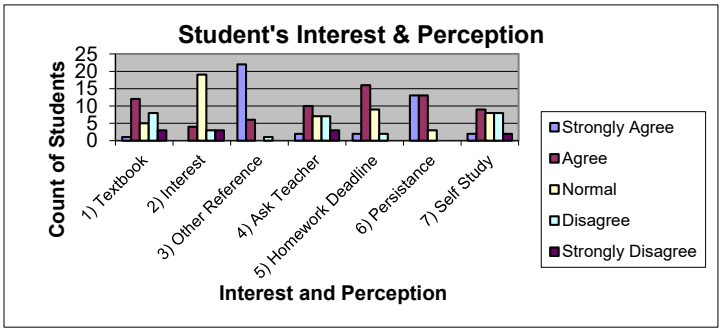

Figure 16: Student's Interest and Perception.

Figure 1 showed that many of the highest rate answers fall under normal category which means they neither *Agree* nor *Disagree*. There is no question that has *Disagree* as the highest rate. Question 7.3 was about student's understanding of what teacher taught in classroom or computer laboratory. Ten students *Strongly Agree* and another eighteen students *Agree*. None of the students disagreed that they understand the learning session. Question 7.4 was about the frequency of teacher helps in learning. Sixteen students *Strongly Agree* and ten students *Agree* that teacher does always help them in learning programming. Question 7.10 fourteen students *Strongly Agree* and thirteen *Agree* that learning aid such as video and audio usage is important as it helps them to learn better. Finally, question 7.20 was about the statement that *Disagree* theory is learned more compare to practical or writing program. Or simply said, there is no balancing between theory and practical learning period. Ten students *Agree* and another two students *Strongly Agree*. To sum up, majority of the students agreed that there is lack of practical session during learning.

According to Figure 2, the majority of the highest rate fall into S*trongly Agree / Agree* scale. For example question number 7.1, twelve students *Agree* and one student S*trongly Agree* that the textbook was thick and there are too many for them. While eight *Disagree* and three *Strongly Disagree* with the statement. In question 7.5, twenty-two students S*trongly Agree* and six respondents *Agree* that they used other reference such as search engine, peers help and other reference books to do homework. On another hand, there were ten students *Agree* and two S*trongly Agree* of the statement about the lack of seeking teacher helps from question number 7.6. As for question number 7.7, sixteen agreed and two S*trongly Agree* that they always met the deadline of homework. In question number 7.11, about thirteen students S*trongly Agree* and thirteen *Agree* that they will not give up in solving the questions. And lastly, about nine *Agree* and two S*trongly Agree* that they do self study outside the school. The rate for *Agree* scale almost on par with *Disagree* with eight students disagreed and another two strongly disagreed.

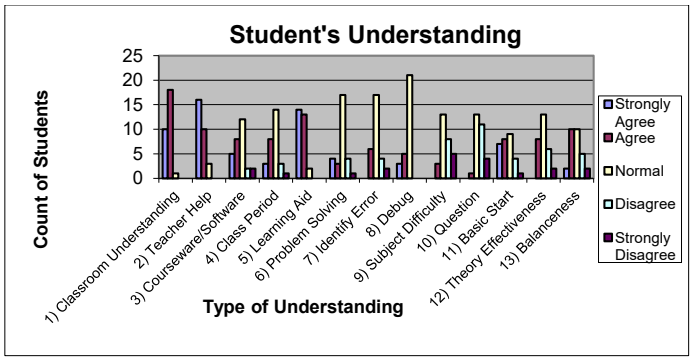

Figure 17: Student's Understanding

Based on an interview session done with two secondary school ICT teachers, many ideas and issues had been pointed out about the subject. Firstly, the use of Malay Language in IT term seems not effective as it should have been. The real meaning of IT term has not successfully conveyed to students when it was translated into Malay Language. Other than that, teachers need to verify their teaching style since there are three groups of learner which were excellent, average and poor. Students also do not understand even though they memorize the content (theory) so they tend to be misled when it comes to tricky questions. However, with the appropriate teaching materials such as Toolbook, Courseware and peers coaching method, there is no problem with the rate of failed students in ICT subject (100% passed).

STATISTICAL ANALYSIS

Nine research questions are made upon the questionnaire. The gist of those research questions is to find out the relationship between two variables. Does this factor affecting the other factor or does this problem occurred because of that factor, illustrating the sketch of the research questions. Several considerations have been taken to associate between two variables according to its own category which are factors, interest and understanding.

Table 1: Correlation of Variables (p<.05)

Research Questions	Independent Relation
1) Is there any relationship between stream of studies and difficulty of the subject being perceived?	No relationship
2) Is there any relationship between owning computers with ICT activities?	No relationship
3) Is there any relationship between classroom understanding and learning aid such as video and audio?	There is relationship
4) Is there any relationship between initiative and persistence?	No relationship
5) Is there any relationship between interest and self study?	There is relationship
6) Is there any relationship between theory effectiveness and basic understanding (problem solving concept)?	There is relationship
7) Is there any relationship between courseware/software and difficulty of the subject being perceived?	No relationship
8) Is there any relationship between interest and difficulty of the subject being perceived?	No relationship
9) Is there any relationship between basic understanding (problem solving concept) and programming questions?	No relationship

These research questions are analyzed using chi square test (x2) in order to determine the independent relation between two variables. To make sure that a variable has relationship from other variable, five percent degree of independent (as small as possible) has been put. Therefore, probability was used to represent the 'degree of independent'. If probability is lower than 0.05, there is relationship between two variables according to pivot table. The correlations of variables are shown in Table 1 where surprisingly only three research questions have correlations between two variables out of nine questions. The related question was analyzed using descriptive analysis and summarized into a table.

DISCUSSION

Based on Table 1 above, we can see that many of the assumptions are out of track when seven of research questions shown that there were no correlation between two variables. In research question number 2 for example, it proved that having a computer at home does not guarantee someone to be skilled in using computer or heavily involved in non-programming activities such as Facebook, video game, Internet browsing or even the use of *Microsoft* software. It means that there are lots of reasons to influence them to be familiar with these ICT activities such as friends and cyber café facility. Perhaps, they don't have to be actively engaged in those activities in order to be a good programmer. For research question number 4, although the graph analysis shown a good correlation result between 7.6 and 7.11, however the chi-square test denied it. The purpose of this research question is to correlate that student's lack of initiative to ask teacher leads them to solve questions by their own (persist) until it is done. Here, it can be interpreted that sometimes the habit of do not asking help is the indicator of someone's ability to solve the problem by their own. It can be defined in various ways although shyness always popped out to be as the best factor. According to research question number 8, there was no correlation between the variables interest and difficulty of the subject being perceived based on the chi-square test. It implied that if the course is considered as difficult, that does not prove that it will be

hated by students. Sometimes, students are thrilled with the 'challenge' it offers once you manage to solve the questions. These three research questions; number 2, 4 and 8 are mainly focused on the factors, understanding and interest of school students towards programming.

For the three research questions which have relationship, the reason behind research questions number 3 is to identify the effectiveness of the learning aid such as video and audio on the understanding of the subject. It is proven that learning aid do help school children in understanding the programming when the probability shows a significant small number, 0.016 which is less than 0.05. It has been said that audio and video learning aid method was used by many researchers to tackle the novice's understanding inside the memory of program execution (Iain & Glenn, 2002; Smith & Webb, 2000). As for research question 5, the correlation between two variables which are interest and self study is positive. Interest is the essence of motivation, and motivation has something to do with willingness. The relationship indicates that student who has interest in programming are likely to study by themselves apart of what they learnt in school. This is strengthen from what Gomes et al. (2007) implied that psychological effects on programming is considered as one of the problems in learning programming. Last but not least, the research question number 6 confirmed that there is a correlation between the effectiveness of the theory module with the basic understanding of problem solving. This relationship indicates that the theory module affect the degree of understanding in problem solving concept. The relation according to the analysis goes like this, that there are more students who do not understand the theory and as a result they do not know how to apply it into problem solving during code writing stage.

Living in era of Information Technology (IT) and being an IT student had surely made these students know how to use computer and gadget for basic purpose such as emailing, computer application, playing games and surfing the Internet. According to the survey, majority of the students are able to do the ICT activities on their own except for programming software. Programming software is an advanced activity that requires special skills beyond their knowledge compared to other ICT activities mentioned just now. Based on researches done by Wilson & Shrock, 2001; Holden & Weeden, 2003; Wiedenbeck & Kain; 2004, etc. prior programming experience such as emailing, playing games and surfing the internet do affect the programming performance in class. With the experiences, student could excel the programming field. However, SMKBBST students are not familiar with programming software, but have used computers before for other basic purposes. As the result, 100% of the students are passed the ICT examination in Sijil Pelajaran Malaysia (SPM). This indicates that student may not be excellent in the subject but they still able to do programs with only single side experience which is none programming experience. It is believed that later on, they will obtain the programming experience and becoming expert as they learn further with good attitudes as a programmer.

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AN IMPROVED ALGORITHM IN TEST CASE GENERATION FROM UML ACTIVITY DIAGRAM USING ACTIVITY PATH

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ABSTRACT. This paper proposed an improved algorithm to automatically generate test cases directly from UML activity diagram using an activity graph. This algorithm has been implemented as a prototype using UML activity diagrams as inputs to generate test cases. These generated test cases are generated automatically are compared to test cases that are generated manually in order to evaluate the algorithm's usability and reliability. The result shows that the test cases generated by the developed test case generator program are the same as the one manually derived.

Keywords: test case generation, automated generation, test case

INTRODUCTION

Test case generation is one of the most important elements for the testing efforts for programs and applications (Linzhang et al., 2004). It is especially complicated when a system contains simultaneously executing participants, since a system like that can show different responses depending on the simultaneous occurrence conditions. A Unified Modelling Language (UML) activity diagram is a suitable modelling language for describing interactions between system objects given that an activity diagram can be conveniently used to capture business processes, workflows and interaction scenarios (Kim et al., 2007).

Many have generated test cases from UML activity diagrams by generating them manually to test the system (Linzhang et al., 2004; Kundu & Samanta, 2009; Kim et al., 2007). Many generate test cases automatically using different methods (Chen et al., 2009; Javed, Strooper & Watson, 2009), however none of these studies has revealed the algorithm that they have used.

Kundu & Samanth (2009) have developed an algorithm to generate test cases using activity paths. Their algorithm has never been implemented and this algorithm needs an activity graph that has been generated manually from the activity diagram. Their algorithm also needs to enter the type of each node manually and apply some rules to get the result paths.

This paper focuses on extending Kundu & Samanth (2009)'s algorithm used in generating test cases using UML activity diagram by applying activity path approach, in which the test cases are generated automatically generated. The activity path is a method to calculate all possible paths from the activity diagrams, converted each number in the path to its original data, and from there will generate the test cases.

BACKGROUND

The following are the main concepts applied in this study.

UML Activity Diagram

UML is a standard that contains a large set of modelling concepts that are related in complex ways. Since UML became a standard of OMG in 1997, UML models have become main class of artefacts in software development processes. UML provides a number of diagrams to describe different aspects of software artefacts. UML activity diagrams illustrate the sequential control flows of activities. They can be used to represent control flow of an operation or model the dynamic aspects of a group of objects, which form a kind of design specifications for programs (Chen at al., 2009).

In order to directly reuse the activity diagrams modeling of an operation as a test model to generate test cases, it is necessary to follow the testability requirement. An activity diagram should only have one initial activity state, pair of branches and merges, pair of forks and joins. The owner object of each activity state should be labeled by swim lanes, or be labeled in the name of activity state. Every node other than the initial node and final node has at least one outgoing edge and one incoming edge, which means all nodes are reachable. Any fork node only has two exit edges. Concurrent activity states will not access the same object and only execute asynchronously (Linzhang et al., 2004).

Activity graph

An activity graph is a directed graph while its construct is represented by each node in the activity graph (initial node, decision node, flow final node, guard condition, join node, fork node, etc.), and from that each border of the activity graph symbolizes the stream in the activity diagram. Furthermore, the activity graph as shown in Figure 1 summarizes assemble of an activity diagram in an organized way which can be used for further automation (Kundu & Samanta, 2009). These nodes are used for test case generation due to their capability for detecting more faults in the synchronization and loop faults than the other approaches. In addition the ability to identify location of the faults will help to reduce testing afford and having model-based test case generation to improve and develop design quality. Furthermore, it has a possibility to built automatically prototype for the activity graph. The algorithm by Kundu & Samanta (2009) has taken the activity graph as an input and the output from it will be the activity path. Furthermore, the generated paths will need some of rules to apply on the result paths to get all the possible paths that will be needed to generate the test cases.

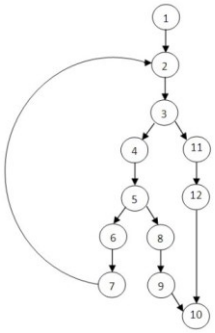

Figure 1. Activity Graph for login screen

Test Case Generation

Test case generation has attracted more and more research attention (Cartaxo, Neto & Machado, 2007; Chen at al., 2009; Heumann, 2001; Javed, Strooper, & Watson, 2007; Kim etal., 2007; Kundu & Samanta, 2009; Linzhang at al., 2004; Mingsong, Xiaokang, & Xuandong, 2006). Large number of them focused on UML activity diagram as a based to generate the test case (Chen, at al, 2009; Kundu & Samanta, 2009; Kim, Kang, Baik, & Ko, 2007; Linzhang at al., 2004; Mingsong, Xiaokang, & Xuandong, 2006), and none of them reveal their proposed approaches or algorithms, or share their testing implementation conducted during the testing.

A test case specifies a set of test inputs, expected results, and execution conditions developed to verify observance with a specific requirement or implement a particular program path (Lilly & G, 2010).

PROPOSED ALGORITHM FOR GENERATING TEST CASES

The following algorithm will generate all the possible paths from the activity diagram, and from the result paths, test cases will be generated. This algorithm is evaluated in terms of its usability and reliability by comparing manual test cases with test cases automatically generated from the prototype of this algorithm. The manual test cases are obtained from Alshammari (2010), where four test cases for student functionalities from Universiti Utara Malaysia learning management system called, LearningZone are used. The functions are login, download assignment, change password, and forum search. Due to space limitation, only one Login function is used and presented in this paper.

Algorithm 1: Generate Test Case

Part A: variables used in the Algorithm

Input: an activity diagram
Output: test case
To find the number of paths, the following are the variables used:
TDN-the number of node which has two directions.
RNN- the number of return node.
TDNI - the number of two directions inside each return node.
RNNI- the number of return node inside each return node.
Basic paths with the return paths number (BPR) = TDN +1
Basic paths number (BP) = BPR - RNN
Number of paths after return (PAR) = TDNI- RNNI
The number of all paths (AP) = BP + PAR(s)

Part B : Pseudo code of methods supported in the algorithm

1. To find the basic paths with the return paths, the following are the variables used:
   a. Node - to put the nodes
   b. LoopFlag - to keep track of the loop
   c. N1 - for the first next of the nodes
   d. N2 - for the second next of the nodes
   e. Nodeflag – for keeping track of the visited nodes
   f. End – for know the end of the path

```
Begin
LoopFlag = TDN, Node = first node, Nodeflag=0, End= true
While LoopFlag is not empty do
  While End is true do
```

If (it's the first node) then put the first node in the path;
Put the node first next in N1 and its second next in N2;
If (N1 = 0) then put end to true;
If (NodeFlag = 0 and N2 = 0) then put N1 for the next node in the path;
Else if (NodeFlag = 0 and N2! = 0) then put N1 for the next node in the path and put NodeFlag = 1, put NodeFlag = NodeFlag – the number of two direction node before it;
Else if (NodeFlag = 1 and N2! = 0) then put N2 for the next node in the path and put NodeFlag = 2;
Put the next node of the path as the current node;
End
Put the path in array;
End

2. To found all the paths (AP)
   Duplicate the paths that have without End to the (TDNI+ RNNI) number;
   Put the return paths inside it to continue it to the number of paths inside the return path;
   Finish each one from the size basic paths;
   That will generate the possible paths.

3. From the save information of each node, print out the details of each path to the last one, what will give us the test case.

Automatic generate for the test case from the login activity diagram

First: Use the activity diagram, as shown in Figure 2 to generate the test case from it.

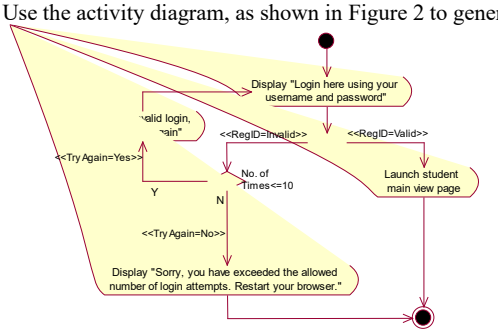

Figure 2. Activity Diagram for "Login"

Using the algorithm explained earlier, the prototype will generate the following result as shown in Figure 3

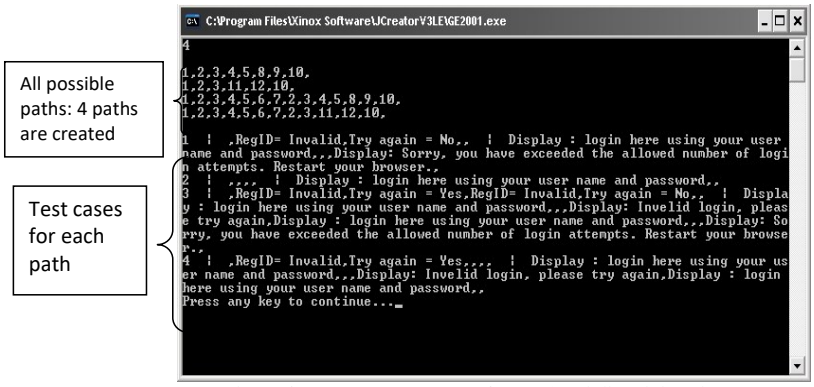

Figure 3. The program result for the "login" activity diagram

This result contains all possible paths that are generated from the algorithm based on given activity diagram as shown in Figure 3. The detail for each path together with saved nodes is used to generate the test cases. The test cases generated for Login activity diagram can be seen in Table 1 in the last column. Column two shows the branch conditions that each path follows.

Table 1. The generated test cases for "Login"

Test case	Sequence of Branch Conditions	Activity Sequence
1	RegID=Invalid Try again=No	Display: Login here using your user name and password , Display: Sorry, you have exceeded the allowed number of login attempts. Restart your browser.
2	RegID=Valid	Display: Login here using your user name and password , Launch student main view page.
3	RegID=Invalid Try again=Yes RegID=Invalid Try again=No	Display: Login here using your user name and password, Display: Invalid login, please try again. Display: Login here using your user name and password, Display: Sorry, you have exceeded the allowed number of login attempts. Restart your browser.
4	RegID=Invalid Try again=Yes RegID=Valid	Display: Login here using your user name and password, Display: Invalid login, please try again, Display: Login here using your user name and password, Launch student main view page.

Test Result

Four student functionalities have been automatically generated using the proposed test case generator prototype. The generated test cases are compared with the test cases manually generated by Alshammari (2010). From this comparison, it shows that the test cases generated

by the developed test case generator program are the same as the one manually derived. Therefore, it can be concluded that the proposed algorithm is usable and reliable.

FUTURE WORK

In the future, this algorithm can be generalized so that it can accommodate various test coverage criteria within the same test derivation framework. This prototype can be improved by developing the ability to build directed graph and parse test cases from it. The UML activity diagrams that have been used in this research were using UML 1.0 version. For the future work, the use of UML 2.0 notation is recommended. Additionally, the UML activity diagrams were generated manually in the work; therefore, the use of a tool that is able to automatically generate these diagrams is suggested.

CONCLUSION

The use of active graph is a good method to ensure that the generation of the test cases automatically using the proposed algorithm and its implementation, and using the UML activity diagram as a base to guarantee the ability of automatic implementation. The reusability of this research work can be applied to complete full automatic analysis. This test will open new opportunity to discover new techniques or methods for the testing using UML diagrams and automatic test cases generation.

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VALIDATION OF MGBL ENGINEERING MODEL USING GROUP TREATMENT EXPERIMENTAL STUDY

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ABSTRACT. A mGBL engineering model is proposed intentionally for developing mGBL applications and is outlined in this paper to provide novice developers with an integrated model with which they can approach more systematically the design and development of mGBL. The engineering model combines a game life cycle based on iterative prototyping and learning model, with supporting activities drawn from sources of best practice in mobile game development. This paper describes an experimental study involving the implementation of the proposed model with a group of undergraduate students who are taking Game Application Development course. The results indicate that the proposed model was practical and workable in developing mGBL applications compared to other models.

Keywords: mGBL, experimental study, group treatment, mobile game based learning, engineering model.

INTRODUCTION

Mobile game-based learning (mGBL) can be defined as a game specifically utilized for learning which is played on mobile devices such as mobile phones. The main objective of mGBL is to use game play to enhance motivation in learning, engage in knowledge acquisition, and improve effectiveness of learning activities through mobile environment. Furthermore, mobile environment offers learning in a natural setting, everywhere, and anytime. For those prospective reasons, the key challenges for effective learning with mGBL are for the learners to be interested, motivated, engaged, and mobility accessed.

There is a global trend to incorporate mGBL into learning environment to increase the efficiency, cost effectiveness and quality of learning. However, the literature still lacks of the mGBL design and development guidelines. Also, due to the different nature of mGBL, the issues to further explore the design and development of mGBL to help developers make the learning context more valuable are needed. Therefore, a mGBL engineering model is proposed (as described in the next section) which incorporates learning models and structured processes which aims to provide the steps and stages on mGBL design and development. In validating the proposed model, a group treatment experimental study was conducted by comparing to other models. The result from the study will test the hypothesis whether the proposed model is applicable.

THE PROPOSED MGBL ENGINEERING MODEL

The proposed mGBL engineering model comprises phases, components, activities, and deliverables. This model is proposed intentionally for guiding developers to develop mGBL applications. A better mGBL application delivery is also expected by implementing the proposed model. It is divided into two layers, where the first inner layer is called as general phases; pre-production, production and post-production. In the second layer, there are

components should be included for each respected phase as illustrated in Figure 1. The three phases are executed in a sequential manner which starting from pre-production phase followed by production phase and then post-production (the clockwise-direction arrows represent the flows of the phases). After completing the first phase, all designs are sent for review before second phase is taken place. Any amendments are made and corrected after review. If the design are approved and signed off, the production phase is carried on next. The similar review activity also should be conducted after completing the production phase. All errors and inaccuracy of technical aspects of the game are rectified before it continues to the final phase.

The engineering model also includes components which are numbered from 1 to 12. These components are flexible and iterative, which can be customized based upon developer preferences. These components are mapped to the AI four stages: i.e. discover, dream, design and delivery. In addition, the mGBL engineering model suggests the expanded guidelines by providing specific objectives, activities, and deliverables for each component.

In pre-production phase, four components are identified which are essential to be considered at the initial stage of mGBL development, namely Requirement Analysis and Planning; Mobile Interaction and Technical Analysis; Learning Content Design; and Game Features Design. This phase is initially about discovering the target audience, conceptualizing of idea, designing interaction, specifying learning domain and creating storyboard. At this stage, creating the mGBL concept is vital activities which will be referred to. All of the theories should be embedded in the mGBL learning content design in order to achieve the learning objective. The next phase is shifting to real development of the mGBL where it is coded and integrated with features as specified in the previous phase. Components should be included in this phase are Learning Content Development; Game Assets Development; Coding and Core Mechanics Development; and Game Features Integration. The most important component in this phase is the learning content development which focuses on the learning concept and contents. The learning contents development should be referred from the content experts. Finally, at the final phase, the core activity is the testing procedure to ensure its quality before releasing to the market. Game Porting and Deployment; Playability,

Usability and Mobility Testing; Educational Testing; and Distribution are the main components in this phase. Deployment step is essential at this stage to cater problems of running on different platforms of mobile devices. The platforms vary in different types and categories such as Symbian, Windows Mobile, Java, and Palm OS. In addition, this engineering model also provides flow of documents and deliverables to be referred to for documentation and references (Zaibon & Shiratuddin, 2010). In validating the proposed model, a group treatment experimental study was set up as described in the next section.

MODEL VALIDATION USING GROUP TREATMENT EXPERIMENTAL STUDY

A group treatment experimental study was conducted involving the implementation of the proposed model with a group of undergraduate students who are taking Game Application Development course at Universiti Utara Malaysia. 70 students participated in this study and they were divided into four groups for comparison as illustrated in Table 1. Group A, B, and C were allocated as the control groups while group D was the experimental group. They were required to use the given model as a basis for designing and developing mGBL applications for their final project. This study was carried out concurrently for all groups and took a whole semester. Each group was given detail descriptions of their model and both course instructor and researcher helped students in terms of the technical aspects for developing mGBL.

Table 4. Experimental and control groups

Group	N	Types of Development Model
A (Control)	18	Analysis, Design, Development, Implementation, Evaluation (ADDIE)
B (Control)	20	Input-Process-Output (IPO)
C (Control)	14	Game Life Cycle (GLC)
D (Experimental)	18	mGBL engineering model (mGBL)
Total	**70**	

Table 2. Evaluation Dimensions

	Dimensions	Descriptions
1.	Visibility	The model is visible to the game developers, so that the developers can judge the relevance and completeness of the game development.
2.	Complexity	Complexity is the degree to which a model is perceived as being difficult to use. The more complex of the model, the more difficult to use. Learning about the model should be easy, clear and understandable.
3.	Compatibility	Compatibility refers to the degree to which a model is perceived as being consistent with the existing values, needs, and past experiences of game developers.
4.	Flexibility	The model provides flexible development process with minimal planning. The model is also adaptive and responsive to changing user needs. The model should be flexible and adaptable for future use.
5.	Clarity	The model as a whole is workable. The phases in the model are easily followed and steps or activities included in the model are easy to apply. The model also provides specific guide to mGBL development.
6.	Effectiveness	The model is perceived as being better than its precursor. By using the model, it will increase productivity, effectiveness and quality of mGBL development.
7.	Manageability	The processes and activities in the model to be capable of being managed or controlled. In general, the model also provides project management.
8.	Evolutionary	The model provides the dynamic process which evolves through continuous feedback from users. The model is capable of incremental change, to cope with new ideas or technological opportunities. The model provides developers to communicate and collaborate with users continuously to incorporate their evolving requirements.

In validating the proposed model, some evaluation dimensions were studied which can be used for the model assessment. A number of evaluation dimensions have been proposed by researchers to evaluate models and methodologies which come from different fields such as general software development, multimedia applications, and project management. These are from Veryard (1985), Platts (1990), Henderson-Sellers (1995), Lang and Barry (2001),

Riemenschneider (2002), Yu and Cysneiros (2002), Ciconte (2003), Hecksel (2004), Bonner (2008), and Kerzner (2006). These dimensions were composed as illustrated in Table 2. Table 3 presents the mean of all models based on the 8 dimensions denoted by students. It shows that mGBL engineering model scored mean above 7.0 (out of 10) of all dimensions compared to other models. This suggested that the mGBL engineering model is highly accepted by the experimental groups.

Table 5. Means and standard deviations for four models and eight variables

	ADDIE		IPO		GLC		mGBL	
Dimension/ Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Visibility	6.722	1.300	6.483	1.374	6.714	1.563	7.833	1.195
Complexity	6.300	1.224	6.320	1.640	6.886	1.836	7.022	1.768
Compatibility	6.611	0.981	6.720	1.245	6.471	1.599	7.467	1.552
Flexibility	6.847	1.269	6.488	0.985	6.607	1.675	7.750	0.928
Clarity	7.236	1.044	6.469	1.173	6.277	2.091	8.035	1.317
Effectiveness	7.011	1.103	6.640	1.203	6.271	1.746	7.922	1.336
Manageability	6.792	1.412	6.675	1.095	6.589	1.890	7.917	1.406
Evolutionary	7.233	1.152	6.580	1.131	6.357	1.681	8.222	1.127

In order to ensure there are significant different between all groups, one way ANOVA was run eight times for each dimension. The results show that there are significant differences ($p < .05$) between all groups in term of Visibility with $F(3, 66) = 3.666$, $p = .017$; Flexibility with $F(3, 66) = 3.996$, $p = .011$; and Manageability with $F(3, 66) = 3.278$, $p = 0.26$. For dimension Clarity and Effectiveness there are very significant differences between all groups with $F(3, 66) = 5.571$, $p = .002$ and $F(3, 66) = 4.717$, $p = .005$ respectively. The result also indicates that the Evolutionary dimension is highly significantly different of all groups with $F(3, 66) = 7.543$, $p = .000$. However, two dimensions are not significantly different ($p > .5$): Complexity $F(3, 66) = 0.956$, $p = .419$ and Compatibility $F(3, 66) = 1.869$, $p = .143$. The reasons could be due to that students felt the models were complex with many steps or activities to be followed, therefore not well-suited to them as novice developers. In order to detect differences among groups, a multiple comparison test using Tukey Least Significant Difference (LSD) is utilized. The test can be used to determine whether a significant mean difference exists between each pair of groups (Table 4).

Table 6. Multiple comparisons between models using Tukey LSD

Types of Model		**Mean Different (I – J) for Each Dimension**							
(I)	(J)	Visibility	Complexity	Compatibility	Flexibility	Clarity	Effectiveness	Manageability	Evolutionary
mGBL	ADDIE	1.111* p= 0.016	0.722 p= 0.186	0.856 p= 0.061	0.903* p= 0.029	0.799 p= 0.094	0.911* p= 0.045	1.125* p= 0.022	0.989* p= 0.022
	IPO	1.350* p= 0.003	0.702 p= 0.187	0.747 p= 0.093	1.263* p= 0.002	1.566* p= 0.001	1.282* p= 0.004	1.242* p= 0.010	1.642* p= 0.000
	GLC	1.119* p= 0.023	0.137 p= 0.814	0.995* p= 0.042	1.143* p= 0.010	1.758* p= 0.001	1.651* p= 0.001	1.327* p= 0.012	1.865* p= 0.000

*The mean difference is significant at the .05 level.

In Visibility dimension, comparing mGBL to ADDIE, IPO, and GLC, mGBL is seen more visible with the mean difference in visibility is large ($M > 1$). The Sig. values of ADDIE ($p = 0.016$), IPO ($p = 0.003$), and GLC ($p = 0.023$) show that this is statistically significant. However in term of Complexity, the mean differences between mGBL to ADDIE, IPO and

GLC are relatively small (M < 0.7) and non-significant ADDIE (p = 0.186), IPO (p = 0.187), GLC (p = 0.814) even though mGBL is less complex than the three models.

In Compatibility dimension, although mGBL scored higher than ADDIE and IPO, the mean difference in compatibility is relatively small (M < 0.9) and the Sig. values (p > .05) shows that this is statistically not significant. In contrast, comparing mGBL to GLC, although the mean difference in compatibility is less than 1 (M = 0.995), the Sig. value (p = 0.042) shows that this is statistically significant. mGBL also gained more score compared to ADDIE, IPO and GLC in Flexibility and statistically significant. To compare mGBL to ADDIE, the mean difference in Clarity is small (M = 0.799) even though the positive sign indicates that mGBL is clearer than ADDIE. The Sig. value (p = 0.094) shows that this is not significant. However, in comparing mGBL to IPO and GLC, the mean difference in clarity is large and the Sig. value (p < .05) shows that this significant. The other three dimensions (Effectiveness, Manageability, Evolutionary) mGBL also have higher scores compared to ADDIE, IPO, and GLC. The mean difference in effectiveness is quite big and the Sig. value (p < .05) shows that this is statistically significant. The positive sign also indicates that mGBL is more effective than GLC. Significantly higher mean scores in visibility, flexibility, clarity, effectiveness, manageability, and evolutionary exhibited by students for mGBL engineering model, indicated that they understand how to implement the model as guideline for their mobile game development project. They also have completed their project in a systematic manner without having difficulties in finding the game requirements especially related to mobile game for learning. Nevertheless some minor issues with the mGBL engineering model did become noticeable where a few students found some of them confusing. These issues are related in particular to some aspects of technical testing for their project. In answering the main research question, a hypothesis testing was conducted. The hypothesis null is as follows:

H_0: The proposed mGBL engineering model is not significantly applicable.

Based on results of the experimental study, it can be summarized that the 8 evaluation dimensions can be defined as a single term which is applicability. Therefore one-way ANOVA test was run another round (included all 8 dimensions) that test the applicability of the proposed model as indicated in Table 5. In comparison of the applicability of the proposed model with other models, the results show significant values p = .007 (p < .05) with the value of F (3, 66) = 4.341. Here, the result shows that the null hypothesis would not be accepted. Therefore, it can be concluded that the proposed mGBL engineering model is significantly applicable in designing and developing mGBL.

Table 5. One Way Analyses of Variance for Four Models on Applicability

Attributes	df	SS	Mean Square	F(3,66)	Sig.
Applicability					
Between Groups	3	25.329	6.045	4.341	.007 *
Within Groups	66	118.145	1.392		

*significant level at .05

CONCLUSION

This study has proposed the mGBL engineering model that can be helpful for the developers to follow through for developing mGBL applications which make the mGBL more effective for learning environment. This study also validated the proposed model based on 8 dimensions, namely: visibility, complexity, compatibility, flexibility, clarity, effectiveness, manageability, and evolutionary. In the group treatment experimental study, the results indicated that six dimensions (visibility, flexibility, clarity, effectiveness, manageability, and evolutionary) were significantly different to all models, however two dimensions (complexity and compatibility) were not significantly different. These results showed that the mGBL engineering model scored a high overall mean. Hypothesis testing was also conducted and the

result shows that the null hypothesis rejected. This implied that the proposed model could be implemented by potential developers to develop mGBL applications. A number of future considerations can be suggested for this study, for example the experimental study should be extended to other group of students and to developers in commercial and industry environments. Validation, verification and testing along the whole process of the proposed mGBL engineering model also required to be focused on. Such findings can perhaps provide richer information and more discussions. In addition, the evaluation session can be conducted to other mGBL applications.

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EXPLORING FACTORS THAT INFLUENCE TELEWORKERS IN THE SEARCH FOR WORK-FAMILY BALANCE

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ABSTRACT: The purpose of this paper is to present the factors that influence teleworkers in managing border between work and family in order to attain balance. By understanding the individuals characteristics may help telewokers in balancing their work and home life. The study used the qualitative method by focusing on a single case study. Three types of techniques in collecting data were used; interviews, on-line survey and discussion forums. The interpretative analysis technique was used to analyze the data and the results were produced based on the analysis. This paper contributes to our understanding the personality factors of teleworkers success in balancing work and home life. The results show that factors such as time management, discipline, family support , motivation, and patience are important in managing work and family while working from home.

Keywords: teleworking, work-family balance, boundary, personality factors

INTRODUCTION

The advancement of Information and Communication Technology (ICT) has made possible for people to work at any time and from anywhere. Teleworking or telecommuting, the practice of setting up home offices for employees with appropriate resources for computing and communication is one example of the working alternatives. This option has given individuals freedom to do paid work and domestic work based on their needs. Job satisfaction was reported as the most consistent individual's benefits among teleworkers (Jamal, 2007).

According to Felstead & Jewson (2000), the major problem faced by teleworkers is work-family conflict. Work-family conflict is a form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect (Greenhaus & Beutell, 1985). The proposed solution to the problem work-family conflict was the idea of work-family balance whereas work and family should be balanced (Akdere, 2006). The aim of this paper is to present the findings of a study on factors that influence teleworker in managing boundary between work and family domain in balancing work and family life. Work-family balance is defined as individual having control over when, where and how they work, leading them to be able to enjoy an optimal quality of life as well as family (The Work Foundation, 2005). The focus of this study is on the eHomemakers Malaysia that is a cyber-community network that promotes working from home, teleworking and the Small Office and Home Office (SOHO) businesses through the utilization of ICT.

TELEWORKING

Based on the European Commission's E-Work 2000 Status Report, there are three main categories of telework: home-based telework, mobile telework and telework by self-employed Small Office/Home Office (SOHO). In this study, telework is defined as working from home on a full-time basis using ICT in performing paid work (Vora & Mahmasani, 2002). This definition is able to capture a wide range of activities, including work that is home-based, outsourced, self-employed, employed directly by a company or freelance or mobile teleworkers (Qvortrup, 1998).

Teleworking Benefits

The advantages of teleworking can be approached from the perspective of individual or worker, organization, and society in general. For the individual, the benefits may include increase opportunities and choices, job satisfaction, generally improving the quality of life (Jamal, 2007). For the organizations, the benefits may arise from better quality of work output; increase worker productivity and attitude of workforce in addition to financial benefits (Crandal & Gao, 2005) The benefits for the community may be in the form of intangible benefits such as helping alleviate the number of vehicles on the road (Harpaz, 2002) and consequently, reducing the amount of pollution and oil consumption (Mills et al., 2001). Rural communities also view telecommuting not only as a potential strategy for economic development but one that is environmentally friendly (Turban, Reiner, & Potter, 2003)

Blurring boundaries and work-family balance

Evidence from the literature on teleworking has shown that teleworking is not the solution for work-family balance (Baruch, 2000; Jamal, 2007; Kurland & Bailey, 1999). Since work is done at home, boundaries between work and family become blur or ambiguity (Baruch, 2000). Teleworkers have difficulties to separate their work and family activities, which may lead possible stress (Desrochers et al. 2005; Golden et al. 2006).

Studies have shown that the problem of blurring boundaries can be reduced by managing the border between work and family domain (Kowalski & Swanson, 2005; Matthews, 2007). Therefore, finding the solution on how individuals can manage the boundary is essential in order to achieve work-family balance.

Practices of Malaysian Teleworkers

In Malaysia, teleworking concept is one of the government initiatives to help women who are not working or who were forced to stop working due to domestic commitments to be able to generate their own source of income (http://www.kpwk.gov.my). The government hopes that this concept will encourage them to contribute to the country's economy as well as strengthen the family institution. There is minimal research on teleworking arrangement where majority of the companies in this country do not officially recognize teleworking concept (Karia et al, 2003; Ndubisi & Kahraman, 2005). Karia et al. (2003) also reported that the discipline regarding work, improved productivity, and degree of concern quality of work delivered are the motivating factors for the human resource managers to consider telecommuting as a part of their organization.

A study by eHomemakers (2003) found that ICT usage and time flexibility have improved the life of teleworkers especially women. However, they found that women have greater difficulty in separating their work and home life as they often face problems in balancing their careers and family responsibilities. In December 2009, Ministry of Works has launched three months work from home pilot project where thirty-nine (39) draftsmen from Public Works Department (JKR) have been selected as pioneers (The Sun, January, 2010). The government reported that the project was successful where the staffs' productivity has 100% increases while working at home. The government planned to continue the programmed in future

depending on the approval from the Department of Public Service (Utusan Malaysia, 18 September, 2010).

METHODOLOGY

A qualitative method was used in this study with the focus on a single case study. This case study would offer a rich depiction of the teleworking and helps the workers relationship, interpretations and behaviors

In order to test the consistency of the findings, triangulation method was used (Yin, 2003). The data was collected using interview and online survey method where semi structured and open question were prepared to achieve the clear view of the teleworkers characteristics in managing border between work and family life towards work family balance. Data was alos gathered from a discussion forum in eHomemeakers portal. The sampling frame for this study was individual who have registered with the eHomemakers Malaysia. The eHomemakers Malaysia is a community for housewives and home workers who have opted for the role of parenting as their main responsibility and home office as an alternative lifestyle. In summary the study focuses on three types of telework in the eHomemakers that is: (1) home-based workers; (2) mobile workers; and (3) self-employed in SOHO.

RESPONDENTS' PROFILE

A total of seventy six (76) respondents have participated in this study. Out of this, five (5) were responses from interview, and seventy one (71) were from online survey. About 71% of the respondents are women. Respondents are spread across all age groups; from 21-30 to 56 plus. Majority of the respondents (62%), are in 31-40 years old, 14 (18%) are between 21-30 years, 11 (14%) are between 41-50 years and four (5%) are above 50 years. Majority of the respondents (71%) are Malay. About 76% are married, 9% respondents are single parents, and 14% are still single. Referring to the academic background, 37 (49%) of the respondents possess bachelor degree, 24 (32%) respondents have Diploma, 10 (13%) respondents with Sijil Pelajaran Malaysia (SPM), four (5%) respondents possess master degree and one (1%) respondent has Sijil Tinggi Peperiksaan Malaysia (STPM). All of the respondents are self-employed. More than half respondents (51%) had experience less than 2 years, 36% respondent between 2 to 4 years and 13% respondents with more than 5 years. Majority of the respondents (62%) have average monthly income between RM1001-RM3000.

DATA ANALYSIS AND DISCUSSION

The questions were provided to identify factors influencing teleworker in managing border to attain balance. The study has classified the answers into five thematic categories including i) time management, ii) discipline, iii) family support, iv) motivation, and v) patience.

Time Management

From a total of 76 respondents , only 38 (50%) stated that having a good **time management** such as scheduling and proper planning in terms of time, space and people will ease them in managing of home and work. Teleworkers said that they they can manage their own time according to their task at home. They were able to break up assignments into manageable chunks or deadline into steps.

Commented [DH1]: Delete lah sebab kita bagi findings je kat sini.

Discipline

A total of 30 (39%) teleworkers stressed that strong **self-discipline** is very important to individual who work at home. They suggested that discipline is a vital factor that influences them in managing the border between work and family domain to attain balance

Family Support

The next theme is **family support.** A total of 17 teleworkers identified support from spouses and children as critical to their ability to manage both their professional and personal responsibilities. High on the list of family support was spousal support, in which respondents overwhelmingly credited their husbands' support as the reason they are able to meet the expectations and demands of their jobs. They agreed that understanding, negotiation and cooperation from the family members contribute to achieve balance in work and family life.

Motivation

Another theme is **motivation** where 16 of them (21%) stated that strong self-motivation such as self-driven, positive thinking, high spiritual, strong foundation in religion, and love for family have influenced them in managing border between work and family in order to attain balance. A male respondent with five years of experience working from home stressed the need for strong motivation and discipline in order to complete work.

Patience

The next theme for the factors that influence teleworkers in managing border between work and family is **patience**. Thirteen respondents (17%) claimed that patience is a fundamental characteristic in order to achieve work-family balance while working from home. For instance, a respondent with two years of experience working from home has talked about patience and passion and both should come together in order to manage work and family effectively.

There are also other factors that influence balance between work and family namely **spirituality, professionalism, responsibility, love, teamwork, knowledge as well as IT literacy**. Several respondents credited the strength they draw from their spiritual faith as foundational to their ability to cope with and manage their professional and personal responsibilities.

CONCLUSION

The paper contends that teleworkers in this study did achieve balancing in their work and family life by having certain characteristics such as high self discipline, good time management for work and family, highly motivated, patience and tolerance. These findings also show that employee must be self disciplined, a good time manager, organized and able to work without structure as supported Kinsman, (1988) in Riley & McCloskey (1996). This study help us to understand the consequences of new ways of working that enable individuals and interested parties (e.g. self-employed people) to explore innovative ways to achieve business and personal goals. In addition, it contributes to making plans for improving the individuals in developing their skills in managing boundaries between work and family life.

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A DYNAMIC REPLICA CREATION: WHICH FILE TO REPLICATE?

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ABSTRACT. Data Grid is an infrastructure that manages huge amount of data files and provides intensive computational resources across geographically distributed collaboration. To increase resource availability and to ease resource sharing in such environment, there is a need for replication services. Data replication is one of the methods used to improve the performance of data access in distributed systems. In this paper, we propose a dynamic replication strategy that is based on exponential growth or decay rate and dependency level of data files (EXPM). Simulation results (via Optorsim) show that EXPM outperformed LALW in the measured metrics – mean job execution time, effective network usage and average storage usage.

Keywords: Data Grid, resource sharing, data replication, EXPM

INTRODUCTION

A Data Grid (Venugopal, 2006) is a geographically-distributed collaboration in which all members require access to the datasets produced within the collaboration. In Data Grids (Foster, 2001)(Foster, 2002), distributed scientific and engineering applications often require access to a large amount of data or they continuously generate several terabytes, even petabytes, of raw data in data grid. Therefore one of the tasks in Data Grid is to manage the huge amount of data and facilitate data and resource sharing. In order to achieve this task, data must be copied and stored in several physical locations to vouch the efficient access, without a large consumption of the bandwidth and access latency. In other words, such a system requires replica management services that create and manage multiple copies of files. Creating replicas can reroute the client requests to certain replica sites and offer a higher access speed than a single server (Tang, 2005)

In a Data Grid, when a file is required by a job and is not available on local storage, it may either be replicated or read remotely. If a file is replicated, the next time it is requested, the job can read it quickly and the time to complete the job will be reduced. But, if replicating a file requires deletion of other files, execution of certain jobs (in the future) may take longer. Therefore, an important decision of determining files to be replicated must be made. Replica value is defined as the number of times a replica will be requested in a future time window. There are two types of replica request; a direct request from user, i.e. a user directly access a file, and an indirect request from a file, i.e. a file accesses other files by calling one or more of its methods. Most of the existing works (Chang, 2006) (Tang, 2006) (Tang, 2005) focus on the first type of request and ignore the one made by files. Such approaches determine the importance of a file by only tracking users' request. This may be applicable if files in Data Grid system are running independently, i.e. files can be executed without invoking other files. But, if files are running dependently, there is a need to assume both direct and indirect requests. In this paper, a dynamic replication strategy, known as Exponential

Mechanism (EXPM), is designed by tracking both the users and file behavior. Outcome of this strategy is the identification of files to be replicated.

The rest of this paper is structured as follows. Section 2 provides a brief description on existing work in dynamic replication strategies, focusing on how to identify files that need to be replicated. We include details of our proposed replication strategy in Section 3 and the performance evaluation is presented in Section 4. Finally, we conclude the paper in Section 5.

RELATED WORKS

In this section, we introduce some of the studies undertaken involving dynamic replication strategies. Two dynamic replication mechanisms (Tang, 2005) are proposed in the multi-tier architecture for Data Grids, including Simple Bottom-Up (SBU) and Aggregate Bottom-Up (ABU). The SBU algorithm replicates any data file that exceeds a pre-defined threshold. The main shortcoming of SBU is the lack of consideration to the relationship with historical access records. For the sake of addressing the problem, ABU is designed to aggregate the historical records to the upper tier until it reaches the root. Let us consider the data shown in Figure 1. It is an example of access history for two files, X and Y. In addition, the predefined threshold is 10. According to SBU algorithm, if the parent P1 has enough space, file X will be replicated, since the value of its *numOfAccess* is greater than threshold. On the other hand, file Y will be overlooked, although from the viewpoint of the overall system (looking the system as a whole) it was accessed for 16 times (6 + 10). This means that file Y is more popular compared to file X and therefore should be replicated instead of file X. But SBU algorithm processes the access history individually, and does not consider the relation among the accessed files. In the contrary, Aggregate Bottom Up (ABU) takes into consideration the relation among the files, since it aggregates the files included under the same node, and the file with the highest rate will be replicated. Revert to the same example and apply ABU, the records after aggregation are < P1 , X , 12> and < P1 , Y , 16 >.

nodID	fileID	numOfAccess
C1	X	12
C2	Y	6
C3	Y	10

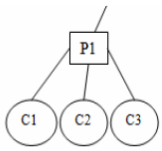

Figure 1: An example of the history and the node relation

The dynamic replication algorithm proposed in (Tang, 2006) determines popularity of a file by analyzing data access history. The researcher believes that the popular data in the past will remain popular in the near future. The history table is in the format of < FID , NOA >, which indicates that the file FID (file ID) has been accessed NOA (number of access) times. Having analyzed data access history, the average number of access, NOA, is computed. Files with NOA's value that is greater than the computer average NOA will be replicated. Hence, the order of which files to be replicated depends on the NOA. The larger the NOA, the more popular the file is and will be given a higher priority during the replication process.

Nevertheless, these replication strategies did not consider time period of when the files were accessed. If a file was accessed for a number of times in the past, while none was made recently, the file would still be considered popular and hence will be replicated. The algorithm proposed in (Chang, 2006) called Last Access Largest Weight (LALW) tries to solve this problem. The key point of LALW is to give different weights to files having different age. The LALW algorithm is similar to other algorithms (Tang, 2006) by means of using information on access history to determine popularity of a file. But, the innovation is included by adding a tag to each access history record of a file. The weight of the record decays to half of its previous weight after a constant time interval. Older access history

records have smaller weights; it means that a more recent historical record is more important. An Access Frequency is calculated to represent the importance of access histories in different time intervals and this is achieved using the formula stated as below.

$$Af(f) = a_0 + \sum_{t=1}^{N_T} \left(a_f^t \times 2^{-(N_T - t)}\right), \forall f \in F$$

Where: N_T is the number of time intervals, F is the set of files that have been requested, and a_f^t indicates the number of accesses for file f at time interval t.

However, this approach (i.e. LALW system) assumes that the decay rate is constant and equals ½ that means all of files decay in the same rate regardless the access rate of each one. As a result, the declension rate of weight will be slower. Subsequently the storage element will take time to delete the unwanted files (i.e. the less important files). To address this problem we propose that the value of file growth/decay varies based on the access rate of the file. That means the growth/decay rate of each file is not the same.

THE PROPOSED MODEL

Our replication system is designed by integrating information on file popularity from two perspectives; users and the file system. The first viewpoint is based on users behavior of requesting a file while the latter utilize information on dependencies of files in the grid system.

Users' Behavior of Requesting a File (File Lifetime)

Many real world phenomena can be modeled by functions that describe how things grow or decay as time passes (Kapitza, 2003, Kremer, 1993). Exponential growth/decay is a positive or negative growth in which the rate of growth is proportional to the current size (Richards, 1959, Bartlett, 1996). This work proposes to apply the exponential growth/decay rate in determining importance of a file (Madi, 2009). We describe an exponential growth/decay model for file's number of access in access history. The process of accessing files in data grid environment follows an exponential model. If we use N_f^t to represent the number of access for file f at time t, and N_f^{t+1} to represent the number of access at time $t+1$, our exponential growth/decay model would be given by:

$$N_f^{t+1} = N_f^t \times (1 + r) \quad (1.1)$$

Where: r is the growth or decay rate in number of access of a file in one time interval. Therefore, we can calculate the value of r using the following formula:

$$r = \left(N_f^{t+1}/N_f^t\right) - 1 \quad (1.1.1)$$

Assume t is the number of intervals passed, and N_f^t indicates the number of access for the file f at time interval t, then we get the sequence of access numbers:

$N_f^0\ N_f^1\ N_f^2\ N_f^3 \ldots\ N_f^{t-1}\ N_f^t$

Therefore, there are $t-1$ time intervals, and each time interval has a growth or decay rate in number of access of a file. So, according to the exponential growth/decay model we can write:

$$r_0 = \left(N_f^1/N_f^0\right) - 1,\ \ r_1 = \left(N_f^2/N_f^1\right) - 1,\ \ r_2 = \left(N_f^3/N_f^2\right) - 1,$$
$$r_{t-1} = \left(N_f^t/N_f^{t-1}\right) - 1 \quad (1.1.2)$$

Therefore the average rate for all intervals is $r = \sum_0^{t-1} r_i/t - 1$ (1.1.3)

Having known the average accessed rate (growth or decay) for a file during the past intervals, we can estimate the number of access for upcoming time interval:

$$\text{File Lifetime} = N_f^t \times (1 + r)$$

In order to avoid extreme cases where the growth or decay rate is equal to infinity, we are assuming that all files have been accessed for at least once.

Files Behavior of Requesting a File (File Weight)

In a distributed system, there are files that require other files in order to be executed - dependency level of a file. A file depends on other file if it needs the later during compilation and/ or execution. The dependency level differs from one file to another, in other words, the importance of a file to the environment is not the same. Our concern is to find the importance of a file to all files in the system. This is termed as File Weight (FW). The File Weight is computed by the following equation:

$$\text{File Weight} = \sum_{i=1}^{n} NOA_i \times DL_i \quad (1.2)$$

Where, n: Total number of the files in the grid system, NOA: Number of access of the file that needs the underlying file, DL: The dependency level of the file, if there is no dependency then the DL is zero.

In order to understand how to calculate File Weight, consider the following example: Suppose that we have four files in a grid system: File1, File2, File3 and File4. The DL and NOA for the files are shown in Figure 2.

$$File\ Weight(File_1) = 0$$

$$File\ Weight(File_2) = (20 * 0.45) + (15 * 0.39) = 14.85$$

$$File\ Weight(File_3) = (20 * 0.15) + (30 * 0.20) = 9$$

$$File\ Weight(File_4) = 0$$

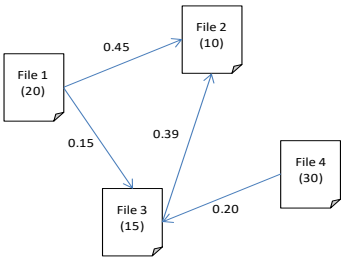

Figure 2: An example files dependency

Based on Figure 2, File 2 has the highest weight among the files, which means File 2 is the most important file for the current grid system. FW And FL are used to compute the $File\ Value$, that indicates the volume of demand on a file in the grid system. The larger $File\ Value$,is for a file, the more popular is the file. Hence, it needs to be replicated. $File\ Value$ is computed by the following equation:

$$File\ Value = FL + FW \quad (1.2.1)$$

EXPERIMENTAL ENVIRONMENT

Dynamic replication algorithms must be tested before deploying them in real Data Grid environments. A Grid simulator that is called OptorSim (Bell, 2003) which was developed by the European Data Grid project is used in order to implement and evaluate the proposed algorithm. The topology of our simulated platform adapts the topology and configuration used in (Chang, 2006) as it is the most similar work to ours. This configuration has four clusters and each one has three sites. One site has the most capacity in order to hold all the master files at the beginning of the simulation. The others have a uniform size, 50GB. All the network bandwidth is set as 100 Mbits/sec. The connection bandwidth is 100 Mbps. There are 500 jobs need to be submitted. We ran the simulation with 500 jobs. A job is submitted to Resource Broker every 25 second. Resource Broker then submits to Computing Element according to an appropriate scheduling algorithm. There are 6 job

types, and each job type requires specific files for execution. The order of files accessed in a job is sequential and is set in the job configuration file as an input to the simulation. The number of files in our simulation is 150, and a file size is 1GB.

Simulation Results

The performance metrics we chose to evaluate the proposed system are: Mean Job Execution Time (MJET), Efficient Network Usage (ENU), and Average Storage Usage (ASU). MJET is the average time a job takes to execute, from the moment it is scheduled to Computing Element to the moment when it has finished processing all the required files. ENU (Cameron, 2004, Bell,2003) is used to estimate the efficiency of network resource usage. A lower value indicates that the utilization of network bandwidth is more efficient. ASU is a percentage of capacity consumed by files over the total capacity for the underlying storage. The proposed model (EXPM) is compared against the Simple Optimizer and LALW (Last Access Largest Weight). The Simple Optimizer is a base case which does not involve any replication and files are accessed remotely. The LALW algorithm is as presented in (Chang, 2006).

A summary of the results is shown in Table 1. As shown in Figure 3, the mean job execution time using EXPM is about 22% faster than Simple optimizer, and 5% than LALW. Figure 4 illustrates the ENU metric of the three strategies. The Simple Optimizer consumes the most network bandwidth as CEs need to read all files remotely. However, LALW and EXPM reduce the bandwidth consumption by half. Moreover, EXPM outperforms LALW by 9% in improving ENU. This is because number of replications required by EXPM is less LALW - EXPM depends on two criteria to determine files that require replication as compared to only one by LALW. Figure 5 illustrates the storage value of the strategies - Simple Optimizer uses the least amount of storage while the EXPM outperforms LALW by 7%. This is because in EXPM, the base of exponential decay varies based on the access rate of the file. Contrary to LALW approach which assumes that the base of exponential decay is constant and equals ½ - all files decay in the same rate regardless of its access rate. As a result, the declension rate of weight will be slower.

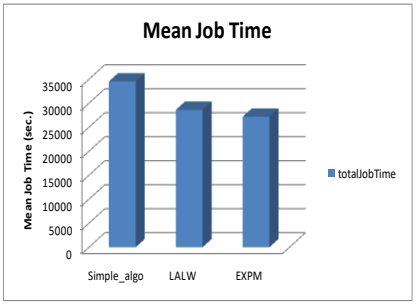

Figure 3: Mean job execution time

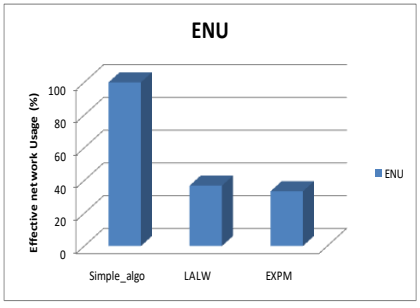

Figure 4: Effective Network Usage

Table 1: Simulation results of LALW and EXPM

	Simple_algo	LALW	EXPM
ASU	10.42	23.32	21.69
ENU	100.00	36.87	33.43
Mean Job Time	34573.52	28626.88	27195.53

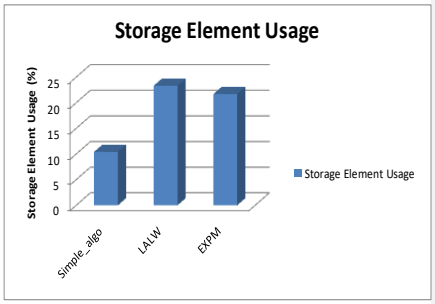

Figure 5: Storage Resources Usage

CONCLUSION

Exponential growth and decay are mathematical changes. The rate of the change continues to either increase or decrease as time passes. In this paper we adopted the exponential growth and decay, and file dependency in determining files that need to be replicated. Such an approach considers both the user and file behaviors. Simulation results (via Optorsim) show that the proposed strategy, EXPM, outperformed LALW in the measured metrics – mean job execution time, effective network usage and average storage usage. For future work, we plan to extend our model to include decision on replica deletion by investigating approaches to determine the minimum and maximum threshold to categorize popularity of files.

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PAIR PROGRAMMING IN INDUCING KNOWLEDGE SHARING

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ABSTRACT. The Pair programming as a part of the Agile software development has been gaining acceptance among practitioners and software development community. This successful leads a wide use of pair programming in educational setting as pedagogy in programming course. Pair programming can foster knowledge sharing among students. Many studies have been done with pair programming in education however most of them do not highlight internalized knowledge particularly tacit knowledge from knowledge sharing processes between students who act as driver and navigator in pair programming practice. Thus, this paper will discuss knowledge internalization based on the knowledge sharing activities in pair programming practices by employing the process of Socialization, Externalization, Combination and Internalization (SECI). The sample of the study consisted of 60 students who were actively engaged in pair programming practices. The factors investigated were types of internalized tacit knowledge in the form of learning, thinking and decision making skills among the students. Online questionnaires were adapted from SECI model into educational context. T Test technique was used to analyze the data. This study is expected to contribute a better understanding of important knowledge sharing activities to construct student's skills during Internalization process through pair programming. This study's result will be considered for future rigorous theoretical framework for constructing tacit knowledge among the students in pair programming environment.

Keywords: pair programming, knowledge sharing, SECI

INTRODUCTION

Pair programming as one of the key practices in Extreme Programming has been gaining acceptance among practitioners and software development community. This successful leads a wide use of pair programming in educational setting as a computer science or software engineering pedagogical tool especially in programming courses (Canfora et al., 2003; Brereton et al., 2009, Cliburn, 2003; Mendes et al., 1997). Various studies have been done on determining the usefulness and effectiveness of Pair Programming as pedagogical tool and indicated the following positive results:

a) Pair programming can improve students' performance by gaining higher scores on programming assignment (Werner et al., 2004; McDowell et al., 2003; Cliburn, 2003; Slaten et al., 2005).

b) Pair programming can increase student's confidence and satisfaction (Werner et al., 2004; McDowell et al., 2003; Cliburn, 2003; Slaten et al., 2005).

c) Pair programming can encourage students to complete the programming course (Werner et al., 2004; McDowell et al., 2003)

Pair programming shifts the programming learning from solitary activity into a collaborative learning process (McDowell et al., 2003). It involves two students who act as a

driver and navigator working on the same problem from design to testing phase. In general, driver is a person who involves in creating and implementing the code, whereas navigator who is responsible in checking errors and suggesting the implementation technique. Navigator provides alternative solution to the given problem and assists the drivers to solve the problem. Meanwhile, driver fully controls all input through the keyboard or mouse and come out with solution based on his/her idea or navigator's suggestions (Williams and Kesler, 2000; Beck, 2005).

Besides roles, switching partners is an important issue that should be considered in implementing the pair programming. Switching partners and roles rotation can induce knowledge sharing among students (Chau and Maurer, 2004; Beck, 2005). This leads to exchange or spread information and knowledge throughout the whole team of software development (Muller and Tichy, 2001). Indeed, a better structured pair interaction is required by having a proper communication within a pair (Gallis et al., 2003; Beck, 2005). Pair programming involves an informal and spontaneous communication as relies on face-to-face communication between driver and navigator (Chau and Maurer, 2004). However, frequent switching of partners is required in achieving knowledge sharing (Gallis et al., 2003).

Pair programming can foster knowledge sharing among students. pair programming is usually performed by students, as novice programmer to develop small programming tasks, which improves knowledge transfer and quality (Vanhanen and Korpi, 2007). Many studies have been done with pair programming in education however most of them do not highlight internalized knowledge particularly tacit knowledge from knowledge sharing processes between students who act as driver and navigator in pair programming practice. Thus, this paper will discuss knowledge internalization based on the knowledge sharing activities in pair programming practices by employing the process of Socialization, Externalization, Combination and Internalization (SECI). For completeness, the overview of knowledge sharing will be discussed more details in section 2. The third section describes the method used in the implementation of this study. The last section describes the result and discussion of this study.

KNOWLEDGE SHARING

Knowledge management is needed to properly manage the knowledge shared within an organization. Knowledge management is a systematic process involving exploration, choosing, rearranging, repairing and information delivering that can uplift individual ability in attended field (Sommerville and Craig, 2006). Apart from managing the knowledge, knowledge management also covers knowledge supervising processes consisting of knowledge creation process, knowledge storing process and knowledge application process and become the basis to new knowledge creation (Natarajan and Shekar, 2001). Generally, knowledge management covers obtaining process, sharing, utilizing and storing knowledge among individuals in an organization. Knowledge sharing is the important part of knowledge management and crucial task in agile software development processes. It is promoting the knowledge transmission among individuals in community or organization and normally supported by the knowledge sharing mode (Fengjie et al., 2004). There are various kind knowledge management modes that enable the individuals to exchange knowledge such as face-to-face communication, conference, knowledge network, and organization learning. However, this study focuses on the face-to-face communication as a knowledge sharing mode in co-located pair programming practices.

According to Fengjie et al.(2004), knowledge sharing process involves two main parties namely contributor and receiver. Contributor contributes a part of his/her knowledge and transmits to the receiver. The receiver will receive the knowledge and try to add his/her understanding and transform it into his/her knowledge. This scenario similar to the pair programming practices where the navigator plays as a contributor and the driver as receiver.

Navigator will provide suggestion in assisting the driver to solve the given problem in implementing the program whereas the driver will use the suggestion given and blend with his/her own knowledge to come out with the best solution.

There are three steps involves in transmitting the fluent knowledge. Firstly, the receiver not just the knowledge beneficiary but also the knowledge provider during the knowledge sharing process. In pair programming, a tendency to avail the knowledge sharing should be overcome by promoting them a reward (Yin and Zhang, 2005). In learning environment, a grade satisfaction is a reward to encourage them sharing their knowledge in achieving a good solution in programming. Besides, a well-designed knowledge sharing space is required to assist knowledge transition such as NetMeeting, Yahoo/MSN Messenger, web-based knowledge sharing system and others. There is no restriction of time and place especially to implement the distributed pair programming. Students need the virtual collaboration environment when their schedules are conflicts and they cannot get physically together in finishing the programming assignment (Ho et al., 2003). Lastly, a proper way is needed to ensure the knowledge is easy to understand by having an effective communications.

During the pair programming process, some explicit and mostly tacit knowledge is shared between the driver and navigator (Chau and Maurer, 2004). Explicit knowledge is easy to share because it can be expressed in words and numbers (Nonaka and Konno, 1988; Ho et al., 2003; Fengjie et al., 2004). However, the representation of explicit knowledge is easy to understand and convenient to retrieve should be considered during explicit knowledge sharing process (Fengjie et al., 2004). Meanwhile, more efforts are required to gain tacit knowledge due to very hard to formalize and difficult to codify the tacit knowledge. Tacit knowledge is a human judgment and strategic decision making (Brockmann and Simmonds, 1997; Guthrie, 1995). The main sources of tacit knowledge are experience and thinking (Gerard, 2003). Tacit knowledge is related to teaching and learning process and also generated through learning experience (Gerholm, 1990). Thus, tacit knowledge will be obtained through pair programming practices between pairs to generate learning, thinking and decision making skill.

Oppose to explicit knowledge, tacit knowledge is hard to share due to it's difficulty to express it in language (Fengjie et al., 2004). Thus, Socialization, Externalization, Combination and Internalization (SECI) is adopted in this study to facilitate knowledge conversion between tacit and explicit knowledge and also to promote knowledge sharing between partners during pair programming practice. Socialization is a process of sharing experiences and thereby creating tacit knowledge such as shared mental models and technical skills. Externalization means the process of articulating tacit knowledge into written form or explicit knowledge but still inconsistent condition. So that it can be shared by others and become the basis of new knowledge. Combination refers to the process of converting explicit knowledge that is inconsistent into a more complex and systematic sets of explicit knowledge. During internalization process, the experiences will be converted into individual knowledge (Nonaka and Takeuchi, 1995). The spiral indicates the spread of knowledge among colleagues and emphasizes the importance of interaction between tacit and explicit knowledge dynamically and consistently. In pair programming practices, knowledge sharing involved social interaction, sharing and constructing knowledge between the partners. Thus SECI model is applicable to promote sharing and constructing knowledge between partners in generating learning, thinking and decision making skill.

This paper discusses on internalization based on the knowledge sharing activities in pair programming practices by employing the process of SECI. The factors investigated were types of internalized tacit knowledge in the form of learning, thinking and decision making skills among the students. In order to assess empirically the effect of knowledge sharing amongst programmers using pair programming, the following hypotheses has been formulated.

- Ho: There is no difference state of learning activities in internationalization knowledge sharing between the pair programmers and non-pair programmers
- H_1: There is significance difference state of learning activities in internationalization knowledge sharing between the pair programmers and non-pair programmers
- Ho: There is no difference state of thinking activities in internationalization knowledge sharing between the pair programmers and non-pair programmers
- H_1: There is significance difference state of thinking activities in internationalization knowledge sharing between the pair programmers and non-pair programmers
- Ho: There is no difference state of decision making activities in internationalization knowledge sharing between the pair programmers and non-pair programmers
- H_1: There is significance difference state of decision making activities in internationalization knowledge sharing between the pair programmers and non-pair programmers

METHOD

Procedure and Sample

The sample of the study consisted of undergraduate College of Arts and Sciences (CAS) students at Universiti Utara Malaysia (UUM) enrolled in *Basic Programming* course. *Basic Programming* course is a compulsory course for first year student in information technology (IT), multimedia, and education in IT. Each week students attend two hours of lectures and two-hour laboratory session. In the laboratory, students were required to solve programming assignments assigned by the lecturer. Students were divided into two groups; pair programming group and non-pair programming group to work on the assignments. During the lab session, an instructor was assigned to assist and support the students to solve programming problems for both groups.

At the mid of the semester, 119 questionnaires were distributed to the students who were actively engaged in pair programming practices and had experience applying non-pair activities. Students were required to complete ten-minute survey to determine level of knowledge sharing amongst pair and non pair programmers. All questionnaires were returned completed, representing an acceptable response rate. Of the 119 questionnaires administered, 77 students from the pair programming groups and 42 from the non-pair programming groups completed the survey. To ensure the validity of knowledge sharing scores, outlier data was excluded in the analysis, resulting in data set of 118 respondents. The age of respondents ranged from 20 to 25, with a mean age of 18.7 years. Slightly more than 65.5% of the respondents were female.

Measure

In order to test the hypotheses, a survey study was conducted. The questionnaire was adapted from SECI model in educational context (Mazida, 2010) particularly focuses on internalization factor. The validity and reliability of this questionnaire was demonstrated in other study (Mazida, 2010).The factors investigated were types of internalized tacit knowledge in the form of learning, thinking and decision making skills among the students. All items in the questionnaire were measured using a five point Likert scale ranged from "1-Strongly disagree", "2-Disagree", "3-Don't Know", "4-Agree", and "5-Strongly agree".

Independent t-test was conducted to measure level of knowledge sharing between pair programming and non-pair programming groups. Independent t-test was used to compare the two groups' level of knowledge sharing in terms of learning, thinking and decision making skills between those groups. SPSS tool was used to analyze the data. Reliability analysis for

this questionnaire was 0.7, which exceeds minimum requirement of Cronbach Alpha, 0.6 (Nunally, 1978).

RESULT AND DISCUSSION

Data were analyzed in terms of learning, thinking and decision making skills. The main goal was to demonstrate that pair programming practice is a viable tool to promote knowledge sharing activities, particularly amongst the programming students.

Learning

There was no significance difference in score of learning for pair programming ($\underline{M}$ =20.24, $\underline{SD}$=3.40), and non-pair programming groups [$\underline{M}$ =19.43, $\underline{SD}$=3.76; $\underline{t}(116)$=1.19 , $\underline{p}$=0.24]. This can be illustrated in Table 1.

Table 1. Group Differences for Learning between Pair Programming and non-pair programming groups

	Pair Programming		Non-Pair Programming		
Learning	M	SD	M	SD	T
	20.24	3.40	19.43	3.76	1.19

*$\underline{p}$ < 0.05

In education context, pair programming involved two novices that need guidance from the lecturer as an expert. Even though they can do the job but still facilitation from the lecturer exceeds what can be attained in pair (Vygotsky, 1978). Level of students' potential ability is uplifted to a higher level with the guidance from the expert compared to self learning (Holzman, 2009). The finding is supported by a claim that students require strong support from the instructor for a better education (Heywood, 1992). With the continuous guidance from the lecturer, lecturer's tacit knowledge is transferred and the knowledge is shared amongst the pair.

Thinking

There was significance difference in score of thinking for pair programming ($\underline{M}$ =20.24, $\underline{SD}$=3.40), and non-pair programming groups [$\underline{M}$ =19.43, $\underline{SD}$=3.76; $\underline{t}(116)$=2.47 , $\underline{p}$=0.015]. This can be illustrated in Table 2.

Table 2. Group Differences for Thinking between Pair Programming and non-pair programming groups

	Pair Programming		Non-Pair Programming		
Thinking	M	SD	M	SD	T
	18.97	2.26	17.90	2.25	2.47*

*$\underline{p}$ < 0.05

Students applying pair programming showed higher order thinking skills compared to solo programmers (Williams, 2002). This is because they can share knowledge to solve programming assignment with their partner during pair programming. Therefore, the students are more independent without fully relying on instructor to discuss solutions during lab session. In addition, by doing programming in pair, tacit knowledge instilled in brain can be transferred among the students, which encourages intrinsic motivation among team members (Mazni et al., 2009). In pair programming, students need to be alert and attentive to check and review their partner's code program. This situation encourages them to think more compared to non-pair programmer, which develops codes in isolation. When this happens, logical thinking amongst the pair increased and assisted them to broaden way of thinking, which improve creativity during programming activities.

Decision Making

There was no significance difference in score of decision making for pair programming (M =17.82, SD=2.28), and non-pair programming groups [M =17.76, SD=1.97; t(116)=0.13 , p=0.9]. This can be illustrated in Table 3.

Table 3. Group Differences for Decision Making Between Pair Programming and non-pair programming groups

	Pair Programming		Non-Pair Programming		
Decision	M	SD	M	SD	T
Making	17.82	2.28	17.76	1.97	0.13

*p < 0.05

Pair programming promotes better decision making when two heads better than one (Chong et al., 2005). However, in reality, this position not always true. Students in pair have to put more effort in creating mutual understanding between them in order to make better decision. This becomes more complex when the partners have different programming abilities and also personality types (Hannay et al., 2010; Hahn et al., 2009; Katira et al., 2004; Williams et al., 2006). Common characteristics of pair partners are important to drive consensus in the decision making. Nevertheless, programmers need to understand each pair partner differences to reach project goals successfully. Understanding others' differences yield more added values and better decision making process in programming tasks.

The results indicate that both pair programming and non-pair programming achieved a statistically significant result in thinking activities. Therefore null hypothesis, H_0 for thinking activities in internationalization knowledge sharing has been rejected. However, two null hypotheses, H_0 for learning and decision making in internationalization knowledge sharing has been accepted because there were no statistically significant different for both groups.

CONCLUSION

This study contributed for better understanding of important knowledge sharing activities to construct student's skills during Internalization process through pair programming. It is undisputed that the pair programming is one of the pedagogical approaches that can enhance students' abilities in the areas of programming. Knowledge sharing in pair programming can be improved with the guidance of lecturers and also increasing the frequency of programming activities between the pairs. Socialization factor is an important factor in ensuring the success of pair programming. Pair programmers need time to understand other's differences. This can lead them to share insights, leap their thought, make soundness decisions, and thus inducing knowledge sharing during programming activities. Further works will be considered rigorous theoretical framework for constructing tacit knowledge among the students in pair programming environment.

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OPEN SOURCE SOFTWARE INNOVATION: AN ALIEN ENVIRONMENT FOR WOMEN?

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ABSTRACT. This paper presents the case on lack of participation from women in Open Source Software (OSS) innovation process. OSS innovation process seems to be an alien environment for women where long term existing problems regarding women and software industry such as under-representation, sexism, discriminations and prejudices are still being duplicated. Little participation and contributions from women in OSS innovation creates imbalanced population in the OSS based knowledge demography and unbalanced proportion of gender distribution. Based on comprehensive review, the paper aims to suggest a Constructivist-Technofeminist-OSS Innovation Process framework for understanding female contribution in OSS innovation.

Keywords: Open Sourse Software (OSS), Constructivist Technofeminist OSS Innovation Process framework

INTRODUCTION

In the past few years, Open Source Software (OSS) has gain its popularity and becoming a prominent phenomenon in Information Technology (IT) field.The escalating numbers of OSS projects reflected that OSS is shaping the society in several important ways that includes computer science society in reviewing the software engineering and practices. OSS stimulates social researchers to look at the phenomenon of volunteerism, motivation in working as a team from globally distributed individuals in software development (Lin & Risan, 2007). Its success has attracted and motivated governments, industries and community globally to adopt and implement OSS as an alternative to proprietary software due to varied reasons (Shirali-Shahreza & Shirali-Shahreza, 2008).

Although OSS innovation process emphasizes its philosophy of "freedom" (like freedom of 'speech', not 'price') still the problems regarding gender in software industry are being replicated (Lin, 2005a). Despite fewer obstacles to participate in OSS innovation such as no formal requirement on qualification or degree in Computer Science (CS) related needed as compared to proprietary software industry, women are still under represented in OSS development (Ghosh, Glott, Krieger, & Robles, 2002; Nafus, Leach, & Krieger, 2006) and still being driven out of OSS communities, usually by the unconscious sexism of well-intentioned men (Lin, 2005b; McPherson, 2009). According to OSS survey and report (Ghosh et al., 2002; Nafus et al., 2006) there is a great gap between genders where less than 2% are female contributors in OSS development. Another study in Australia reported almost similar figure where only 7.3% are female contributors (Waugh Partners, 2008) which still reflects very low involvement of female in OSS innovation. Though there are a lot of studies being carried out in OSS, only a few found that gender biasness in OSS is problematic while most of the research focus on the process and structure of OSS related on organizations and management (Lin, 2005a). Thus, OSS innovation is still a foreign environment for women.

The remainder of the paper is structured as follows. In the next section, a brief overview on the issues regarding women in software development industry followed with the OSS environment and the issues women are facing. Next, arguments that OSS phenomenon and innovation process involves socio-technical elements are elaborated followed with discussion on the conceptual framework.

WOMEN IN SOFTWARE DEVELOPMENT

Issues about the scarcity of women in IT have been continuously mentioned in academic literature where IT workplace is still predominantly male (Hodgkinson, 2000; Ilavarasan, 2006; Klawe, Whitney, & Simard, 2009) .The low percentage of women participation in the industry are showing almost the same trend globally such as in New Zealand (Crump, Logan, & McIlroy, 2007) women only make up 27% of computer scientist in United States (US)which has the biggest IT industry in the world (Varma, 2007) while only 16% of women work in IT industry in United Kingdom (Moore, Griffiths, Richardson and Adam, 2008). This is to say as the effect on low numbers of female entering CS or IT related higher education in most of the Western countries(Powell, Hunsinger, & Medlin, 2010). Previous statistics from research provide several reasons why women are being discouraged from initially entering into computing fields (Ilavarasan, 2006)). One of the factor is the common understanding of the relationship between gender and IT is seen as "masculine" (Lagesen, 2008) and women's claims that IT education is uninteresting, difficult and time consuming (Weinberger, 2004), the assumption of IT work involves long working hours and is not conducive to family life (Crump & Logan, 2000) and the lack of prominent female role model for young women in IT (Ilavarasan, 2006; Lin, 2005a). The gender issue of 'glass-ceiling' for women is still existed in IT organizations and resulted in lesser number of women in high hierarchy levels in the IT organization(Ilavarasan, 2006). Klawe, Whitney, and Simard (2009) reported that women with the same qualification of CS degree earned less than $2k from men in US and only 5% of women made it in the top leadership in technology industry.

Although the underrepresentation issues of women in computing and technology industry seem to be showing a positive increments in numbers of CS tertiary education in US, India and some Asian countries, but it still can be considerably low (Klawe et al., 2009). On the other hand, it is not to say all women reject 'geek culture' nor that computer science is generally accepted as masculine like for example Malaysia seems to be a unique case where women constitute about half of all students in higher computer science education (Lagesen, 2008; Othman & Latih, 2006). The positive increments of female entering computer science however stop short of achieving equal representation and point to the fact that much work has yet to be done in terms of gender biasness in computing industry (Klawe et al., 2009).

It is not about the gap of men and women using computers, Information and Communication Technology (ICT) and other Information Systems (IS) since it is narrowing, but rather than women as part of the development team (Powell et al., 2010). Many studies has revealed the analysis of how women have been excluded from technological fields like computer science and how gendered perceptions and values influence the technological design as well as the usage of the technology and come to a general understanding that the exclusion of women is the result of strong relationship between men's performance of masculinities (Moore et al., 2008; Wajcman 2009, 2004; Faulkner 2001; Cockburn and Ormrod 1993). CS has been portrayed as "masculine" and thus seems to neglect women participation in this field (Ilavarasan, 2006; Klawe et al., 2009).

The trend of men dominated the complex and advanced computing and computerised equipment compared to women is still existing (Wajcman, 2009) that prove women are largely excluded from the process of technical design that shape the world we live in (Wajcman, 2009). The imbalanced domination of both sexes is among the social factor that is studied especially the way technology reflects gender divisions and inequalities. The issue was not

only men's domination of technology, but also the way gender is embedded in technology itself (Wajcman, 2009).

OSS an Alien Environment for Women?

The gap of male and female contributors in OSS is shockingly wide where women only made up less than 2% from OSS total contributors (Ghosh et al., 2002; Nafus et al., 2006). This reflect that OSS phenomenon is still largely male dominated playground although OSS community innovation field reflects a broad and relatively boundless innovation system that allows various types of actors (core developers, casual contributors, bug reporters, patch submitters and end-users) participating and engaging in its development voluntarily (Lin, 2004).

Among the factors that hinders women participation in OSS innovation process are they are actively or unconsciously excluded rather than passively disinterested to join because of unconscious sexism or hostility to women in the community by men (Nafus et al., 2006). The inflammatory talk in the community that is accepted in most of OSS communities as a key means of building reputation is an off-putting for women and worsens the confidence levels in joining the process especially with lower level of computing experiences (Lin, 2005a; Nafus et al., 2006; Powell et al., 2010). For the newcomers it can be offensive and discouraging from involving further in OSS process. Apart from communications discrimination, developer's documentation unconsciously reflects prejudices with the use of 'he' rather than 'he or she' or 'they'. It might not be the intention of the developers but it still portrays a non-welcoming environment for women when coupled with the inflammatory talk in the community (Lin, 2005a; Powell et al., 2010). When women are becoming part of the community either they are being treated like an alien, or assumed to be male (online context) or received a high amount of attention because of their gender which somehow decreases the feeling of being accepted as a community member rather than the 'female gender identity' (Lin, 2005a; Nafus et al., 2006).

OSS phenomenon is also popular with "hacker" ethics that relies on strong programming culture that involve long hour of coding activities which usually situates itself outside the 'mainstream' sociality. This is very hard for women to volunteer in a committed situation with the fact that women have less spare time in comparison with men as they need to attend to housework chores (Lin, 2005a). As successful OSS project requires volunteers to commit to it progressively but without much spare time and energy from women to contribute to makes it difficult for them to succeed in OSS projects.

The imbalanced population of genders in OSS world reflects a phenomenon that is still not thoroughly understood and researched. Most of the researches in OSS focus on the process and structure of OSS related organizations and management (Lin, 2005a). The gender issues in OSS such as discrimination, inequality and lack of participation from women have been voiced out by industrial people in many OSS technical conferences keynote, OSS communities and business journal (Deckelmann, 2009; Lin, 2005a; Malmrose, 2009; McPherson, 2009; Wajcman, 2004) but perplexingly received almost no attention from the academic literature (Lin, 2005b). This phenomenon showed that there is a gap between the academic curiosity and industrial perceptions.

OSS INNOVATION AS A SOCIO-TECHNICAL PROCESS

OSS community innovation field reflects a broad and relatively boundless innovation system that allows various types of actors (core developers, casual contributors, bug reporters, patch submitters and end-users) participating and engaging in its development (Lin, 2004). In OSS development, the phases in the innovation process cannot be clearly distinguished as in proprietary software development. OSS innovation in its community is an active socio-technical process which is influenced by various factors namely social and technical aspect (Lin, 2004). It demonstrated a unique combination of private and collective aspect of

innovation and knowledge and represent bizarre collaborative effort that depends on the skill of the contributors and adhered to certain philosophies(Wang & Chen, 2005).

OSS, as a technology that is society made durable based on the collaborative work in the community then the gender power relations will influence the shaping and the design process of technological change which in turn configures gender relations (Wajcman, 2010). OSS as technology are socially shaped but shaped by men to the exclusion of women The gendering of technologies can only then be understood as not only embedded in design, but also reconfigured at the multiple points of consumption and use (Wajcman, 2010). Consequently, the absence of women's viewpoints in constructing OSS innovation portrays the domination by men on its development. The lack of female OSS developers resulted in a large numbers of female unfriendly software where women's perspectives on software design and usage are not accounted in since diversity in developers can lead to better technologies.

UNDERSTANDING WOMEN CONTRIBUTION IN OSS INNOVATION

Taking the stand that OSS innovation is a product of socio-technical process, this study applies Social Construction of Technology Theory (SCOT) by Pinch & Bijker (1984), Feminist (Cockburn & Ormrod, 1993)and Technofeminism (Wajcman, 2004), and Technology Use concept (Crowston, Wei, Howison, & Wiggins, 2008). SCOT theory will be applied on OSS community's process of software development and innovation that involves diverse social groups while feminist theory and Technofeminism pays particular attention to female software developers' contributions that help shape and assign meanings to OSS (Mahmod, Yusof, & Dahalin, 2010a, 2010b). The following discussions on conceptual framework of Constructivist-Technofeminist-OSS Innovation (Figure 1) briefly explain the reasons choosing the theories and expectations to learn from applying them to OSS innovation.

CONCEPTUAL FRAMEWORK

The framework (Figure 1) shows the proposed relationships among the constructs of interest as derived from the theories. SCOT theory made up constructivist concepts that are related to *relevant social groups* and contributes *interpretive flexibility*, *closure and stabilization*, and *technological frames*. Since, SCOT did not acknowledged technological influences in determining the construction of technology (Pinch & Bijker, 1984), there is the need to incorporate technology use influence in the framework since the nature of OSS development is mostly relies heavily on computer-mediated communication (Crowston, Annabi, Howison, & Masango, 2005). Since being inherently social science researchers, social constructivist researchers cannot know technologies at the level or way in the way that engineering or physical scientists understand about technologies. No matter how well these researchers understand the content of technology, their understanding may be still remaining at the outside of technology content (William & Edge, 1996). If social constructivist researchers understand the content of technology such as how a certain technology technologically functions and describe it in the sense of technologically working or non-working, then the research would be an engineering study crossing over the boundary of social constructivism (William & Edge, 1996).

Crowston et. al (2008) discuss *technology use* as a very important input variable to an OSS project since the type of technology use by contributors in OSS community is very crucial in coordinating their OSS development activities that has significant impacts on the software development. The type of technology use for communication are emails, Internet Relay Chat (IRC), Concurrent Versions System (CVS), or subversion is critical for knowledge sharing and creation of OSS development especially in coordinating OSS development and for mediating control of OSS source code when at the same time, multiple developers may be working on any given portion of OSS development (Crowston et al., 2008). The influence of the features offer by technology use have impacts on the OSS development in terms of sharing of

knowledge and creation of software innovation (Crowston et al., 2008). Thus, the concept of technology use is necessary to facilitate the four concepts of SCOT theory in understanding the construction of OSS innovation.

Feminist Theory

Gender is an issue that has been largely ignored in most of constructivist studies of technology and innovation including SCOT. Its methodology having difficulties in explaining the influence of broader social structures and why some actors are excluded or marginalized and why some actors(namely gender) and outcomes may be absent(Wajcman, 2000; Williams & Edge, 1996) thus led to the representation of technology is sharply gendered (Wajcman, 2000).

To amend this problem, Wajcman (2004) introduces technofeminism. It emphasizes the need to investigate the gendering of new technologies to assess critically how technologies are shaped in ways detrimental to women. Technofeminism relies on feminist political practices in combination with feminist research to change sociotechnical networks to include more women in technology development. It recognizes the 'mutual shaping' of technology, whereby *gender relations* influence the development of technology as technology too has the ability to affect (positively and negatively) gender relations. Gender relations shows that the particular power dynamics which is embodied in the conceptualization of differences and sameness, or inequalities or assumed equalities between men and women (Cockburn & Ormrod, 1993; Gillard, Howcroft, Mitev, & Richardson, 2008). *Gender identities*(Cockburn & Ormrod, 1993) is needed to explain about how we go as regards for being men and women in OSS innovation process. It captures the notion of socio-technical in technology development that social and technological elements are mutually constituting and hence the co-production of gender and technology (Faulkner, 2000) based on the political of gender relations. Therefore, the technofeminist approach to technology studies suggests that a technology development and use cannot be understood without reference to gender and vice versa.

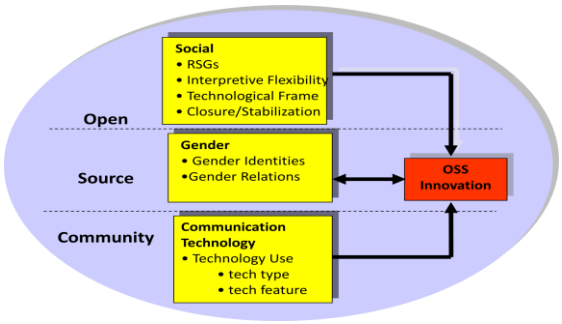

Figure 1. Conceptual framework of Constructivist-Technofeminist-OSS Innovation.

CONCLUSION

This paper has demonstrated the issues of what women have faced in software industries and OSS innovation process. Although, OSS is based on volunteerism, still women have little interest in participating in the alien environment because of the similar genders issues in software industry thus limit the potential contributions toward OSS innovation. Further studies can make use of the conceptual framework in obtaining evidence on how women contribute in

the construction of OSS not only from a bias viewpoint of the social science aspects but also from the technical aspect of the OSS innovation process.

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CRITICAL SUCCESS FACTORS (CSFS) OF THE PRE-ADOPTION AND PRE-IMPLEMENTATION PLAN OF CUSTOMER RELATIONSHIP MANAGEMENT (CRM) SYSTEM

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ABSTRACT. The success of Customer Relationship management (CRM) is not an easy thing to be achieved. The understanding of the main factors that could contribute in the success of CRM initiatives will make the difference toward successful CRM systems adoption and implementation. An extensive review of the literature was conducted in order to highlight the main success factors that if the organization be aware of and dealt with properly will achieve success and will gain the intended benefits of their CRM initiative or program. This paper revealed that top management support, managing organizational and cultural change, CRM understanding, organizational readiness, and users' involvement are among the most important CRM systems success factors. In addition, this paper proposed plan of six success factors to be as a pre-adoption and pre-implementation plan for the successful adoption and implementation of CRM systems.

Keywords: Customer Relationship management (CRM), Critical success factors (CSFS)

INTRODUCTION

Organizations are increasingly relying on CRM to initiate, enhance, and tighten their relationships with customers. The increasing competition among businesses and the decreasing customer loyalty creates the need for a new paradigm for doing business. CRM makes a transformation and reform for the traditional marketing applications and capabilities. CRM turns the focus of organizations to customers rather than to products and it has been defined from different perspectives by researchers and scholars. Rababah, Haslina, and Huda (2010) defined CRM as "the building of a customer-oriented culture by which a strategy is created for acquiring, enhancing the profitability of, and retaining customers, that is enabled by an IT application; for achieving mutual benefits for both the organization and the customers". Another definition is provided by Lun, Jinlin, and Yingying (2008) who stated that "CRM is the philosophy, policy and coordinating strategy mediated by a set of information technologies, which focuses on creating two way communications with customers so that firms have an intimate knowledge of their needs, wants, and buying patterns". These information technologies or IT applications are referred as CRM systems. Lin (2003) defined CRM system as "a software system designed to empower a company to maximize profits by reducing costs and increasing revenue; to increase competitive advantage by streamlining operations; and to achieve business goals".

The adoption and implementation of CRM has become prevalent among organizations from different kinds of business (Adebanjo, 2006). However, there is clear indication in the literature regarding the high rate of failure of CRM initiatives (Rigby, Reichheld, & Schefter, 2002; Zablah, Bellenger, & Johnston, 2004). In addition, there is a broader debate among

researchers and scholars regarding the reaching of the expected benefits of CRM. Lindgreen, Palmer, Vanhamme, and Wouters (2006) assured that CRM systems have failed to achieve economic benefits and, in some cases, have destroyed the relationship between an organization and its customers. Despite the huge investment in CRM, organizations are still unable to reap the expected benefits from these investments (Corner & Rogers, 2005). Karakostas, Kardaras, and Papathanassiou (2005) indicated for a criticism regarding the CRM effectiveness and contribution in achieving competitive advantage. On the other hand, the tremendous benefits associated with the successful CRM initiatives encourage and stimulate the continuing of adoption of CRM and motivate the researchers to more and more study the causes of failure and try to tackle it out (Kristel, Koen, Malaika, Jerry, & Nicholas C. Romano, 2007). Regardless of the high rate of CRM failure, there are substantial opportunities of the successful CRM where it will help an organization identify and adapt offerings to the needs of their customers, reduce transaction costs, and enable the development of closer relationships with loyal customers (Sharma & Iyer, 2007). The factors of successful adoption and implementation of CRM systems are of widespread debate (Arab, Selamat, & Zamani, 2010). Therefore, they need to investigated and identified.

This paper aims to highlight the main critical success factors of CRM systems adoption and implementation that need be taken into consideration by organization in order to increase the success rate and decrease the failure rate of CRM initiatives or systems. Specifically, this paper will emphasize on the pre-adoption and pre-implementation success factors of CRM systems in organizations. The organization of the rest of the paper is as the following; the identification and summarizing of the critical success factors of CRM systems then, the discussion of the main success factors of the pre-adoption and pre-implementation CRM systems. The last section discusses the conclusions and recommendations of the paper.

CRM SYSTEMS CRITICAL SUCCESS FACTORS

The identification of the CSFs of CRM systems is an important issue for the successful adoption and implementation of CRM. The critical success factors have been defined by Rochart (1979) as “Critical success factors are the limited number of areas in which results, if they are satisfactory, will insure successful competitive performance for the organization. They are the few key areas where "things must go right" for the business to flourish. If results in these areas are not adequate, the organization's efforts for the period will be less than desired”. This definition explains and emphasize on how much are important these factors to ensure success. Defining these factors and ensuring the right fulfillment of these factors will definitely contribute and enable the success of an organization. In this case, identifying and understanding these factors will lead to the success of CRM systems implementation.

Many studies have investigated and studied CSFs for CRM. For example, Mendoza, Marius, Pérez, and Grimán (2007) indicated for the top management support and communication of CRM strategy as the most important success factors of CRM. In addition, Caldeira, Pedron, Dhillon, and Jungwoo (2008), Wikstrom (2004), and Zhong Hong (2008) emphasized on managing the organizational change associated with the CRM project as an important success factor. Table 1 provides a summary of these CSFs based on several studies conducted from 2002 to 2009.

Table 7. Summary of CSFs of CRM

Success Factors	Sources
Top management support and commitment.	(Alt & Puschmann, 2004; Caldeira et al., 2008; Chen & Chen, 2004; Croteau & Li, 2003; Harej & Horvat, 2004; Injazz & Karen, 2003; King & Burgess, 2008; Kotorov, 2003; Maleki & Anand, 2008; Mendoza et al., 2007; Zhong Hong, 2008).

The communication of the CRM strategy.	(King & Burgess, 2008; Mendoza et al., 2007)
Managing the organizational change associate with the CRM project.	(Alt & Puschmann, 2004; Caldeira et al., 2008; Wikstrom, 2004; Zhong Hong, 2008).
The business process change.	(Christopher, 2003).
The understanding of CRM.	(Injazz & Karen, 2003; Pedron & Saccol, 2009)
The effective leadership.	(Chen & Chen, 2004; Christopher, 2003).
User training and education.	(Caldeira et al., 2008; Christopher, 2003; Harej & Horvat, 2004; Injazz & Karen, 2003; Maleki & Anand, 2008; Zhedan, Hyuncheol, Jongmoon, & Hojin, 2007)
The existing of project champion.	(Wilson, Daniel, & McDonald, 2002).
The existing of targeting and evaluation strategies.	(Christopher, 2003)
The cultural change.	(Chen & Chen, 2004; Injazz & Karen, 2003; King & Burgess, 2008; Wilson et al., 2002).
Aligning business IT operations.	(Chen & Chen, 2004; Maleki & Anand, 2008).
Knowledge management capabilities.	(Chen & Chen, 2004; Croteau & Li, 2003; King & Burgess, 2008)
The evolution path (from operational to analytical to collaborative CRM).	(Alt & Puschmann, 2004; Zhedan et al., 2007).
Operational and strategic perceived benefits.	(Croteau & Li, 2003)
Users or employees involvement	(Maleki & Anand, 2008; Payne & Frow, 2006; Wilson et al., 2002).
Forming cross functional or multidisciplinary team	(Kotorov, 2003; Mendoza et al., 2007).
The existing of timeframe for CRM implementation	(Alt & Puschmann, 2004; Zhedan et al., 2007)
CRM readiness assessment	(Caldeira et al., 2008; Croteau & Li, 2003; Payne & Frow, 2006)
The data quality and data integration.	(Chen & Chen, 2004; Karakostas et al., 2005)
The integration of CRM system with other systems	(Chen & Chen, 2004; Christopher, 2003; King & Burgess, 2008; Mendoza et al., 2007; Meyer, 2005; Zhong Hong, 2008).
Customer information management, customer service, sales automation, marketing automation, customer contact management, and objectives definitions.	(Mendoza et al., 2007)

The next section discusses the most important factors for the pre-adoption and pre-implementation of CRM systems in organizations.

DISCUSSION

In Table 1, it is clear that the most CSFs that are referred by researchers are top management support, users training and educating, managing organizational change, the integration of CRM system with other systems, the cultural change, the knowledge management capabilities, and the users' involvement in the implementation of CRM systems.

As stated earlier, this study focuses on the pre-adoption and pre-implementation success factors of CRM systems. Therefore, based the thorough review of the literature, this paper recommends the following six factors as the main factors for the pre-adoption and pre-implementation plan of CRM systems.

The first thing and the most important factor is the ensuring of top management support and commitment before the adoption and implementation of CRM systems. This factor is not only important for the pre-adoption and pre-implementation plan of CRM systems but also in all the upcoming stages. The inadequate support from the top management was referred by Kale (2004) as one of the seven deadly sin for CRM initiatives. Therefore, the existence of top management support and commitment is very essential for the success of CRM.

The second factor is the understanding of the concept of CRM and the communicating of the expected benefits and values of CRM and CRM systems to the organization, employees, and customers. The failure to understand business benefits is considered as the most common CRM failure's causes (Caldeira et al., 2008).

The third factor is the setting of CRM objectives and corresponding measurement systems for the achievement of these objectives. Mendoza et al. (2007) emphasized on the definition of CRM objectives as an important factor for the successful adoption and implementation of CRM. Caldeira et al. (2008) indicated for the inadequate measurement systems as one of the most common CRM failure's causes.

The fourth factor is the assessment of the organizational readiness for the adoption and implementation of CRM system which include technical and financial readiness assessment. The importance of this factor has been emphasized in many studies (Caldeira et al., 2008; Croteau & Li, 2003; Payne & Frow, 2006).

The fifth factor is creating a plan for managing the different types of changes that are expected to accompany the adoption and implementation of CRM system such as cultural change and processes change. Managing the organizational change associated with the CRM project is an important success factor for the adoption and implementation of CRM systems (Alt & Puschmann, 2004; Caldeira et al., 2008; Wikstrom, 2004; Zhong Hong, 2008).

The sixth factor is creating a plan for dealing with the users' acceptance. One of the major problems that encounter the CRM system implementation is user acceptance (Mankoff, 2001). The user acceptance of a CRM system has a crucial role in its success (Carter, 2009). According to Anderson (2001) user training and acceptance of the new processes and software solutions is essential to the success of CRM transformation. Hence, system use is an important issue in information system research and is often correlated with user attitude and satisfaction (Wu & Wu, 2005). If the end users did not realize how the new technology of CRM will enable them to serve customer better, they will resist it (Petouhoff, 2006). According to Petouhoff (2006) the resistance of end users will contribute to the failure of CRM project where, it will make the project end up with longer time-lines, scope creep, missed mile stones, higher implementation costs, and fewer realized benefits. Besides, according to Mike (2007) end users' willingness to integrate CRM system into their work environment determines the success of the system. In addition, communicating, listening, proving, training, and rewarding the end users are determining their attitude toward the CRM system (Mike, 2007).

These sex factors are proposed to form a per-adoption and pre-implementation plan for the successful adoption and implementation of CRM systems in organizations. The next section provides suggestions for the future work in the area of CSFs of CRM systems.

FUTURE WORK

CSFs of CRM systems could be related to the characteristics of CRM technology, organization, individuals, tasks of CRM, or environment. Hence, further empirical researches are needed for the investigation of the influence of these factors on CRM adoption process.

CONCLUSION

In conclusion, identifying and understanding the critical success factors of CRM systems is very essential for its successful adoption and implementation. The critical success factors of CRM span for diverse areas covering different issues. The review of literature has shown that these factors are related to organization culture and structure, technology that is, the CRM system and its characteristics and features, an environment in which an organization runs its business, or human aspects like users' acceptance. The thorough review of the literatures revealed that the most recommended success factors to be given more attention for the successful CRM initiatives are top management support, managing organizational and cultural change, users training and involvement, understanding CRM, the assessment of the organizational readiness, and choosing the right technology. This paper proposed a pre-adoption and pre-implementation plan of sex success factors for achieving success of CRM systems. This study also recommends more empirical investigation of the influence of these technology, organizational, human, and environmental factors on the adoption and implementation of CRM.

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DEVELOPING AN EXTENDED TECHNOLOGY ACCEPTANCE MODEL: DOCTORS' ACCEPTANCE OF ELECTRONIC MEDICAL RECORDS IN JORDAN

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ABSTRACT. The purpose of this study is to construct doctors' acceptance model of Electronic Medical Records (EMR) in private hospitals. The model extends the Technology Acceptance Model (TAM) with two factors of Individual Capabilities; Self-Efficacy (SE) and Perceived Behavioral Control (PBC). The initial findings proposes additional factors over the original factors in TAM making Perceived Usefulness (PU), Perceived Ease Of Use (PEOU), Behavioral Intention to use (BI), SE, and PBC working in incorporation. A cross-sectional survey was used in which data were gathered by a personal administered questionnaire as the instrument for data collection. Doctors of public hospitals were involved in this study which proves that all factors are reliable.

Keywords: Electronic Medical Recors (EMR), Technology Acceptance Model (TAM),

INTRODUCTION

EMR is defined as "an electronic patient record that resides in a system specifically designed to support users by proving accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge, and other aids" (Institution of Medicine (IOM), 1997). It offers several benefits such as improving efficiency, productivity and effectiveness of work. Despite the benefits of using Information System (IS) in an organization, IS users' resistance is a common problem in many industries including healthcare (Daim, Tarman, & Basoglu, 2008).

Acceptance studies related to technology adoption in the healthcare domain have been conducted in various countries in which most studies show that doctors' acceptance over the EMR were low (DesRoches et al., 2008). Some factors were identified causing the low acceptance on the technology by doctors, which lead healthcare organizations not to adopt EMR systems (DesRoches et al., 2008). The factors include lack of computer self-efficacy which refers to the ability to use computers in the accomplishment of a task (Aggelidis & Chatzoglou, 2009) and lack of perceived behavioral control which refers to the confidence in the ability to perform a task (Yi, Jackson, Park, & Probst, 2006).

In relation, Dillon and Morris (1996) defined user acceptance as "*the demonstrable willingness within a group to employ information technology for the tasks it is designed to support*". Moreover, it was found that studies on user acceptance of healthcare systems regarding healthcare managers and professionals' perceptions have affected the healthcare system implementation's success (Kijsanayotin, Pannarunothai, & Speedie, 2009).

Also, there are some theoretical models introduced to study user acceptance of IS implementation. Some of the famous theories are Theory of Reasoned Action (TRA) (Davis, Bagozzi, & Warshaw, 1989), Theory of Planned Behavior (TPB) (Ajzen, 1991), Technology Acceptance Model (TAM) (Davis, et al., 1989), and Social Cognitive Theory (SCT) (Bandura, 1986).

TAM; as seen in Figure 1; was proposed by Davis in 1989 after adopted from the TRA to predict and explain user's acceptance and rejection of computer-based technology. It was attempted to provide a basis to study the effect of external variables on user behavior by identifying some basic variables as determinants of computer acceptance.

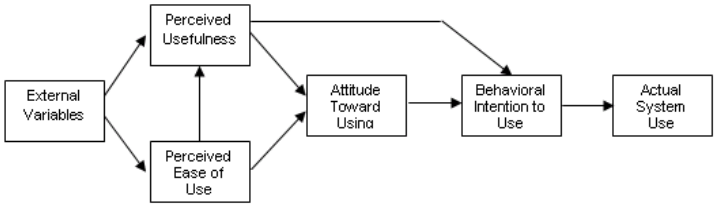

Figure 18. Technology Acceptance Model (Adopted from Davis et al. (1989)).

TAM suggests that PU and PEOU are particular beliefs acting as the determinants of computer acceptance behaviors. According to TAM, there are external variables influencing PU and PEOU. In addition, PU is also influenced by PEOU, and both determine the person's attitude towards using the system (ATT). This ATT with PU determine the BI which in turn determines the actual system use (Davis, et al., 1989).

Findings in previous works also indicate that SE and PBC can influence PU, PEOU, and BI. Therefore, it can be concluded that the factors are relevant to determine doctors' BI to use EMR in their daily work. In particular, (Davis, et al., 1989) clearly defines BI, PU, and PEOU. Shortly, BI is defined as "*the strength of one's intention to perform a specified behavior*", while PU refers to "*the degree to which a person believes that using a particular system would enhance his or her job performance*". While, PEOU is "*the degree to which a person believes that using a particular system would be free of effort*".

On the other hand, the SE factor is originated from SCT. Bandura (1986) defined SE as "*people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses*". Then, Compeau and Higgins (1995) adopted the SE factor into their technology adoption study and defined this factor as "*an individual's perception of his or her ability to use a computer in the accomplishment of a job task*". Meanwhile, PBC factor is originated from TPB. Ajzen and Madden (1986) defined PBC as "*a person's estimate of how easy or difficult it will be for him or her to carry out the behavior*". In short, both SE and PBC refer to individual's beliefs that they are capable of performing a given behavior (Tavousi et al., 2009).

Therefore, doctors' BI to use EMR can be measured by PU, PEOU, SE and PBC. Hence, this paper aims to develop doctors' acceptance model by extending TAM specifically by adding SE and PBC as individual capabilities perspective factors.

LITERATURE REVIEW

The robustness of TAM has been tested in the healthcare application domain. Many studies can be found in the literatures that utilize an enhanced version of TAM, depending on the technology being studied. **Error! Reference source not found.** lists previous studies u tilizing TAM in healthcare, which tested the main factors of TAM; PU, PEOU and BI to use.

These studies tested the technological and behavioral perspectives, in addition to the SE from the individual capabilities perspective.

Table 8. Summary of TAM in Healthcare - PU, PEOU, BI and SE.

Author	Technology	Country	Respondent	Findings (Significant = Sig / Non-Significant = Non-Sig)		
				Relation	Independent Factor	Dependent Factor
(Park & Chen, 2007)	Smart phone	USA	Doctors, Nurses, and Healthcare providers	Sig	PEOU	PU
				Sig	SE	PEOU
				Sig	PU	BI
				Sig	SE	BI
(Aggelidis & Chatzoglou, 2009)	IT in hospitals	Greece	HIS users: Medical, Nursing, and Administrative	Sig	PEOU	BI
				Sig	PU	BI
				Sig	SE	BI
				Sig	SE	PEOU
				Sig	PEOU	PU
(Johnston & Warkentin, 2008)	IS	USA	Professionals	Sig	SE	BI
(Wu, Wang, & Lin, 2007)	Mobile systems	Taiwan	Physicians, Nurses, Technicians	Sig	PEOU	PU
				Sig	SE	PEOU
				Sig	SE	PU
				Sig	PU	BI
				Sig	PEOU	BI

In contrast, Table 9 lists the studies of TAM in healthcare, which tested the main factors of TAM; PU, PEOU and BI. These studies tested the technological and behavioral perspectives, in addition to the PBC from the individual capabilities perspective.

Table 9. Summary of TAM in Healthcare - PU, PEOU, BI and PBC.

Author	Technology	Country	Respondent	Findings (Significant = Sig / Non-Significant = Non-Sig)		
				Relation	Independent Factor	Dependent Factor
(Chau & Hu, 2002)	Telemedicine	Hong Kong	Physicians	Sig	PU	BI
				Sig	PBC	BI
				Non-Sig	PEOU	PU
(Yi, et al., 2006)	PDA	USA	Resident and faculty physicians	Sig	PU	BI
				Sig	PBC	BI
				Sig	PBC	PEOU
				Non-Sig	PEOU	PU
				Non-Sig	PEOU	BI
(Rawstorne,	Nursing IS	Australia	Nurses	Sig	PEOU	BI

Jayasuriya, & Caputi, 2000)				Sig	PEOU	PU
				Sig	PU	BI
				Sig	PBC	BI

Based on Tables 1 and 2, the studies show that SE and PBC have not been tested together with TAM factors in EMR domain especially in Jordan. Therefore, it can be concluded that doctors' acceptance model can be developed based on individual capabilities, technological, and behavioral perspectives. The literatures also show that SE and PBC might affect PU, PEOU and BI to use the application. Therefore, SE and PBC are two factors that can be integrated into an extended TAM as determinants of PU, PEOU and BI to use an EMR system. In fact it has been shown that the integration of different models can provide more understanding and explaining of individual technology acceptance model (Chau & Hu, 2002; Yi, et al., 2006).

Hence, user's acceptance factors can be classified into; individual capabilities, technological, and behavioral perspectives. In particular, the individual capabilities perspective consists of SE and PBC, while the technological perspective consists of PU and PEOU. In completion, the behavioral perspective consists of BI to use. These three user acceptance perspectives are used to develop the intended model.

In addition, researchers in many countries developed acceptance studies in various healthcare domains. However, in Biomedical Informatics domain, especially in Jordan, there is no specific model integrating the three user acceptance perspectives to explain doctors' acceptance of EMR in Jordan. Therefore, there is a need for this model because such model is necessary in supports of the recent widespread of EMR implementation.

METHODOLOGY

Based on the factors as identified and discussed in the previous section, the intended model was constructed and illustrated in **Error! Reference source not found.**.

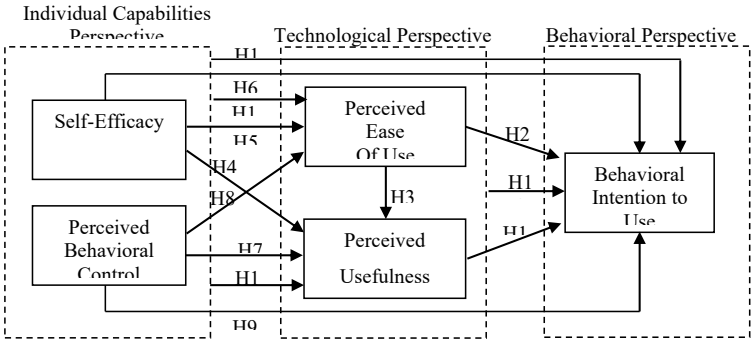

Figure 19. Research Model

As seen in the model in Figure 2, the following hypotheses were formulated to test the relationships between the observed factors:

H1: PU has a direct effect on BI
H2: PEOU has a direct effect on BI
H3: PEOU has a direct effect on PU
H4: SE has a direct effect on PU
H5: SE has a direct effect on PEOU
H6: SE has a direct effect on BI

H7: PBC has a direct effect on PU
H8: PBC has a direct effect on PEOU
H9: PBC has a direct effect on BI
H10: Individual Capabilities Composite Component has an effect on PU
H11: Individual Capabilities Composite Component has an effect on PEOU
H12: Technological Composite Component has an effect on BI
H13: Individual Capabilities Composite Component has an effect on BI

After developing the research model and formulating relevant hypotheses, a questionnaire was designed based on the observed factors and measurement items. The measurement items were adopted from Davis (1989), Compeau and Higgins (1995), and Ajzen (2001).

A cross-sectional survey was used in this study in supports of hypotheses testing necessities. Data were gathered through personal administered questionnaires. Specialty Hospital (SH) and King Hussien Cancer Center (KHCC) were the targeted hospitals for employing doctors as the respondents. Altogether, the population is 187 doctors in KHCC and 52 doctors in SH. Based on the population size (239), 24 pilot questionnaires were distributed to test its' reliability and to make sure that the measurement item in the instrument is error-free (Sekaran, 2003). Response rate from the respondents were 100 percent. The results of the test showed that Cronbach's Alpha values for all factors are greater than 0.6. Therefore, all the factors are considered acceptable and reliable to be included in the questionnaire (Sekaran, 2003). In addition, the Cronbach's Alpha of the questionnaire is 0.853. The actual collected data will be analyzed using Simple and Multiple Linear Regression analysis using the statistical analysis tool SPSS version 18.0. Further, the results from the hypotheses testing will justify whether the tested factors can be included in the doctors' acceptance model.

CONCLUSION

As a conclusion, this study has proposed an extended TAM based on findings from previous works incorporating three perspectives; individual capabilities, technological, and behavioral perspectives. The model (as seen in Figure 2) can be used to predict doctors' acceptance of EMR in Jordan. The outcomes of the study are useful to the top management of healthcare organizations in preparing a strategic plan for EMR implementation, specifically focuses on doctors' awareness and readiness for EMR.

This study contributes to the theoretical knowledge of TAM. The proposed extended model consists of individual capabilities, technological, and behavioral perspectives as an enhancement for the original TAM, which consists of PU and PEOU in the technological perspective and BI in the behavioral perspective, by introducing SE and PBC from the individual capabilities perspective.

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SURVEY ON WIRELESS BODY AREA SENSOR NETWORKS FOR HEALTHCARE APPLICATIONS: SIGNAL PROCESSING, DATA ANALYSIS AND FEEDBACK

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ABSTRACT. Wireless sensor networks (WSNs) technologies are considered as one of the key of the research areas in computer science and healthcare application industries. The wireless body area sensor networks (WBASNs) is a wireless network used for communication among sensor nodes operating on or inside the human body in order to monitor vital body parameters and movements. The paper surveys the state-of-the-art on WBASNs discussing the major components of research in this area including physiological sensing, data preprocessing, detection and classification of human related phenomena. We provide comparative studies of the technologies and techniques used in such systems.

Keywords: Wireless Sensor Networks (WSNs), Wireless body area sensor networks (WBASNs)

INTRODUCTION

A wireless sensor network (WSN) is an infrastructure-less network that consists of a number of self-configuring wireless devices capable of sensing vital signs for characterizing contemporary phenomena. Such vital signs include, but not limited to, environmental e.g. air quality, ambient e.g. temperature and pressure, and human e.g. heart and brain signals. The sensor data readings are transmitted over a wireless communication channel to a base-station that will be gathering raw data from all sensors, then to a running application that analyzes and makes decisions based on these readings. In this paper, a number of widely applicable capabilities, such as sensing and preprocessing, communication (sending & receiving), feature extraction and detection & classifications are briefly discussed. Healthcare industry is one of the world's largest and fastest-growing industries. Consuming over 10 percent of gross national product of most developed countries, healthcare can form an enormous part of a country's economy. Several factors lead to the increasing demand for revolutionary solutions in the healthcare industry, including i) increasing number of chronic disease (CD) patients; currently more than 860 million (WHO, 2006), ii) CD accounts for less than 50% of the population in US and Europe, but more than 80% of the healthcare spending (Intel, n.d), iii) increasing of death caused by CDs, 76% in Qatar (WHO, 2006; Hatler, Gurganious, & Chi, 2008) and iv) percentage of people over 60 is on the rise (WHO, 2006).

Due to these factors, traditional healthcare cannot provide the scalability required to cope with the growing number of elderly and CD patients as it requires a physical one-to-one

relationship between the caregiver and the patient (WHO, 2006). Therefore, the need for high performance, cost-effective healthcare solutions is one of the critical strengths for any developing country seeking sustainable future advancements (Hatler, Gurganious, & Chi, 2008). Remote monitoring using WSN have recently emerged to provide real-time patient surveillance and provide CD patients with more autonomy. The conditions most commonly treated by these remote monitoring services include diabetes, cardiac arrhythmia, sleep apnea, asthma and chronic obstructive pulmonary disease (Dolan, 2010). Using wireless sensors in the field of healthcare is one of the potential areas, which is expected to save $25 billion dollars worldwide by 2012 through leveraging cost-effective solutions and applications as highlighted in the healthcare market report from OnWorld (Hatler, Gurganious, & Chi, 2008).

WBASNs enable constant monitoring of the health conditions of people with chronicle diseases. WBASN consists of multiple on-body and ambient sensor nodes, capable of sampling, processing, and communicating one or more physiological signs (e.g., heart activity, brain activity, movements, blood pressure and oxygen saturation) over an extended period. Such physiological signs are measured using different types of sensed signals such as the ElectroCardioGram (ECG), ElectroEncephaloGram (EEG), and acceleration. Also, it is used for communication among sensor nodes operating on, or inside the human body in order to monitor vital body parameters and movements as well as to enable its user with quality of life, assisted living, sports, or entertainment purposes (Huang et al., 2009). Respiration is one of the most important applications for human to survive. The primary function of the respiratory application is to supply the blood with oxygen in order for the blood to deliver oxygen to all the body. So the rate of respiration plays a key role in intensive care and neonatal. The most common way to monitor the rate of respiratory has been the visual observation of the patient, but in recent times has involved modern technologies in this area.

This paper mainly focuses on surveying the state-of-the-art on WBASNs, discussing the major components of research in this area including physiological sensing and data preprocessing, feature extraction, detection and classification of human related phenomena. We provide a comprehensive studies and comparisons for sensor technologies used, wireless radio technologies, and different detection and classification techniques required to realize the end-to-end WBASNs framework for respiratory-related disorder detection and classification. Our survey framework consists of WBASN which captures medical phenomena that contains the raw data, communication environments, data fusion and major data processing at doctor side.

The rest of this paper is structured as follows: section 2, we talk about WBASN; it illustrates sensing and preprocessing operations like compression. Section 3 briefly discusses different communications technologies that can be used to transfer data to the gateway which gathers data and passes to the doctor side. Section 4 describes data analysis and feedback which includes feature extraction, detection and classification. Paper concluded presented at section 5.

WBASN SIGNAL PROCESSING AND COMMUNICATION FRAMEWORK

WBASN Signal Processing and Communication Framework (WSPC) framework consists of three major components for real-time applications, namely: sensing and preprocessing (SAP), application-specific WBASN communication (AWC), and data analysis and feedback (DAF) to the patient. SAP contains a number of sensors for capturing a raw data related to medical phenomena, e.g. blood pressure, respiratory rate, ECG, EEG, etc. AWC utilizes application-specific wireless protocols such as ZigBee (Cao et al., 2010) or Bluetooth (Krasteva et al., 2005) to transfer data from body sensors to the gateway, less commonly, in case of high data rates without compression, WiFi protocol may be utilized for intensive data transmission (fortypoundhead.com, 2008). Analysis of raw data including, possibly, detection and classification of medical anomalies will occur at the DAF component, providing strict and

accurate criteria for the physician to make recommendations that maybe sometimes fed back to the patient to provide proactive treatment. Figure 1, shows the conceptual view of the WSPC framework.

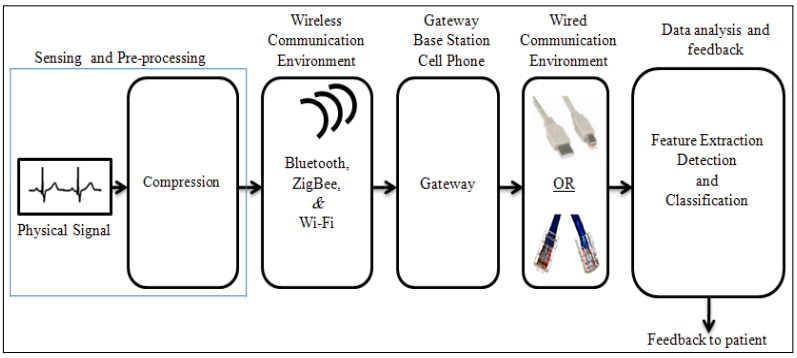

Figure 20. WSPC Conceptual Data Framework.

Sensing and Preprocessing

Sensor platform architecture typically consists of a sensing device, an operating system, and a communication and power management elements. Sensing is essential for all sensor networks, and its quality depends on largely progress in the manufacture of signal conditioning. Sensing is the detection of a physical presence of data and the transformation to a signal that can be read by an observer or instrument. To better observe a human's vital signals, a wide range of commercially sensors technologies are used to capture physical data such as, accelerometer, ECG, Electromyography (EMG), (EEG) electrodes, pulse oximetry, respiration rate, heart rate, blood pressure, blood sugar, and temperature sensors will be deployed. Table 1 illustrates some commonly sensors are employed in WBANs systems and their typical sampling rate (Huasong et al., 2009; Pantelopoulos, & Bourbakis, 2010).

Table 10. Description of Common Sensors in WBAN Systems.

Sensor Type	Signal Type	Description of measured data	Sample Rate
Accelerometer	Body Move	Measure the acceleration relative to freefall in 3D.	100 KHz
ECG/EEG/ EMG	Skin/ scalp electrodes	Measure Electrical activity of the heart, skeletal muscles, and brain activity respect.	250/250 2khz
Pulse Oximetry	Oxygen saturation	Measure the oxygenation or the amount of oxygen that is being "carried" in a patient's blood	<1 Hz
Respiration	Piezoelectric/ Piezoresistive	Number of movements indicative of inspiration and expiration per unit time (breathing rate).	150 Hz
Heart rate	Pulse oximeter/	Frequency the cardiac cycle	60 khz
Blood pressure	Arm cuff-based monitor	Measures the systolic pressure and diastolic pressure.	<1 Hz
Blood glucose	Strip-base glucose meters	Measurement of the amount of glucose (main type/source of sugar/energy) in blood.	<1 Hz

Temperature probe	Body and/or skin temperature	A measure of the body's ability to generate and get rid of heat	< 1 Hz

The wireless sensor node operating system (OS) plays a fundamental role in the overall capabilities and performance of the platform. Early research into OS for sensor networks lead to the development of TinyOS by UC Berkeley's researchers (http://www.tinyos.net/). OS is used in the processing of signals captured. A transceiver communication unit allows the transmission and reception of data to other devices that connects a wireless sensor node to a network. Details about the communication environment will be discussed in section 3. Power management provided by the operating system is to enforce an optimal way of utilizing energy. Conserving power involves accessing/controlling components on the sensor node. The components which expose power management interfaces are processor, radio and battery. The components that can be controlled to conserve power are processor and radio.

Data Compression

Data compression means that reduce the amount of physical data traffic that the sensor send in a small size to improve utilize bandwidth communication, power consumption, speed the processing, and memory space as well as save time. Data compression can be categorized into two methods: lossless method which will get the original signal exactly after compression with no lost any part of it; this method will not achieve the low data rates. In contrast, lossy method will not get the original signal accurately after compression but can obtain a higher data rates. Lossy is preferred for ECG signals. Lossy method used two major criterions: i) compression ratio that is representing the ratio between the original signal and compressed signal and ii) percentage root-mean-square difference (PRD) which defined as the error criterion in estimating of signal rebuilt for lossy compression (Hua et al., 2010). The error criterion for lossy compression techniques to estimating the distortion of signal rebuilt with respect to the original one is very important, especially for ECG signal, where a slight loss or change of information can lead to wrong diagnostics. The controlled transmission quality measure PRD for ECG compression is described in Eq. 1:

$$PRD = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \hat{x}_i)^2}{\sum_{i=1}^{N}(x_i - \mu)^2}} \times 100\% \quad (3)$$

where x_i and $\hat{x}_i$ are the i^{th} samples of original and rebuilt ECG signals of length, N and μ is the signal mean value.

Kim et al. (2010) proposed quad level vector for ECG signal processing to achieve a better performance for both compression flow and classification flow with low-computation complexity. The classification algorithm was employed for the heartbeat segmentation and the R-peak detection methods. The overall energy consumption cost is reduced by 45.3% with the proposed compression techniques.

WBASN COMMUNICATION TECHNOLOGIES

Communication technologies in WBASN are a radio-frequency wireless networking technology-based that interconnects tiny nodes through sensor or actuator capabilities in, or inside a human body. WBASN healthcare applications use different types of wireless protocols like Bluetooth (IEEE 802.15.1) and Zigbee (IEEE 802.1.5.4 Standard) as well as WiFi (based on 802.11b) with different change of each technology for low power and long range. Each BASN consists of multiple of interconnected nodes on, or within a human body,

which together provide a sensing, processing, and communication efficiencies. A WBASN system has its own characteristics, as listed in Table 2:

Table 11. WBASN System Characteristic.

Characteristic	*Description*
Architecture	WBASNs have certain sensor nodes on or inside a human body; but in Wireless Personal Area Network (WPAN) includes router nodes around human body as an infrastructure for sending data away from WBASNs. Every node is a sensor node as well as a router node
Density	The number of sensor nodes deployed on/in body depends on the application; sensor nodes grouped into different groups, but routers is widely distributed
Data rate	Most WSNs are applied for remote monitoring, where events can occur irregularly. In comparison, human's physiological activities are mostly periodic, and as a result, the generated packet streams have steady data rates
Latency	For certain medical applications, latency caused by underlying communications network of a WBASN-WPAN system is critical. Power saving is definitely useful in WBASN-WPAN, but certain nodes could be always on rather than go to sleep often, and whenever necessary to change the battery
Mobility	Humans move. Even those people with particular medical treatment are likely to move sometimes. Compared to equipments wired bedside which limit patients' mobility, WBASN takes benefit of wireless connections. However, this also contributes to the complexity of the network (Cao et al., 2010)

In the following subsection a brief description on Bluetooth technology based on IEEE 802.15.1 protocol and ZigBee technology that is based on IEEE 802.1.5.4 standard protocol as a sensor communication environment. WiFi based on 802.11b protocol, in case if there is a high data rate and no compression, is discussed as well.

Bluetooth

Bluetooth is a wireless technology designed to connect different wireless devices such as telephones, notebooks, PDAs, printers, computers and so on (fortypoundhead.com, 2008). It is also low power and low processing with an overhead the protocol, which is means, the applications with Bluetooth are virtually endless. Bluetooth isn't line of sight and it provides short-range (30 feet) of 10 meters, which can be increased up to 100 meters, Bluetooth operates in the 2.4 GHz band with moderately fast transmission speeds (data rate) of 800 Kb/s (Krasteva et al., 2005). Eventually, Bluetooth as short-range wireless technology is very suitable for many medical applications. The Bluetooth Health Device Profile (Latuske, n.d) was released by the Bluetooth special interest group in June 2008, which contributed to the propagation of Bluetooth in many healthcare applications. Bluetooth and WiFi use the same frequency range, but employ different modulation techniques. The main application of Bluetooth is to replace cables in a variety of small-scale applications, whereas WiFi is used to provide wireless high speed connectivity for general local area network access (Akiba, 2009).

ZigBee

ZigBee is a standard targeting low-data-transfer-rate, low-power-consumption and low-cost wireless applications. ZigBee is used for wireless control and sensing inside a home or hospital if the application does not talking to a phone (fortypoundhead.com, 2008). Its lower physical data rate is traded for lower power consumption, and together with a simpler protocol stack, ZigBee devices enjoy relatively longer lifetime. It uses a wide range of

frequencies: sixteen channels in the 2.4 GHz. It can accommodate up to 2^{64} nodes in the network (Ken, & Xiaoying, 2010). It is corresponding to Bluetooth technology in terms of infrastructure-oriented mesh networking support (Krasteva et al., 2005). Its applications are different from home and industrial automation to remote control and medical monitoring. Authors in (InterBluetooth, n.d) used Zigbee in design and implement an intelligent system for remote monitoring ECG, analysis and diagnosis. ZigBee is designed if a number of different radios were deployed in a particular area, the network will figure our automatically without user intervention taking care of retries, in addition to, the network self-recovery, acknowledgements, and routing data message. The technology found in ZigBee is intended to be simpler and expensive than Bluetooth.

Wireless Fidelity (WiFi)

WiFi refers to certain types of wireless network protocol 802.11b standards to communicate devices to each other without cords or cables. WiFi is more convenient for running full-scale networks; it enables better range from the base station, a faster connection, and better security than Bluetooth (InterBluetooth, n.d). Therefore WiFi can be also used for online communication method to notify and alerts doctor if both the doctor and patient are in one building (Zhao et al., 2001). Despite the high power consumptions of WiFi-based devices this technology will become essential for intensive health signals with high data rates and lightweight or no compression. WiFi differs from Bluetooth in that it covers greater distances and provides higher throughput, but requires more expensive hardware and may present higher power consumption (Akiba, 2009). Table 3 shows the comparison between ZigBee, Bluetooth and WiFi (Krasteva et al., 2005; Khan, Hussain, & Kwak, 2009):

Table 12. Comparison between ZigBee, Bluetooth and WiFi.

Category	ZigBee	Bluetooth	WiFi
Cost	Cheap	Cheap	Inexpensive
Ease of use	Not Easy	Easy	Acceptable
Range	20-25 feet	30 feet	100 feet
Reliability	Reliable	Not very reliable	Not very reliable
Flexibility	Good	Poor	Fair
Scalability	Excellent	Poor	Fair
Power Consumption	Low	Average	High
Interoperability	Good	Excellent	Excellent

DATA ANALYSIS TECHNIQUE AND FEEDBACK

ECG Feature Extraction plays a vital role in diagnosing most of the cardiac diseases. Recently, numerous research and techniques have been developed for analyzing the ECG signal. The proposed schemes were mostly based on fuzzy logic, artificial neural networks, support vector machines, and other signal analysis techniques. Zhao & Zhang (2005) proposed a feature extraction method using wavelet transform and support vector machines. The paper presented a new approach to the feature extraction for reliable heart rhythm recognition. The results of computer simulations provided to determine the performance of the proposed approach reached the overall accuracy of 99.68%. The features extracted will then be used to detect an adverse patient event using a function of all the features measured, without classifying the severity of this event. On the other hand, classification is used to provide grade levels for the severity of the patient's adverse event. The research work in (Noh et al., 2007) tries to find out significant heart rate variability signal through comparison

between power spectrums of ECG-Derived Respiration (EDR) and R-R interval variability ratio. The result shows that classification of set of significant data is confirmed as worthy data because cross correlation results are mostly bigger than 0.7.

Data analysis will lead to useful feedback to the patient; we can summarize them in three categories; namely: Information, recommendation, and diagnostic. The information feedback (Durham et al., 2009) focuses on sending transparently, to the patient, the information output from the detection and classification phase, without any data inference that can lead to diagnosing the patient symptom. The physician will then look at the analyzed data to provide the appropriate treatment to the patient and send the appropriate feedback to do so. The recommendation feedback focuses on automatic extraction of possible treatments for the patient, and presents this to the physician merely as a recommendation. The physician will look at the recommendations and decide what treatment will be provided to the patient as a feedback (WellDoc, 2010). Lastly, diagnostic feedback is in a way a futuristic concept, where the physician can be removed from the loop for certain illnesses. In this scenario, the information outcome from the data analysis phase can be used to search in a medical treatment database using some intelligent techniques to provide the appropriate treatment for the patient without the physician intervention.

CONCLUSION

In this paper we have provided a survey of this promising field through a survey of pioneer WBASNs research projects and enabling technologies, including, sensing and preprocessing, communication environments of WBANs, data analysis and feedback that have feature extraction, detections and classifications. In particular, for life-saving applications, thorough studies and tests should be conducted before WBANs can be widely applied to humans. Compression is used to reduce the amount of physical data traffic that the sensor send in a small size to improve utilize bandwidth communication, power consumption, and memory space. Bluetooth is low power and low processing with an overhead the protocol. ZigBee is low-data-transfer-rate, low-power-consumption and low-cost wireless applications. WiFi is more convenient for running full-scale networks; a faster connection, and better security than Bluetooth. On other hand the feature extraction plays a vital role in diagnosing most of the cardiac diseases and it is a good tool for detecting certain illness.

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REGULARLY EXPECTED REFERENCE-TIME AS A METRIC OF WEB CACHE REPLACEMENT POLICY

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ABSTRACT. The growth of Internet access was increasing significantly. In facts, more than one user access the same object so there is an opportunity to reduce this redundancy by placing an intermediate storage called cache. By this approach, the bandwidth consumption and response time of system in term of user perception can be improved. When the size of web cache is limited, it needs to manage the objects in web cache so that the hit ratio and byte hit ratio are maximized. Based on previous research the performance of cache replacement is dependent on the user/program access behavior. Therefore, the success of IRT implementation in memory cache replacement is not guaranteed a same result for web cache environment. Researcher has explored the regularity of user access and used this characteristic to be included in a metric of web cache replacement. Other researcher uses the regularity to predict the next occurrences and combine with past frequency occurrences. In predicting process, they use statistic or data mining approach. However, it takes time in computing prediction process. Therefore, this paper proposes a simple approach in predicting the next object reference. This approach is based on assumption that the object could be accessed by user regularly such DA-IRT that be used to calculate the time of next object reference called the regularly expected reference time (RERT). The object with longer RERT will be evicted sooner from the web cache. Based on experiment result, the performance of RERT is dependent on user access behavior and opposite of DA-IRT policy.

Keywords: inter-reference time, expected reference time, web cache replacement

INTRODUCTION

The growth of Internet access was increasing significantly. In facts, more than one user access the same object so there is an opportunity to reduce this redundancy by placing an intermediate storage called cache. By this approach, the bandwidth consumption and the response time of system in term of user perception can be improved. In case of limited size of web cache, it needs to manage objects that are saved in the web cache. The objects in web cache are managed by saving only the valuable objects so that the hit ratio (HR) and the byte hit ratio (BHR) can be maximized. In determining the valuable objects, researchers propose several approaches such as based on popularity, size of object, cost of bandwidth, response time, inter reference time, or combining those metrics. Based on the previous researches, it can be concluded that there is no approach being suitable for all organization. On the other hand, the performance of cache management is depended on the user behavior. By knowing the user behavior, it can be expected the next object requested by user. The user behavior can be learned by exploring the workload of web cache. Therefore, researcher focus on studying the web cache workload for several organization. The research of workload of the web cache was conducted extensively (Breaslau et al., 1999; Cohen&Kaplan, 2008; Sediyono, 2008).

Breaslau, et al. (1999) concluded that the distribution of the web requests follow a Zipf-like distribution and this model can explain why the performance of the web cache is certain asymptotic properties. Then, Cohen&Kaplan (2008) measured the regularity of the workload and use it to design the optimal cache replacement algorithm. Meanwhile, Sediyono (2008) reveals the relation between inter-reference time (IRT) and popularity showing the strong relationship and regularity. Based on this fact, there is an opportunity to implement IRT and its regularity in evicting objects from the web cache. Object with longer dynamic-average of inter-reference time (DA-IRT) is lesser popular and will be evicted from the web cache. By this policy, the performance of web cache outperforms LFU policy for certain log traces. On the other hand, it is also dependent on user behavior as previous research (Sediyono, 2009). By recording the state of purged objects, the performance of web cache can be improved significantly especially for log trace where the DA-IRT has a poor performance. However, it needs an additional storage to save the state of purged object and extra process in finding information of purged object (Sediyono, 2009.a). This paper tries to implement inter-reference time metric in the other side that is to uses the regularity of user access behavior. Based on the fact that web objects are accessed regularly by the users (Cohen&Kaplan, 2008; Sediyono, 2008), it can be predicted the next object that will be referenced by the users. The parameter of prediction is combined with parameter of passed access to be a metric for evicting object from web cache. (Yang&Zhang, 2003; Songwattana, 2008). However, it takes time in computing prediction process. Therefore, this paper proposes to predict the next object by the regularly expected reference time (RERT). RERT is calculated from the time difference between regular reference time and current access time of accessed object.

RELATED WORK

Inter-reference time of the successive object requests was extensively discussed and implemented in memory cache replacement (Phalke&Gopinath, 1995; Jiang&Zhang, n.d; Takagi&Hiraki, 2004). Phalke&Gopinath (1995) explored the behavior of inter-reference gap (IRG) that is the time interval between successive references to the same address. They concluded that the IRG has, in general, a repetitive behavior. Therefore, they applied a k order Markov chain to predict the next reference in the future. Based on the experiment, this method can improve the cache replacement until 37% over the Least Recently Usage (LRU). Jiang&Song (Jiang&Zhang, n.d) introduce the LIRS cache replacement based on Inter-reference Recency (IRR) Set. IRR uses the number of references of the other objects that is in the inter-reference time of certain object. On the other hand, they use spatial locality instead of temporal locality. They argue that the age of the object in the cache can be measured by counting the number of references of the other object after the object measured is entered into the cache. LIRS uses two blocks of cache: LIR for low inter reference and HIR for high inter reference. By using this approach that is not depending on the detectable pre-defined regularities in the reference of the workloads, LIRS can improve the LRU performance. Meanwhile, Takagi&Hiraki (2004) argue that each memory address has own IRG distribution, so that they suggest to make individual probability distribution of each memory block and use the distribution to estimate the next reference in the future. This approach depends on the historical data so that it can introduce the complexity in both memory and computation.

Even though IRT has extensively discussed and implemented successfully in memory cache replacement, the research on the inter-reference time for web cache replacement was rarely conducted. Sediyono (2008) tries to explore the relation between IRT and object popularity. It can be conclude that there is a strong correlation between those parameters. On the other word, it is reasonable to implement IRT in web cache environment. For efficient computation, instead of using IR, the dynamic average of inter-reference time (DA-IRT) was proposed (Sediyono, 2009). DA-IRT is calculated based on step by step average of inter-reference time. By implementing DA-IRT the performance of web cache outperforms LFU

for certain number of web traces. On the other word, the performance of web cache is still dependent on the user access behavior. This result is conformity to previous research (Lindermann, n.d). The extended research of Sediyono (2009) was proposed to maintain the state of purged objects. This approach was applied in order to maintain the state of popular objects that often entering and getting out from the web cache because of object replacement process. By this approach, the performance of web cache can be improved significantly, especially for poor DA-IRT performance. However, it needs extra storage and processing in maintaining the state of purged objects.

Cohen&Kaplan (1999) measured the regularity of the workload and use it to design the optimal cache replacement algorithm. Sediyono (2008) also found the regularity of user access behavior in term of IRT. The regular characteristic of user access behavior can be used for predicting next object reference based on previous information. Therefore, Yang & Zhang (2003) use data mining approach to predict the future frequency of occurrences for current object, and combine to past frequency of occurrence of current object in GDSF policy. The same approach was proposed by Songwattana (2008), he makes a prediction of future occurrences using statistic model, and then combines the probability of future frequency of object with the past frequency of object in GDSF policy. Based on the simulation, this approach outperforms the native GDSF. However, for online implementation, this approach will take time in processing a table as a reference in predicting. Therefore, this paper proposes a simple approach that uses expected time of next occurrence. Object with longest expected time will be evicted from the web cache.

REGULARLY EXPECTED REFERENCE-TIME

In this section it will be presented why RERT is chosen as a metric in evicting object in the web cache and how this metric will be implemented so that the computation time will be efficient.

Rationale

Based on DA-IRT (sediyono, 2009), an object is evicted from the web cache if the object has largest DA-IRT values. It means that DA-IRT policy assumes that object with smallest value of DA-IRT will be access soonest, so it has to be kept in the web cache. This assumes is valid if the object is access regularly. If so, it can also be viewed in opponent side that if we stand in a current time of referred object, it can be calculated how long the object will be accessed again. Because of calculating the future reference time of accessed object, this was called an expected reference time of the object. On the other word, RERT is opponent of DA-IRT as long as the objects are accessed regularly.

RERT is calculated based on DA-IRT value. DA-IRT value of object *n* accessed at time *i* is calculated using formula as in equation 1 [4]

$$IRT_{ni} = \frac{IRT_{ni-1} + (t_{ni} - t_{ni-1})}{f_{ni}} \quad (1)$$

where IRT_{ni} is a dynamic average of inter-reference time of the reference n at time ith, $t_{ni} - t_{ni-1}$ is inter-reference time of reference n at time i, f_{ni} is frequency of reference n. Notable, for the first timer object, the average of IRT is assumed equal to the first reference time and placed into the web cache based on LRU policy among the first timer object. Therefore, RERT is calculated as follows:

$$RERT_{ni} = \left(T_{nl} + mIRT_{ni}\right) - T_{nc} \quad (2)$$

where T_{nl} is the last time of accessed object *n*, T_{nc} is current time of accessed object *n*, and m is integer value so that $RERT_{ni}$ is not lower that zero.

Object with largest RERT will be evicted first from the web cache. This approach assumes that object with smaller RERT will be accessed sooner, so that it has to be kept in web cache in order to be hit.

Implementation

The RERT is implemented using linked list data structure. The data attribute saved in the web cache are object size, lastly referred time, cumulative IRT, and frequency of reference. The cumulative IRT and frequency of reference of the object will be updated if the object is referred. The algorithms of the RERT as follows:

Input: X the object requested by user

Process:
If Object X is in Cache
    Add cumulative IRT by current IRT
    Increase the frequency by one
    Calculate DA-IRT value
    Calculate HR, BHR
Else
    While there is no the space of cache for X
        Calculate RERT and evict the object with largest RERT value
    Add object X into the cache using LRU policy among the first timer

Ouput: HR, BHR

METHODOLOGY

The methodology used in this research is experimental-based methodology. The experiment is conducted by simulating the web cache replacement policy and using the web trace log as a input. This section describes and discusses about the evaluation criteria and the data preparation for the web cache simulation.

Evaluation Criteria

The criteria of evaluation are determined to assess the performance among web cache replacement policies. Based on the previous research, the criteria of evaluation for the web cache replacement are Hit Ration (HR) and Byte Hit Ratio (BHR). The HR is ratio between the number of references and number of requests. Meanwhile BHR is ratio between the number of byte of the references and the number of byte of the requests. The formulation of HR and BHR as follows:

$$HR = \frac{\sum hit}{\sum request} \quad (3)$$

$$HBR = \frac{\sum byte\_hit}{\sum byte\_requested} \quad (4)$$

Data Preparation

This section discusses about data testbed for simulation beginning from the raw data, data processing, and data properties.

The raw data for the experiment are collected from three companies: Garuda Indonesia Airways (GIA), PT Telkom (Telkom), and PT Peti Kemas (PetiKemas). The GIA web caches have been collected as long as three weeks from November, 1st till 18th 2008, and the Telcom

web caches have been collected for one week from Nopember, 2nd till 8th 2008. Meanwhile, PetiKemas web cache has been collected for five weeks from June, 26th 2008 till July, 31th 2008.

Before the web caches workload is explored, the web caches are filtered so that only the cacheable object that will be explored. To filter the cacheable objects, this paper adopts the rule that was also used by Casilari&Trivino-Cabrera (2008). The rule is the web request that contain the '?', 'cgi', or 'cgi-bin' will be discarded from the web cache log, and only those request with a cacheable response code, that is, 200 (OK), 203 (Partial), 206 (Partial Content), 300 (Multiple Choices), 301 (Move), 302 (Redirect), and 304 (Not Modified) will be used in the experiment.

Simulation

The simulation is conducted using computer program in C# language. The web cache replacement policies that are compared in the experiment are LRU, LFU, GDS(1), DA-IRT, and RERT itself. The size of web cache is varied in range 20, 40, 60, 80 percent of the total size of distinct requests in testbed. These policies are implemented in same testbed and then HR and BHR of each web cache replacement policy and web cache size are calculated.

Table 1. The properties of the web caches under investigation

	PT Garuda Indonesia Airways (1-18 Nov 2008)				PT Telkom (2-8 Nov 2008)			Peti Kemas (26 Juni - 31 July 2008)
	GIA #1	GIA #2	GIA #3	GIA #4	Telcom #1	Telcom #2	Telcom #3	
# of Request	3,544,156	8,269,922	4,717,459	3,137,920	5,014,879	4,560,189	8,219,840	7,558,496
# of Cachable Request	1,372,801	3,195,265	2,194,430	1,664,758	2,208,864	1,385,718	3,519,394	3,253,394
Request rate daily	**76,266**	**177,514**	**121,912**	**92,486**	**315,552**	**197,959**	**502,770**	**92,954**
% of Cachable Request	**38.73**	**38.64**	**46.52**	**53.05**	**44.05**	**30.39**	**42.82**	**43.04**
Total Size of Cachable Object (MB)	13,957.7	37,774.8	16,557.4	31,971.9	245,888. 8	99,323.9	245,888.8	66,548.2
One Timer	298,121	649,826	417,580	389,405	35,024	16,584	34,894	792,099
% of One Timer	**21.72**	**20.34**	**19.03**	**23.39**	**1.59**	**1.20**	**0.99**	**24.35**
# of Distinct Request	379,746	839,080	532,241	487,728	594,061	408,016	923,313	1,030,870

EXPERIMENT RESULT AND ANALYSIS

In this analysis, it will only be discussed the experiment of GIA#1 and Telkom#2, because these testbeds have shown an extreme characteristic (Sediyono, 2009; Sediyono, 2009.a). In general, increasing web cache size tends to increases either hit ratio or byte hit ratio. This characteristic confirms to the previous research. GDS(1) outperforms all web cache replacement policies in terms of HR, but it has a poor performance in terms of BHR. This result is also conformity with previous research. As predicted before, the characteristic of RERT is opposite of DA-IRT. This conclusion is obtained from the HR characteristic of RERT and DA-IRT in Figure 1 and 2. On the other word as in previous research, RERT is also dependent on the user behavior in accessing Internet. Therefore, it needs to recognize another metric that can be used as a reference in switching among replacement policies, so that the system can adapt the different user behavior.

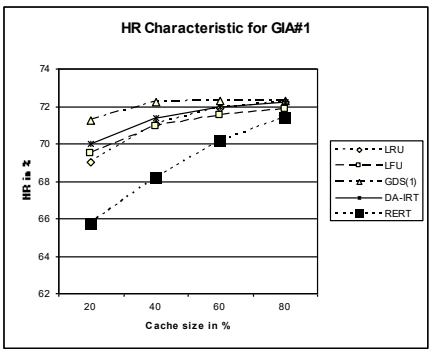

Figure 1. HR Characteristic of GIA #1

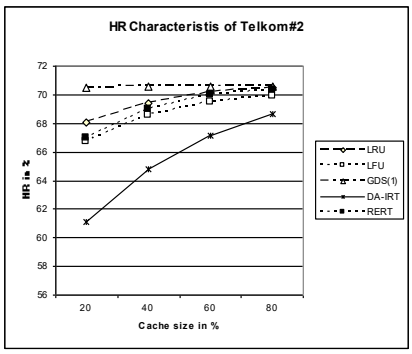

Figure 2. HR Characteristic of Telkom #2

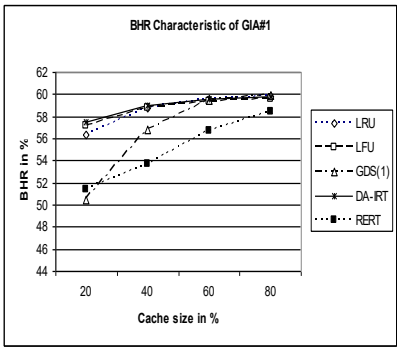

Figure 3. BHR Characteristic of GIA#1

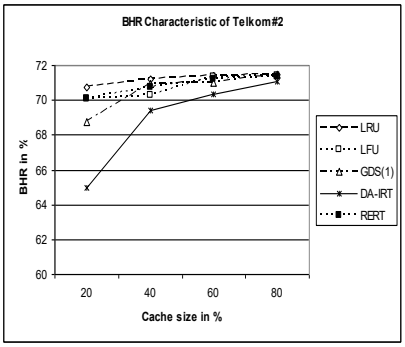

Figure 4. BHR Characteristic of Telkom #2

CONCLUSION AND FUTURE WORK

Based on the simulation result from two testbeds, it can be concluded that the performance of RERT is dependent on the characteristic of workload. Moreover, the characteristic of RERT is opposite of DA-IRT in term of HR. Therefore, if it can be recognized the characteristic of workload so that the system can determine which one of policy that will be implemented, the web cache performance can outperform for all testbeds.

Based on the simulation result in current research, it needs to find the web cache replacement policy that can adapt the difference workload characteristic. Using this approach, it can be expected that system can learn and adapt the user behavior so that the performance of web cache can be optimized.

ACKNOWLEDGMENT

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"SAPS" INNOVATIVE SYSTEM FOR THE AERIAL ALTITUDE PLATFORM SKY MESH NETWORK IN RURAL & DISASTER AREAS

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ABSTRACT. Communications play a significant role in rural and disaster situations since they provide critical information to audiences and organizations, during natural or unnatural disasters, disrupted communications that require a speedy deployment communication networks to carry out necessary relief, in fact, the traditional techniques fail to provide access to the Internet in rural and isolated areas. In order to improve the communication system performance in isolated areas an aerial altitude platform system (AAPS) could be used. But this mechanism has encountered problems of precariousness due to strong winds; this challenge hinders network deployment due to loss of the line of sight (LoS), so a smart antenna platform system (SAPS) base station is suggested. In this paper we demonstrate, for the first time, that the SAPS system provides more stability and accuracy in transmission of radio signals by the use of 3-axis (accelerometer and gyroscope) sensors. The experimental analysis done in this work considers mesh networks and LoS between the mesh nodes with low weight, low costs and high performance.

Keywords: aerial altitude platform, stability, mesh networks, LoS, disasters, rural.

INTRODUCTION

Communications play a significant role in disaster situations since they provide critical information to both national and international audiences (Organization, 2004). Aerial altitude platform systems (AAPS) have the potential to deliver a range of communication services and other applications such as broadband in rural and disaster areas. The aim of the plan is to be capable to provide a high rate of communication directly to the user anywhere in the LoS. The wind speed and flow patterns using, helium-balloons (NABAS, 2007), as a station for a wireless access point in mesh networks requires constancy in the air. High wind speeds have a negative effect on the stability of the communication device signals (Lee, 2005), thus causing difficulties in communications between network nodes. The wind direction altering causes fluctuations in the balloon's position, which directly affects the wireless signals.

According to Hariyanto, the Emergency Broadband Access Network Using Low Altitude platform (EBAN) was faced with the problem in fluctuation of the balloon with high winds (Hariyanto, S. & Widiawan, 2010). The emergency system implementation in disaster areas requires addressing requisites of balloons stability in facing the wind and the fluctuation of the signal, which leads to increases in the data loss between the network nodes and makes the monitoring of these areas quite limited (Lee, 2005).These limitations making use AAPS

technology are not effective; particular in mesh networks that necessitate several nodes for deployment. The situation requires construct an innovative mechanism to formulate the signal transmission between mesh nodes more stable, which also enhances the constancy of the photos sent during surveillance. This can be done through the detection of an effective system method that has the aptitude to sense the environmental changes (self-movement system) and disposition under the changes surrounding it, i.e., resist the varying of the antenna direction due to environmental factor changes, and to amplify the reliability of signal transmission between network nodes; choosing an effective approach to reduce these kinds of obstacles .is the crucial point of this paper.

SYSTEM DESIGN FOR SKY MESH ARCHITECTURE

In our experiment, the mesh network was chosen as an option for network data transfer between nodes. Two nodes were used as receiving and transmission stations. The stability of the suggested system has been tested against environmental changes earlier than raising the balloon payload.

Figure 1 describes the aerial platforms and the mechanism employed in this work. The design shows the significant fundamental requirements that must be provided to connect the two areas in communication services, on the assumption that sky station 2 (SS2) is in a disaster area where Internet services necessitate to be provided; essential system requirements are illustrated in the margin of the figure.

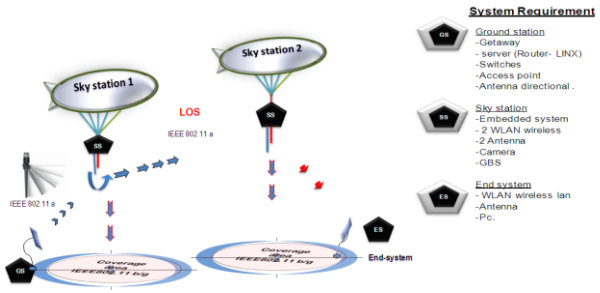

Figure 1.The Proposed Aerial Altitude Platform System Scenario Topology

Hardware System Design

Figure 2 illustrates the overall system design; Figure 2 (A) represents the ground station (GS), which is considered a connecting entrance area to be providing services with the outside world via VSAT, DSL, or any other source obtainable. Figures 2 (B) and (C) illustrate the payload balloon, Figure 2 (B) includes the embedded system optimized for routing signal functions between nodes; this device is associated with two wireless cards: (1) support IEEE 802.11a networking and (2) IEEE 802.11 b/g access points for maximum range. The embedded system is also connected with two external high- power antennas for point-to-point links of frequency bands of 5.8 gigahertz (GHz) and 2.4 GHz. The commercial product dual-radio EnRoute500 can serve as a Wi-Fi access point with a dedicated 802.11b/g radio, an intra-network repeater and router with a dedicated 802.11a mesh enabled radio (Communicate without boundaries, 2010); the specifications are used in communication systems of the AAPS, and correspond with this product.

Experimental Setup SAPS

Wave signals are direct by the antenna transmitter in the ground station to sky station 1 (SS1); in Figure 2 (B) the antenna that attaches to the balloon payload receives a signal from the GS , then the embedded system routes the signal and sends it during the antenna to SS2, at the same time covering the area underside the (SS1). The received signal in SS2 depends on the LoS, to corroborate the reliability of service in the area under SS2. The area coverage range depends on the height of the balloon and the equipment that is used in communication. Reliability of the signal transmission between the mesh nodes depends on the constancy of the source transmitter, which is the focus of discussion for this paper.

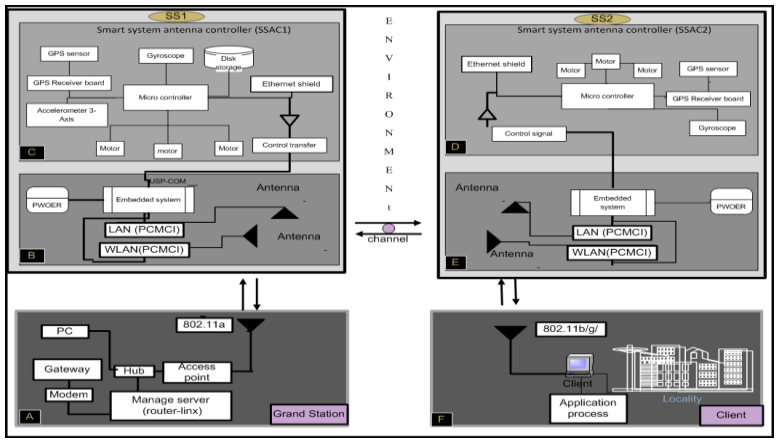

Figure 2.AAPS Physical Architecture Design

For stability of the AAPS, the smart antenna platform system (SAPS) is suggested to insure communication resources to seek the information with the disaster area. SAPS is an integrated system that contains all the essential apparatus to be attached to the balloon; this system is characterized as light in weight, low in cost, and capable to sense external environment changes (self –direction) according to the changes surrounding it .

The SAPS components are illustrated in Figure 3 and 4, which consists of:

a) Movement system control platform.
b) The Global Positioning System (GPS) is a space-based system that provides reliable location and time information for AAPS. GPS sensors with the board shield have been linked to the microcontroller.
c) Embedded system hardware and personal computer memory card international (PCMCIA) – WAN and LAN, shown in figure 4, D2.
d) Figure 4 illustrates the dynamic part of the sub-platform with motors, which is designed to receive the signal that has been sent by the microcontroller, and to organize the movement of the antenna that has been installed in the platform.
e) IP camera system for the surveillance of the disaster area, by wireless network, to survey the information around the disaster area (Shibata, S. &Ogasawara, 2009).

To transmit the influence of the environmental factors to the communication system, a 3-axis accelerometer with a digital interfaces (Tsuzuki & Fisher, 2010), is used and is fixed to the smart antenna platform control (SSAC) to interact with the outside forces vector (R). The vector R can be measured by the accelerometer, to calculate the coordinate of SAPS, i.e., R x, R y, R z projection of the R vector on the X, Y and Z plane. The position of R for SAPS that

the accelerometer measures are transmitted to a gyroscope through the microcontroller that is compatible to work with the sensors being used (Atmel, 2009).The gyroscope is a device for measuring or maintaining orientation based on the principles of the conservation of angular momentum. The coordinates of the SAPS position are sent to the gyroscope to be rotated responding to that change, the gyroscope output data is processed by the microcontroller, and then the signal is sent to motors to correct the SAPS direction.

For the purpose of converting the external movement sensing, (C) programming language was used to interpret the signal from the sensing system to a microcontroller. Figure 3 describes the technical procedures for the mechanism of the system that was used in the SAPS.

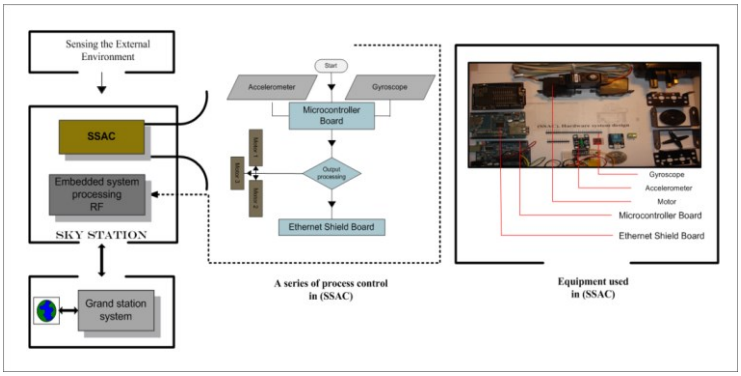

Figure 3.Experimental Setup for SSAC

After discussing the mechanism of the control system unit and its major components, what remain are a compilation of these components into a particular unit and the composition of the essential structure of the system to perform its intended purpose.

Figure 4 describes the design of the SAPS system that is used in the AAPS; the design describes clearly the most essential components of the system and the side table to help clarify each component and its location in the system.

SMART ANTENNA PLATFORM SYSTEM (SAPS$_1$)

No.	Type	Device	Specifications
1	A1	MICROWCONTROLLER	board
1	B1	Ethernet Shield	board
1	B2	GPS- SHIELD	board
3	C1	Motor	servo motor
3	D1	platform	
1	D2	platform box	
1	E1	Sensor (3- axis)	Accelerometer
1	E2	Sensor	Gyroscope
1	E3	Sensor	GPS
1	F1	Antenna Omni directional	802.11a
1	F2	Antenna Omni directional	802.11b/g
1	G1	Camera	IP- camera
2	H1	WIGHET-PALLINCING	
1	I1	PCMCI-card	WAN
1	I2	PCMCI-card	LAN

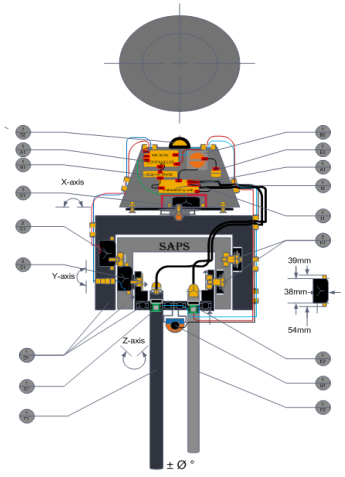

Figure 4.Components of Smart Antenna Platform Experimental System

EXPERIMENTAL RESULTS AND DISCUSSION

In this sub-section, we scrutinize the approach for sensing the inclination with three axes for SAPS, and to determine the angle for each axis of the SAPS accelerometer (SA) to a reference position. The reference position is taken as the characteristic orientation of SA with the x- and y-axes in the plane of the horizon (0 gravity (g) field) and the z-axis orthogonal to the horizon (1 g field). Figure 5 shows the direction field for the desired heading generated by the vector equation.

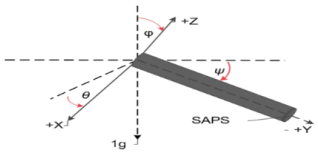

Figure 5.Angles-Inclination Heading Vector in Field Geometry.

The angles of inclination can be calculated using Eq.1, Eq.2, and Eq. 3.The experimental system parameters are based on a published paper (Fisher, 2010).

(SA)posission vector in $3-$ axis $=$

$$\theta = tan^{-1}\left(\frac{SA\,x,out}{\sqrt{SA^2y,out+SA^2z,out}}\right) \quad (1)$$

$$\psi = tan^{-1}\left(\frac{SA\,y,out}{\sqrt{SA^2x,out+SA^2z,out}}\right) \quad (2)$$

$$\varphi = tan^{-1}\left(\frac{\sqrt{SA^2x,out+SA^2y,out}}{(SA\,z,out)}\right) \quad (3)$$

Where θ is the angle between the horizon and the x-axis of the (SA), ψ is the angle between the horizon and the Y-axis of (SA) and φ is the angle between the gravity vector g and the Z-axis. The consequences of the performance of SAPS for sensing the external environmental changes are illustrated in Figure 6, where the X-axis represents the measurement time (0.5) in seconds (sec) and the pulse signal on the axis Y, Table1 shows the experimental parameters that have been adopted by experience. The accelerometer measures sensitivity in a 3-axis direction, for the time period of (0-20) sec in order case of the system stability and for the period of (20-42) sec the direction of system deviation ,that illustrated in the lower part of the diagrams (The line with the arrow in the diagrams shows the launch of the movement the system until the end). Table1 shows the experimental parameters that have been adopted by experience.

The accelerometer in SAPS measures the vibration or acceleration of motion and perform us position R vector in 3-axes, which is the inertial force vector as measured by the accelerometer. The angles of inclination transmit to the gyroscope depend in our algorithm. The gyroscope measures the angles rate changes the defined above, in other words it will output a value that is linearly related to the rate of change of these angles. In short, the microcontroller is constantly reading in data from two sensors, where the output data is sent to the servo after processing to modify the direction of movement to the initial value.

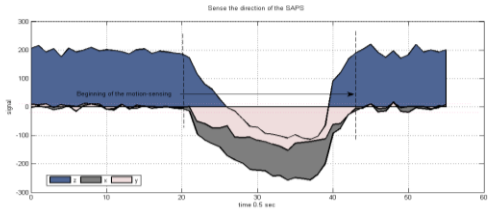

Table1. System Parameters

Parameter	Values
apply voltage range for Acc	2.0 V to 3.6 V
Time movement Experimental	20-42 sec
X axis account numbers.	-300 to 300

CONCLUSION

In this paper, we scrutinize the performance of SAPS for mechanism sensing with three axes. A balloon wireless network aerial platform was suggested to insure communications and to grasp the information within the disaster area, the first stride being to solve the challenge of environmental factors and their impact on the stability of signal transmission from the sky base station to another mesh node, and sensing these effects and turning them into reality in order to develop a mechanism to convert this sensitivity to movement, thereby achieving stability.

The advantages of SAPS are: it contains all broadcast equipment that provides wireless network services, and controlling the system for steadiness signal transmission plus contain the observation tools for the purpose of transferring events from the field directly to the emergency room (disaster control center) for intervention and handling. The innovation has been characteristic as well; light weight, low cost, high performance and can be regarded as an integrated unit for communications that could be adopted in aerial altitude platform systems.

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ENHANCEMENT OF ADAPTIVE FEC MECHANISM FOR VIDEO TRANSMISSION OVER 802.11 WLANS

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ABSTRACT. Forward Error Correction (FEC) techniques have been adopted with Automatic Repeat reQuest (ARQ) to overcome packet losses and avoid network congestion in various wireless network conditions. The number of FEC packets need to be generated adaptively because usually wireless network has varying network condition. In the current Adaptive FEC mechanism, the FEC packets are determined based on average queue length and average packet retransmission time. However, in order to determine average queue length, estimating its weight value (i.e. smoothing factor) is a challenging task. Smoothing factor is an important parameter as it affects the generation of FEC packets. Thus, this work conducted the estimation of suitable smoothing factor value to determine the average queue length according to packet loss rate over the wireless network. The simulation results show that the enhanced FEC mechanism outperformed other Adaptive FEC mechanisms in terms of recovery efficiency.

Keywords: Forward Error Correction (FEC), Automatic Repeat request (ARQ),

INTRODUCTION

Transmission of real-time video over the wireless network usually disturbed by video packet loss that caused by interference, terrestrial obstructions and reflection of transmission signal (Ding et al., 2006). To make sure that the video delivered at the receiver in good quality, Forward Error Correction (FEC) can be used to recover the video packets from losses. The principle of FEC is to add redundant packets so that original packets can be reconstructed in the occurrence of packet loss. In order to generate the appropriate number of FEC, Automatic Repeat reQuest (ARQ) mechanism can be adopted with FEC mechanism. The reason of using FEC with ARQ mechanism is because wireless network faces various network conditions as each mobile nodes experience different channel condition. Thus, it is difficult to decide how many FEC packets to be generated. Small numbers of redundant packets leads to small overhead but it might not be able to recover all loss packets therefore produce bad video quality. On the other hand, large numbers of redundant packets produce large overhead and consume too much bandwidth unnecessarily but produce good video quality.

Recently, there are many researchers work on investigating the combination of FEC and ARQ mechanism. The EAFEC mechanism proposed by Lin et al. (2006) has implemented dynamic FEC combined with ARQ mechanism at base station. This mechanism recovers packet loss according to the network status. Meanwhile, Du et al. (2009) proposed Mend FEC which is an enhancement from EAFEC mechanism where it can improve quality of video in sudden video changing scene. However, both of the mechanisms used uniform error model to verify the mechanisms. Generally, uniform error model is easier to implement compared to GE model. However, uniform error model has disadvantages as it is unable to represent the burst error network that usually occurred in the wireless network. Latré et al. (2007) have

proposed AHAFEC mechanism that can alter the amount of FEC packets and the number of maximum retransmission at base station under burst error network. Unfortunately, they do not provide any information regarding the amount FEC packets required to recover the loss packets. Thus, the recovery efficiency can not be determined.

The aim of enhanced FEC mechanism is to improve the performance of existing Adaptive FEC mechanism in term of recovery efficiency. The performance metric such as PSNR, recovery efficiency and FEC efficiency are used in the performance evaluation.

ENHANCEMENT ON SMOOTHING FACTOR VALUE IN QUEUE LENGTH

The existing Adaptive FEC uses Exponential Weighted Moving Average (EWMA) to estimate the value of average queue length. EWMA is used to minimize the bias against transient burst in the queue length. Whenever the packets queue in the buffer, the average queue length is updated according to equation 1:

$$avg_q = (1 - w_q) \times inst_q + w_q \times avg_q \quad (1)$$

avg_q the average queue length

w_q the smoothing factor

$inst_q$ the current queue

Smoothing is a factor to produce weight average values in order to eliminate the effect of short term fluctuation due to the traffic patterns (Abbas et al., 2004). Based on this equation, w_q that is also called a smoothing factor play an important roles to determine the queue size used in the averaging process (Romdhani et al, 2003). w_q is set with static value in the range of [0, 1] to determine the average queue length. Harun et al. (2010) shows that greater value of w_q will produce the best quality of video i.e., 0.9 when the wireless error rate is low. Otherwise, when the wireless conditions become worst, the w_q need to be set to minimal value, i.e. 0.1, so that more redundant packet can be generated. As a conclusion, the w_q is important in determining the appropriate average queue length and producing quality video at the receiving.

The appropriate values of smoothing factor can be generated based on the number of packet retransmission failed at the MAC layer. When the packet retransmission failed is low, the value of smoothing factor is set to high value. Therefore, the number of FEC generated is also low because the error rates it low. On the other hand, as the packet retransmission failed is increased, the value of smoothing factor is decreased. The decreasing of these values resulting in the ability to generate more FEC packets to recover the packet failed due to the increasing of error rates.

Here, the new values of w_q can be generated as:

if (avg_{rT} < th3)
  w_q = 0.5;
else if (avg_{rT} < th4)
  w_q = int (0.5*(th4 – avg_{rT})/th4-th3);
else
  w_q = 0.1;

Denotes that avg_{rT} is the average of packet send failed during retransmission at the MAC layer, th5 is the low threshold and th6 is the high threshold value for the number of packet failed. When avg_{rT} is less than the certain threshold (th5), the value of w_q is set to 0.5. If the avg_{rT} is larger than th6 value, the value of w_q is set to 0.1. Otherwise, the value of w_q decreases based on the increasing of packet retransmission failed.

SIMULATION TOPOLOGY AND SETTING

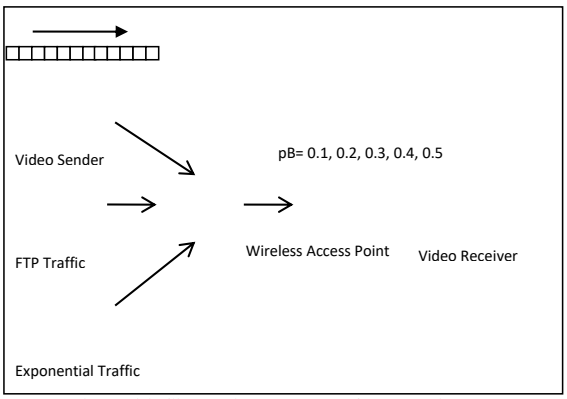

Figure 21. Simulation Topology for Experiments

The simulation topology in this paper is shown in Figure 1. In this simulation, video server transmits video streams over the Internet using wired link while wireless nodes are connected using wireless link. The video traffic trace used for this experiment is "Highway" video using H.264 video coding with JM 1.7 codec. JM 1.7 has been used in this experiment because the newer version of JM doesn't support packet losses (Ke et al., 2006). This means that when some parts of compressed file have removed due to those packets are lost during transmission, the distorted file is unable to be decoded. Thus JM 1.7 is used to encode and decode video sequence. The "Highway" format is QCIF and the Group of Picture (GOP) structure is IPPPPPPPPPPPPPP which is Simple Profile. "Highway" video trace consists of 2000 frames which are divided into transmitting slice. Each slice is about 500 bytes and transmitted via multicast transmission with the GE error model. The P_{GG}, P_{BB} and P_G are set at 0.96, 0.94 and 0.001 respectively. The packet error probability (P_B) represent the channel is in bad state is varied from 0.1 to 0.5 with 0.1 intervals. The frame rate for this video is 30 (frame/sec) and the total video packets sent are 4829. There are two background traffics in this simulation. The first is FTP traffic that transmitted using TCP packets. The second is exponential traffic transmitted using UDP packets. Transmission rate is 1 Mbps which include burst and idle time are both set as 0.5ms. The link between wireless AP and the wireless node is IEEE 802.11b 11Mbps while the link between the Internet and wireless AP is 100Mbps. The link between Internet and each traffic source is set as 10Mbps.

SIMULATION RESULTS AND DISCUSSIONS

This section discussed the simulation results obtained from the performance evaluation done on the Adaptive FEC mechanism and modification of Adaptive FEC mechanism. All the results are generated from different error rate which is from good network status (0.1) to bad network status (0.5).

Table 1. No. of FEC

	EAFEC	Enhanced FEC	Mend FEC
pB=0.1	3±1	1±0	55±3
pB=0.2	14±0	15±1	82±1
pB=0.3	49±2	57±2	152±3
pB=0.4	119±5	110±3	244±6
pB=0.5	195±6	148±4	331±5

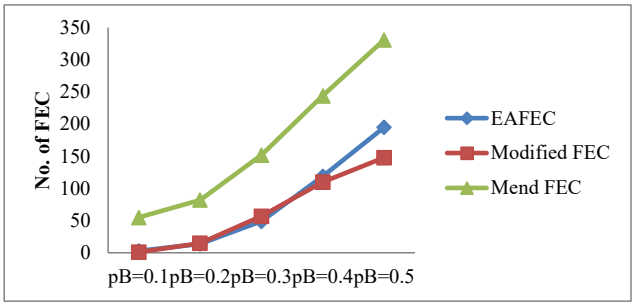

Figure 2. No. of FEC vs error probability

As shown in Table 1 and Figure 2, the number of FEC packets are increased as the packet error rate increased. This is the fact that high packet error rates leads to high packet retransmission until the packet has been correctly received at the receiver. As the packet error increased, Mend FEC generates the highest value of FEC followed by EAFEC and Enhanced FEC. Compared with EAFEC and Enhanced FEC, obviously from the results that Mend FEC generated high FEC packets even when the packet error rate is low. Thus, when network condition is good, Mend FEC is not suitable to be used to prevent network congestion caused by the excessive FEC packets. In contrary, Enhanced FEC generates lower FEC packets compared to other.

Table 2. Recovery efficiency

	EAFEC	Enhanced FEC	Mend FEC
pB=0.1	0±0	0±0	0±0
pB=0.2	0.0095±0.0049	0.0149±0.009	0.0059±0.0015
pB=0.3	0.03±0.06	0.05±0.002	0.029±0.005
pB=0.4	0.0456±0.0071	0.1119±0.0120	0.0609±0.0052
pB=0.5	0.0935±0.0070	0.1956±0.0165	0.1179±0.0055

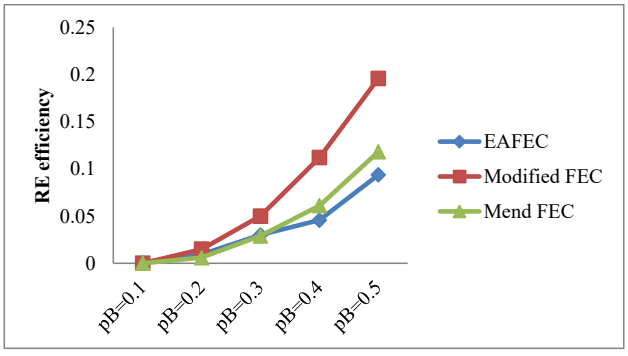

Figure 3. Recovery efficiency vs error probability

Recovery efficiency (RE) is used to measure the ratio of the amount recovered video packet to the total amount of FEC packets. As shown in the Table 2 and Figure 3, Enhanced FEC achieved greater RE compare to EAFEC and Mend FEC. Hence, Enhanced FEC provides a better packet loss recovery performance compared to the others. The number of FEC packets generated by Enhanced FEC are utilized more efficiently to recover the packet

loss. The lowest RE value is contributed by EAFEC mechanism because it generates more than one FEC block for a same video block. For real video trace file, the missing packet sequence can only be recovered by the same packet sequence generated by FEC. For example, packet no.1 can be recovered by FEC packet no.1 but not the packet no.2 or 3.

Table 3. FEC efficiency

	EAFEC	Enhanced FEC	Mend FEC
pB=0.1	0.9995±0.00015	0.9998±0.000002	0.9885±0.0005
pB=0.2	0.9972±0.0001	0.9969±0.0001	0.9833±0.0003
pB=0.3	0.9903±0.0004	0.9889±0.0004	0.9704±0.0005
pB=0.4	0.9769±0.001	0.9801±0.0006	0.9545±0.0011
pB=0.5	0.9643±0.0011	0.9757±0.007	0.9426±0.0009

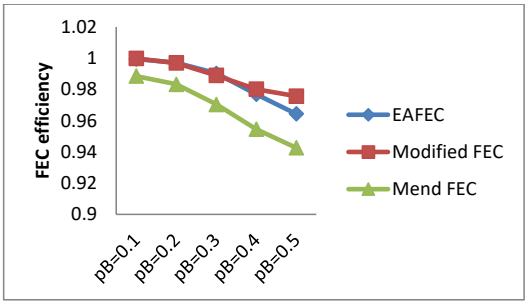

Figure 4. FEC efficiency vs Error probability

The FEC efficiency determines how efficient the FEC packets used to recovered packet loss. The best value of FEC efficiency is equal to 1, which means full utilization of FEC packet or in the condition where no FEC packets transferred due to the video transmission is free from packet loss. As shown in Table 3 and Figure 4, the FEC efficiency decreases as the packet error rate increase. This is the fact that more video packets are dropped in bad network condition. Moreover, Enhanced FEC achieved greater FEC efficiency when error probability increases. This is contributed by the reasonable value of smoothing factor that allows the lower generation of FEC packets for Mend FEC mechanism and thereby the amounts of wasted FEC packets are reduced accordingly. In contrary, Mend FEC contributes the lowest FEC efficiency because unused FEC packets are generated along the time.

Table 3. PSNR

	EAFEC	Enhanced FEC	Mend FEC	Remarks (MOS)
pB=0.1	40.4	40.4	40.4	5 (Excellent)
pB=0.2	40.2	40.32	40.31	5 (Excellent)
pB=0.3	39.97	40.06	40.04	5 (Excellent)
pB=0.4	39.24	39.33	39.46	5 (Excellent)
pB=0.5	38.32	38.55	38.85	5 (Excellent)

As shown in Table 3 and Figure 5, Mend FEC mechanism achieves higher PSNR than other mechanisms due to high FEC packets injected to the video transmission. This is due the fact that high FEC packets leads to high probability to recover packets from loss. When the pB is less than 0.3, Enhanced FEC achieved same PSNR value to mend FEC. However, when pB reach 0.4, the PSNR is reduced because the number of FEC also need to be reduce to avoid network congestion during video transmission. Comparing with EAFEC, Enhanced FEC gives better result because it's high error recovery.

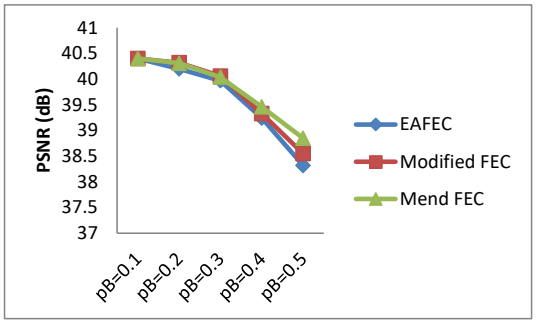

Figure 5. PSNR vs Error probability

CONCLUSION

After analysing the result of the experiments, clearly that performance of Enhanced FEC is better than the others in term of high error recovery using low FEC packets. The performance improvement of Enhanced FEC is related to the reasonable value of smoothing factor setting for the queue length. For the future, the work can be extended by implementing the Enhanced FEC in real network.

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SIGNAL DETECTION ALGORITHM FOR COGNITIVE RADIO USING SINGULAR VALUE DECOMPOSITION

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ABSTRACT. This paper highlights an algorithm for detecting the presence of wireless signal using the Singular Value Decomposition (SVD) technique. We simulated the algorithm to detect common digital signals in wireless communication to test the performance of the signal detector. The SVD-based signal detector was found to be more efficient in detecting a signal without knowing the properties of the transmitted signal. The performance of the algorithm is better compared to the favorable energy detection. The algorithm is suitable for blind spectrum sensing where the properties of the signal to be detected are unknown. This is also the advantage of the algorithm since any signal would interfere and subsequently affect the quality of service (QoS) of the IEEE 802.22 connection. Furthermore, the algorithm performed better in the low signal-to-noise ratio (SNR) environment.

Keywords: cognitive radio, singular value decomposition (SVD), signal detector.

INTRODUCTION

Cognitive radio (CR) has been a very important function to enable the state of the art technology in revolutionizing spectrum efficient utilization. In responding to the idea of CR coined by Mitola and Maguire (1999), IEEE 802.22 Working Group (WG) was formed in 2004. The WG is expected to develop and incorporate CR functionality in a standard known as Wireless Regional Area Networks (WRAN). The new standard is going to operate in TV bands between 54-862 MHz (IEEE802.22, 2010). The standard is likely to deliver broadband internet access on vacant TV channels at the same time avoiding harmful interference to the licensed users in rural areas within a radius of 17 km to 30 km (Xu *et al*., 2008a).

In rationalizing the use of CR, a spectrum management function needs to be implemented in cognitive radio module. As stated by Haykin (2005), the spectrum management process consists of four major steps: 1) spectrum sensing, 2) decision making, 3) spectrum sharing and 4) spectrum mobility. The first and second steps are very crucial in enabling the CR technology. CR users are expected to be able to detect primary user (PU) signals and find the spectrum holes or the unused spectrum in order to operate.

Several spectrums sensing algorithms such as classical energy detection (ED), the eigenvalue-based detection, the covariance-based detection and feature-based detection are reported in the literature to detect primary signal. Discussions about these techniques and algorithms as well as their pros and cons are reported by Yucek and Arslan (2009); Chen and Prasad (2009); Akyildiz *et al*. (2006); Akyildiz *et al*. (2008); and Zeng and Liang (2010). According to Kortun *et al*. (2010), the most accurate techniques that can simultaneously

achieve both high probability of detection and low probability of false alarm with very minimal knowledge about the primary user signals and noise spectrum are the eigenvalue-based detection techniques introduced by Zeng and Liang (2007). It is mentioned in the literature that maximum-minimum eigenvalue (MME) method has many advantages over the rest of sensing methods listed above. This is because the decision of signal presence can be done without prior knowledge of the primary signal and noise.

BACKGROUND WORK

Before the introduction of SVD-based detection, researchers discovered that by analyzing the eigenvalues from a received signal matrix, the threshold for detecting primary signal can be calculated. Most of the researchers used the eigenvalue decomposition. This method is known as eigenvalue-based detection. Discussion on the method can be found in (Zeng and Liang, 2007, Zeng and Liang, 2009, Kortun *et al*., 2010).

The SVD is quite similar to the eigenvalue decomposition technique. However, the SVD is very general in the sense that it can be applied to any $m \times n$ matrix, whereas the eigenvalue decomposition technique can only be applied to certain classes of square matrices. Additionally, the SVD has got several advantages compared to other decomposition methods as listed below (Leach, 2000):

i. more robust to numerical error;

ii. exposes the geometric structure of a matrix an important aspect of many matrix calculations; and

iii. quantify the resulting change between the underlying geometry of those vector spaces.

SVD-based detection was introduced by Xu *et al*. (2008a) and Xu *et al*. (2008b). Both papers used SVD technique to detect wireless microphone signal in a wideband cognitive radio network. In WRAN, the system needs to detect both digital TV and wireless microphone signals since both services are incumbent in the frequency bands. However, in some countries, wireless microphone is not protected by the law as in US where FCC Part 74 protects the service.

In this paper, the SVD technique is used to detect common signals rather than restrict it to the only digital TV and wireless microphone since any other signal would affect the WRAN quality of service.

SYSTEM MODEL

In detecting a signal, two hypotheses are involved: $\mathcal{H}_0$, signal is not present; and $\mathcal{H}_1$, signal is present. The received signal samples under two hypotheses are given respectively as follows (Cabric *et al*., 2006, Chen *et al*., 2007, Sahai and Cabric, 2005, and Urkowitz, 1969):

$$\begin{aligned} \mathcal{H}_0 &: y_i(n) = \eta_i(n) \\ \mathcal{H}_1 &: y_i(n) = x_i(n) + \eta_i(n) \end{aligned} \tag{4}$$

where $x_i(n)$ is the transmitted signal samples, (N) , through a wireless channel consisting of path loss, multipath fading and time dispersion effects, and $\eta_i(n)$ is the white noise which is independent and identically distributed (iid) with zero mean and σ_η^2 variance. Note that $x_i(n)$ can be the superposition of the received signals from multiple primary users, hence, no synchronization is needed here.

There are two probabilities involved for signal detector: probability of detection, P_d, which defines the alternative hypothesis $\mathcal{H}_1$, the probability of the detecting algorithm having detected the presence of the primary signal; and probability of false alarm, P_{fa}, which defines

a null hypothesis $\mathcal{H}_0$, the probability of the detecting algorithm claiming the presence of the primary signal.

In this paper we consider three types of signals: rectangular pulse, raised cosine and root-raised cosine since these are common signals in today's communication system.

SVD-BASED SIGNAL DETECTOR

SVD plays an important role in signal processing and statistics, particularly in the area of a linear system. $y(n)$ should be defined as time series for the received signal with $n = 1,2,\dots,N$, commonly, we can construct a Henkel matrix with $M = N - L + 1$ rows and L columns as follows:

$$\mathbf{R} = \begin{bmatrix} y(1) & y(2) & \dots & y(L) \\ y(2) & y(3) & \dots & y(L+1) \\ \vdots & \vdots & \vdots & \vdots \\ y(N-L+1) & y(N-L+2) & \dots & y(N) \end{bmatrix} \quad (2)$$

then $\mathbf{R}$ is an $M \times L$ matrix. Its elements can be found by substituting $y(n)$

$$\mathbf{R}_{ml} = y(m+l-1), \qquad m = 1,2,\dots,M \text{ and } l = 1,2,\dots,L. \quad (3)$$

Using SVD, $\mathbf{R}$ can be factorized as

$$\mathbf{R} = \mathbf{U}\boldsymbol{\Sigma}\mathbf{V}^H \quad (4)$$

where $\mathbf{U}$ and $\mathbf{V}$ are an $M \times M$ and an $L \times L$ unitary matrix, respectively. The columns of $\mathbf{U}$ and $\mathbf{V}$ are called left and right singular vectors, respectively. The $\boldsymbol{\Sigma} = diag(\lambda_1, \lambda_2, \dots, \lambda_m)$ is a diagonal matrix whose nonnegative entries are the square roots of the positive eigenvalues of $\mathbf{R}^H\mathbf{R}$ or $\mathbf{R}\mathbf{R}^H$. These nonnegative entries are called the singular values of $\mathbf{R}$ and they are arranged in a decreasing manner with the largest number in the upper left-hand corner. The $[\ ]^H$ denotes the Hermitian transpose of a matrix.

Whenever no primary signal or other signal is present, the received signal $y(n)$ includes only AWGN contribution such that its singular values are similar and close to zero. Whenever other signals whose power is higher than a threshold value are active, there will exist several dominant singular values to represent these signals. As a result, the signals can be detected by examining the presence of dominant singular values.

THRESHOLD DEFINITION

The decision threshold and probability of false alarm are derived based on limiting distribution of eigenvalues based on random matrix theory. The decision statistic for the maximum-minimum eigenvalue (MME) detection is defined as the ratio of maximum to minimum eigenvalues of the received signal as follows:

$$T_y = \frac{\lambda_{max}}{\lambda_{min}} \quad (5)$$

Based on the decision statistic in (5), the detection threshold, γ, must be estimated for a required probability of false alarm. To define the threshold in terms of P_{fa} or vice versa, the density of the test statistic, T_y, is required. The density can be found asymptotically i.e. both the threshold values and the probabilities of detection and false alarm are derived based on asymptotical distributions of eigenvalues that is mathematically tractable and less complicated (Kortun *et* al., 2010).

An asymptotic formula of signal detection threshold in term of desired probability of false alarm for MME has been proposed by Zeng and Liang (2007). The detection threshold in

terms of desired probability of false alarm is calculated by using the results of the theorem stated by Johnstone (2001) and Zeng and Liang (2007), as follows (in our case, M=1):

$$\gamma = \frac{\left(\sqrt{N_s} + \sqrt{L}\right)}{\left(\sqrt{N_s} - \sqrt{L}\right)} \cdot \left(1 + \frac{\left(\sqrt{N_s} + \sqrt{L}\right)^{-\frac{2}{3}}}{(N_s L)^{\frac{1}{6}}} \cdot F_1^{-1}(1 - P_{fa})\right) \quad (6)$$

where F_1^{-1} denotes the inverse of cumulative distribution function (CDF) of the Tracy-Widom distribution of order 1 (Tracy and Widom, 2000).

The threshold definition in (6) is formulated based on deterministic asymptotic values of the minimum and maximum eigenvalues of the Hankel matrix, **R**, when the number of samples, N_s is very large. As shown in the equation, it is defined only in terms of number of samples, N_s, level of Hankel matrix, L and the desired probability of false alarm, P_{fa}.

SIGNAL DETECTION ALGORITHM

In implementing the SVD-based signal detector, we adopt method by Zeng and Liang (2007). The algorithm to detect the presence of a signal is as follows:

Step1: Select number of column of a Hankel matrix, L such that $k < L < N - k$ (Tufts and Kumaresan, 1982), where N is the number of sampling points and k is the number of dominant singular values. In this paper, $k = 2$ and $L = 16$.

Step 2: Factorize the Hankel matrix to form the equation as in (4).

Step 3: Obtain the maximum and minimum eigenvalues of the Hankel matrix which are λ_{max} and λ_{min}.

Step 4: Compute threshold value, γ, as discussed in the previous section.

Step 5: Compare the ratio with the threshold. If $\frac{\lambda_{max}}{\lambda_{min}} > \gamma$, the signal is present, otherwise, the signal is not present.

SIMULATION

Simulation parameters

It is assumed that the channel is not changing during the period of samples. The level of the Hankel matrix, i.e. the column of the matrix is $L = 16$. The results are averaged over 10^5 tests using Monte-Carlo Simulations written in Matlab. Simulation results are taken using QPSK modulated random primary signal and independent and identically distributed (i.i.d.) noise samples with Gaussian distribution are used. Three types of signal namely rectangular pulse, raised cosine and root-raised cosine were tested and compared. To find the threshold, we require the probability of false alarm is $P_{fa} \leq 0.1$ and probability of detection is $P_d > 0.9$ as required by IEEE 802.22 standard.

Simulation results

Figure 1 shows simulation results of the P_d when the SVD-based method and energy detector (ED) are used for comparison when SNR is from -18dB to -4dB. It can be noticed from the graphs that the performance of the ED drops dramatically for SNR values below -8 dB. Even though ED at certain points better than the SVD based detection, but the overall performance of the detector is better than the ED. It is also shown in the graphs that the SVD-based method works better in detecting the rectangular pulse signal, raised cosine the second and root-raised cosine the third. The performance of ED for all three signals is quite similar. From these figures, it can be concluded that the SVD-based detection can overcome the flaws in ED when dealing with low SNR signals.

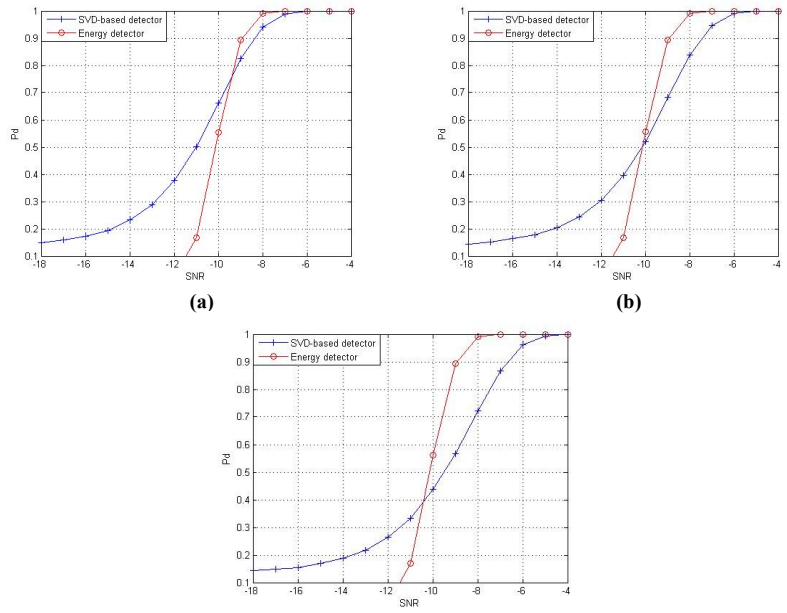

Figure 22. Comparison of P_d between the SVD-based detector and energy detector for a) Rectangular pulse, b) Raised cosine and c) Root-raised cosine.

In terms of performance of the detector, the receiver operating characteristics (ROC) curves are shown in Figure 2. Both methods were simulated at -8 dB SNR and tested for three types of signal. We plot the $\boldsymbol{P_d}$ under $\boldsymbol{\mathcal{H}_1}$ against $\boldsymbol{P_{fa}}$ under $\boldsymbol{\mathcal{H}_0}$ when $\boldsymbol{P_{fa}}$ changes from 0.01 to the desired value of 0.1. It is clearly shown that the ROC curves of the SVD-based detection are much higher than the ED's which proves the good performance of the detector.

CONCLUSIONS

In this paper, we highlight an SVD-based approach to detect common signals in today's digital communication system. The rationale of detecting common signals is that, in order for a CR system to operate with an acceptable QoS, the CR need to avoid interference not only to/from primary users but any signals which could affect the delivery of information to the system. The simulation results show that SVD of the data matrix is very useful in finding the dominant singular values in which the presence of other signals can be detected. The method is more robust to numerical errors and very fast. These qualities are desirable in IEEE 802.22 standard since it is easily suits the need to shorten the period of sensing and hence rendering the system to be more precise and reliable.

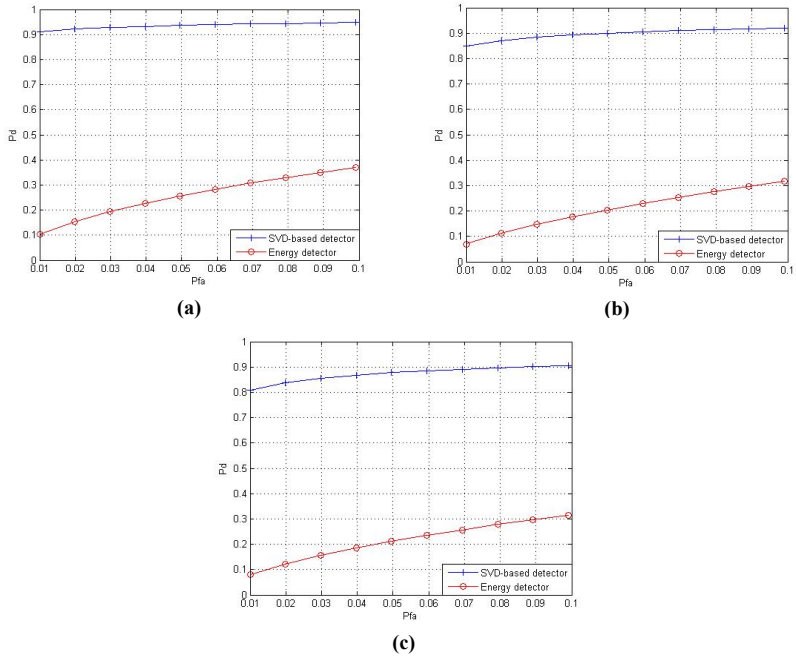

Figure 23. ROC curves of the SVD method and energy detector for a) Rectangular pulse, b) Raised cosine and c) Root-raised cosine.

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THE PERFORMANCE OF DCCP TCP-LIKE WITH INITIAL SLOW-START THRESHOLD MANIPULATION

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ABSTRACT. This paper investigates the performance of the implementation of modified initial slow-start threshold size in Datagram Congestion Control Protocol (DCCP) TCP-like (CCID-2) over long delay link network. TCP-like is one of a congestion control mechanism for DCCP which is suitable for the delivery of multimedia data with abrupt changes during the transmission. The scenario is set for long delay link network, where the impact of the modified slow-start threshold value in TCP-like is significant. As a result, we managed to reduce the time required to obtain the maximum throughput in TCP-like during in the slow-start phase. The result shows that with the correct manipulation of initial slow-start threshold size for TCP-like, it will give a significant improvement to TCP-like performance over long delay link where the maximum throughput during the slow-start phase can be achieved faster.

Keywords: DCCP TCP-like, slow-start threshold, congestion window

INTRODUCTION

As an option to User Datagram Protocol (UDP), DCCP is a new transport protocol for sending multimedia contents in the Internet nowadays. In addition, DCCP is an unreliable transport protocol which has built-in congestion control unlike UDP. With this feature, DCCP ensures that there is no bandwidth monopoly by certain transport protocol like UDP did for years. UDP has been proven that can eat up all the available bandwidth in the Internet while competing with other transport protocols such as Transmission Control Protocol (TCP) in carrying multimedia data in many situations.

The performance of DCCP is good while working in normal network scenario, i.e. short delay link network. As for long delay link network with higher Round-Trip Time (RTT), DCCP suffers from the bandwidth utilization during the beginning of the connection where longer time is taken to exceed the maximum bandwidth (Nor, Hassan, & Almomani, 2008).

This research is aiming in improving the performance of DCCP with TCP-like congestion control mechanism during slow-start phase of the connection for long delay link network. During the slow-start phase of the connection, the throughput is increasing exponentially until the current congestion window (*cwnd*) size exceeds the initial slow-start threshold size. With the idea of increasing the initial slow-start threshold size for more aggressive throughput grow in TCP-like, the initial slow-start threshold size has a significant effect to the performance of DCCP carrying multimedia data over large delay link. Initial slow-start threshold parameter is used by congestion control implemented in DCCP's TCP-like congestion control where all TCP congestion control implementations are required to support it. From our experiments, we

found out that too small initial slow-start threshold value for large delay link makes the traffic throughput sent using DCCP requires longer time to become stable. The selection of suitable value of initial slow-start threshold is then vital to the stability of the network carrying streaming audio data over DCCP.

This paper is organized as follows: This section is followed by related work section regarding the works done by other researchers. The subsequent section explains about the transport protocols for multimedia data. Experimental setup section describes the simulation and performance metrics used. All the results are included in result section, and finally the conclusion section ends the paper.

TRANSPORT PROTOCOLS FOR MULTIMEDIA DATA

TCP (ISI-USC, 1981) has known to be a reliable transport protocol with congestion control for delivering data traffic. Moreover, TCP can deliver the best-effort services for error-intolerant and delay-tolerant data such as web, email, file transport, etc. All that features of TCP make it suitable for the delivery of important, mission critical, and error-free data which requires a reliable data connection.

On the other hand, TCP is not suitable to send multimedia data such as audio and video which request time-sensitive and error-tolerant transmission. For multimedia data transmission, UDP (Postel, 1980) is a suitable transport protocol and has been the favorite choice for decades among Internet users because it is a simple transport protocol and can comply with the transmission requirements. However, the extensive use of UDP can endanger and collapse the network because UDP is greedy protocol, which means that it will send data as much as it can without congestion control, and it is not friendly to other congestion controlled protocol such as TCP.

One of the solutions regarding this problem is the introduction of a new transport protocol for the delivery of multimedia data, DCCP (Kohler, Handley, & Floyd, 2006) which is unreliable like UDP, but has congestion control mechanism like TCP. Currently, DCCP has few congestion control mechanisms, i.e. TCP-like (Floyd & Kohler, 2006a) which follows the TCP Selective Acknowledgment (TCP SACK) (ISI-USC, 1981), TCP-Friendly Rate Control (TFRC) (Floyd & Kohler, 2006b) which follows the TFRC and TFRC-SP (Floyd & Kohler, 2007) which is a version of TFRC for small packet.

DCCP as defined by Internet Engineering Task Force (IETF) is well suited as a transport protocol for delivering multimedia data over wired or wireless networks. It supports bidirectional unicast connections of congestion-controlled unreliable datagram. DCCP is the right choice for applications that used to transfer huge amounts of data such as streaming multimedia data that can take advantage from control over the tradeoff between timeliness and reliability. It is also good for network health due to its built-in congestion control features.

RELATED WORK

TCP-like congestion control is designed for the abrupt changes data with higher buffer size and the data is sent as fast as possible. Same as in TCP, the congestion control mechanism in TCP-like consists of slow-start and congestion avoidance. The *cwnd* size increases exponentially in slow-start phase where it increases linearly in congestion avoidance phase.

The study of the friendliness of DCCP towards TCP was done by Shahrudin et al. (Nor, Hassan, Ghazali, & M. Arif, 2010) which shows that DCCP can coexist with TCP and sharing the bandwidth fairly, not like UDP which is unfriendly to TCP.

Since DCCP is a new transport protocol, most of the research works of DCCP is related to its performance (Azad, Mahmood, & Mehmood, 2009; Bhatti, Bateman, & Miras, 2008;

Chowdhury, Lahiry, & Hasan, 2009). Nevertheless, since TCP-like congestion control mechanism follows the TCP standard, the improvement works on the TCP regarding slow-start threshold (Kaiyu, Yeung, & Li, 2005; Marchese, 2001; Rung-Shiang, Hui-Tang, Wen-Shyang, & Ce-Kuen, 2005) and TCP-like (Chaintreau, Baccelli, & Diot, 2002; Seung-Gu & Jong-Suk, 2000; Zhao & Song, 2009) are related to DCCP TCP-like as well. Shahrudin et al. also did a work on the initial slow-start threshold for DCCP TCP-like in delivering VoIP over long delay link (Nor, et al., 2008).

The slow-start phase in TCP-like, as well as in TCP, can be whether at the beginning of the connection, or when reconnection establishment after idle time due to no data transmission or inactive connection. In normal case, the initial slow-start threshold size is 20 packets for DCCP. The unit packet is used in DCCP in contrast of byte in TCP because DCCP is a datagram transport protocol whereas TCP is a byte stream transport protocol.

In our research for long delay link, TCP-like congestion control mechanism for DCCP is selected because it outperforms TFRC in terms of time taken to achieve the maximum throughput (Nor, Hassan, Ghazali, & M. Arif, 2010). This improvement is done during slow-start phase, where another improvement for TCP-like is done in congestion avoidance phase long delay link as done by Shahrudin et al. in (Nor, Hassan, Ghazali, & M. Kadhum, 2010) and resulted in better and smoother throughput.

EXPERIMENTAL SETUP

The experiments have been carried out by means of simulation with the simulation topology as shown in Figure 1. The network simulation topology uses classic dumbbell topology. Dumbbell topology is a very common topology that has been used in many TCP network simulations. For all the experiments, the simulations consist of a DCCP TCP-like sender and a standard TCP sender, or TCP New Reno in particular, because TCP New Reno is one of the most popular TCP variant used in the Internet nowadays. At the receiver's side, there are DCCP TCP-like and TCP receivers. All the senders and receivers are connected to the routers through 100 Mbps links with 1 ms propagation delay.

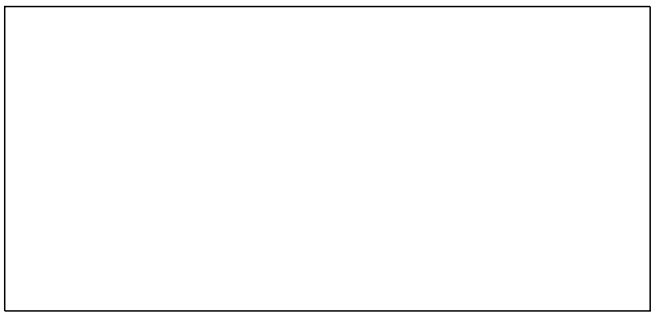

Figure 24. Simulation Topology.

In our simulation environment, we have simulated DCCP as a competing protocol to TCP, so that we can see how the other protocol such as DCCP behaves when they coexist with TCP. The utilization of bandwidth by these two competing protocols is set into a scenario so that a DCCP sender will fully utilize the 2 Mbps bandwidth with the sending rate of 2 Mbps Constant Bit Rate (CBR) traffic. CBR is used as a multimedia traffic and its packet size is 500 bytes. In this case, TCP sender sends the file transfer data using File Transfer Protocol (FTP) application. Unlike DCCP, where the transmission bit rate can be set by the application like CBR, the maximum bit rate occupied by FTP application on TCP will be calculated by the

transport protocol itself based on the link bandwidth provided, packet size, propagation delay, etc. From the simulation results, we will see the effect of the manipulation of initial slow-start threshold size on DCCP TCP-like.

The network topology used in our simulation includes two interconnected routers, R1 and R2 with queue size of 20 packets. For the router to router connection, a long delay bottleneck link is set to have a bandwidth of 2 Mbps with 300 ms propagation delay. This long delay bottleneck link can be used as an emulation of satellite or wireless links with a fixed forward link delay of 300 ms and fixed return link delay of 300 ms. This assumption is reasonable based on Henderson and Katz (Henderson & Katz, 1999) for the satellite link. There is also research done by other researchers that use this assumption for a long delay link (Sathiaseelan & Fairhurst, 2006). In addition, we considered that the bottleneck link has enough bandwidth allocation for the data transfer to flow from the sender to the receiver. For simplicity, instead of using other types of queue management such as Random Early Detection (RED), the type of queue management used in this link is Drop Tail, which implements First-In First-Out (FIFO). For the simulation experiment, the network simulator *ns-2* ("The VINT Project. The Network Simulator - ns-2,") is chosen together with DCCP module (Mattsson, 2004).

The throughput is measured between Router 1 and Router 2 where the DCCP TCP-like and TCP flows compete with each other on the long delay link. The TCP connection is monitored while it coexists with DCCP connection.

Experiment 1 is carried out to show how friendly the DCCP TCP-like is when it coexists with TCP flow on a fully-utilized bandwidth link. For this purpose, the simulation duration is increased to 1000 seconds. The simulation time for experiment 2 is set to 200 seconds because this period is long enough to get the whole picture of the performance of TCP-like which is affected by the initial slow-start threshold size. Four different initial slow-start values are used, i.e. 20, 50, 100 and 200 packets. In our case, the slow-start phase that we will investigate happens at the beginning of the connection. In all the simulation experiments, the FTP application using TCP is started first, i.e. at time 0.5 seconds, whereas the CBR application for DCCP TCP-like is started at time 10 seconds. We assume that 10 seconds is enough to allow the TCP data flow to utilize the bandwidth without any contention with another flow, so that we can see the effect on throughput of having other flows joining the bottleneck link after that.

All the performance metrics used in this research are throughput and packet loss. The measurement of the packet drop percentage are from the simulation time at 20s to 180s for more precise average value, which is not including the setup and tear-down times of the connection. On the other hand, the instant throughput is calculated from the simulation and plotted in the throughput graph. Other performance metrics such as delay and jitter are not taken into account since all measurements are taken at the beginning of the connection, i.e. during slow-start phase. The delay and jitter are suitable to be measured for the entire connection when the throughput has gained the maximum and stable state.

RESULTS

In our finding, we have shown that TCP-like with the manipulation of initial slow-start threshold size can improve the performance of the TCP-like in terms of faster time required to obtain the matured throughput during slow-start phase over long delay link network. The slow-start phase can be in action during the initial connection establishment or reconnection after idle time. This modified mechanism for TCP-like can minimize the time required during slow-start phase, i.e. faster to achieve the stable maximum throughput.

Experiment 1

This experiment is to show how DCCP is friendly to TCP. As shown in the topology in Figure 1, TCP and DCCP flows are sharing the same fully utilized bottleneck link. The

throughput graph in Figure 2 shows that DCCP can share the bandwidth fairly with TCP on a fully utilized link.

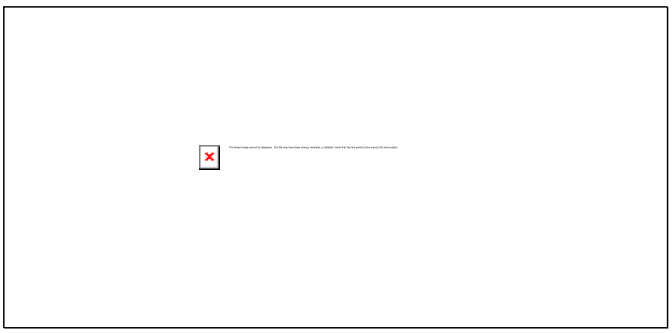

Figure 25. Throughput of TCP-like vs. TCP.

It is noticed that the throughput of the DCCP TCP-like is in the range from about 1 to 1.7 Mbps in zigzag form. This is due to the congestion control behavior of TCP-like which is implementing Additive-Increase Multiplicative-Decrease (AIMD) based on the congestion control of TCP SACK. As for TCP, the average bit rate for TCP data flow is fluctuating around 300 kbps because the TCP throughput is limited by buffer size and Round-Trip Time (RTT).

Experiment 2

This second experiment is to find the optimum value for initial slow-start threshold size in DCCP with TCP-like congestion control mechanism. The graph in Figure 3 shows four different times taken to exceed the maximum throughput with different initial slow-start threshold size, i.e. 20, 50, 100 and 200 packets. For normal initial slow-start threshold size, where the size is 20, it can be seen that it exceed the maximum bandwidth at about the simulation time of 160 ms, whereas for the initial slow-start threshold size of 200 packets, the maximum throughput is gained at time of about 100 ms. This is because the increase of throughput is exponential during slow-start phase, i.e. until its current *cwnd* exceeds the initial slow-start threshold size. After that, the congestion avoidance phase will be entered where the throughput is increasing linearly.

It shows that with the initial slow-start threshold of high value, in this case of 200 packets, the maximum throughput can be obtained faster. The values of initial slow-start threshold of higher than 200 packets do not give any better result. The optimum value of 200 packets for the initial slow-start threshold size has given the best performance in this research in terms of throughput.

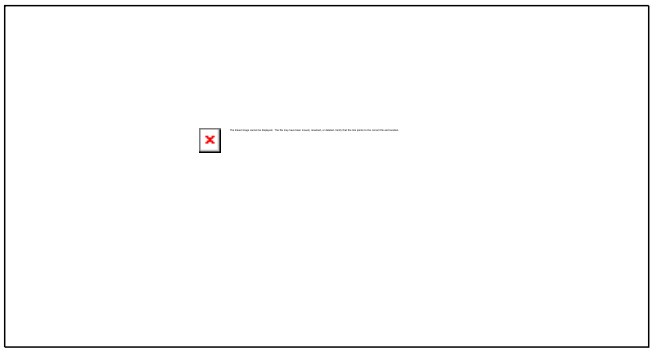

Figure 3. Throughput of Various Initial Slow-start Size for TCP-like

From the experiment result for packet loss as given in Table 1, the percentage of packet loss or Packet Loss Ratio (PLR) is 0.0277% for initial slow-start threshold size of 200 packets, which is within the specification by ITU-T. ITU-T recommendation G.1010 (ITU-T, 2003) states that PLR must be less than 1% for video data.

Table 1. Packet Loss

Initial Slow-start Threshold size (packets)	Packet loss (%)
20	0.0014
50	0.0015
100	0.0107
200	0.0277

CONCLUSION

In our finding, we have shown that with the correct selection of initial slow-start threshold size, we can enhance the performance of the DCCP TCP-like in terms of faster time required to obtain the maximum throughput during slow-start phase for long delay link network. TCP-like with such initial slow-start threshold size can minimize the time required during slow-start phase, i.e. faster to achieve the maximum stable throughput with acceptable packet loss. The implementation can be made during slow-start phase, i.e. whether during the initial setup connection or during the reconnection after timeout where slow-start phase will be in action. It is also shown that the implementation over long delay link still maintain the friendliness of DCCP TCP-like towards TCP.

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IMSI-BASED CARE OF-ADDRESS CREATION FOR FAST BINDING UPDATE IN MIPv6

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ABSTRACT. The growth of Internet user forced the fixed line Internet user to migrate from IPv4 to IPv6 due to the address availability. The similar situation will arise in mobile Internet, in which will forced the users to migrate to IPv6-based network. The numbers of Internet user also affect the access router work load and may grounds the latency in data reception. Handover from one access router to another needs a mechanism called binding update which produces latency. The most liable process in this mechanism is Duplicate Address Detection (DAD) in which take longer time than any other process. This paper proposes a mechanism to reduce the handover latency by eliminating the DAD process, using IMSI number.

Keywords: Binding update, Duplicate Address Detection, handover, MIPv6, IMSI, FMIPv6

INTRODUCTION

Thomson (Thomson et al., 1998) introduced a mechanism to avoid IP address duplication on the network called Duplicate Address Detection (DAD). This mechanism is performed on unicast addresses and must take place on all unicast addresses, regardless of whether the addresses are obtained through stateful, stateless or manual configuration. RFC 2462 stated that DAD may not perform in two cases:

- On anycast addresses.
- Each individual unicast address should be tested for uniqueness. However when stateless address auto-configuration is used, address uniqueness is determined solely by the interface identifier, assuming that subnet prefixes are assigned correctly.

In case a duplicate address is discovered during the process, a new identifier will be assigned to the interface or all IP address for the interface will need to be manually configured. When DAD is applied to addresses, it will be considered as tentative until the procedure has completed successfully.

The address duplication may occur when a mobile node proposes an address to the New Access Router (NAR). Even the address itself is formed by NAR prefix, the interface identifier which is proposed by the mobile node could be the same. Fundamentally the Mobile IPv6 (MIPv6) and Fast Mobile IPv6 (FMIPv6) already provided alternative address in case the duplication is detected. However the alternative address itself might have duplication on the network. The DAD mechanism may take longer time if this happened.

RELATED WORKS

MIPv6 (Mobile IPv6)

MIPv6 is the model of mobility support for IPv6. This model (Johnson et al., 2004)consists of four entities: the Home Agent (HA), Mobile Node (MN), Correspondent Node (CN) and Access Router (AR).The Home Agent function is to assign MN a home address which serves as home origin identification. All data from Correspondent Node is routed to MN via Home Agent if MN is still in Home Agent area, but when MN roams to foreign area FA is responsible to route the data from Correspondent Node. However, the MN has to be authenticated first before receiving a temporary address called Care of Address (CoA) which provided by the FA.

FMIPv6 (Fast Handover Mobile IPv6)

FMIPv6 proposed by Koodli (Koodli, 2009) uses an approach to reduce the handover latency by managing the movement detection and early handover signaling. FMIPv6 model uses the PAR (Previous Access Router) and the NAR (New Access Router) to connect nodes. The PAR is a node where MN is currently attached. Before performing a handover process Correspondent Node sends packets to MN through the PAR node and vice versa. Once MN requesting a handover the PAR node creates a tunnel to the NAR in order to send the current packets from Correspondent Node, and NAR buffered the packets temporarily until the MN completely attached to the NAR. In FMIPv6 model the MN has to be verified by the home agent first before can proceed to the Correspondent Node's binding update. This sequence procedure (Binding Update to home agent then to correspondent node) produces multiple latencies.

The International Mobile Subscriber Identifier (IMSI)

The IMSI (Swenson et al., 2005, Bhattacharjee) is a unique identification number which linked with the Global System for the Mobile communication (GSM) and Universal Mobile Telecommunication System (UTMS) network. IMSI is stored as a 64 bit in the Single Identity Module (SIM) and usually has 15 digits length, but it is possible to use shorter length. IMSI contains Mobile Country Code (MCC), Mobile Network Code (MNC), and the Mobile Station Identification Number (MSIN). As shown in Figure 1 the IMSI format consists of three digits of MCC, two digits of MNC and ten digits of an identification number.

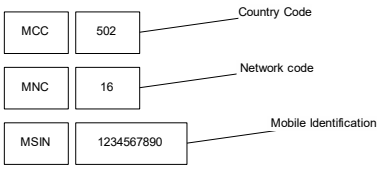

Figure 26. IMSI format

The IMSI provides other details of the mobile within the Home Location Register (HLR) or as locally copied to the Visitor Location Register (VLR). The IMSI may provide the home network location of mobile station, when user is roaming in foreign network.

IMSI-BASED CARE of-ADDRESS CREATION

Basically in all MIPv6 based protocols the CoA is formed by the [AP-ID, AP-INFO] tuple (Johnson et al., 2004) as a subnet prefix and a random generated interface identifier (the last 64 bit after subnet prefix in IPv6 address). Therefore the Duplicate Address Detection model needs to be performed to obtain a unique CoA IP address.

The main concern in the DAD is related with CoA creation. The uniqueness of interface ID determines the CoA's uniqueness, this is because the n-bits of subnet prefix always uses the Access Router local link. IPv6 unicast address uses interface ID to identify interface on a link. The interface ID is illustrated in Figure 2.

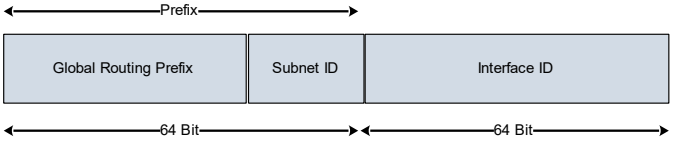

Figure 27. CoA Address

The proposed mechanism no need to perform the DAD process, because the Care-of Address (CoA) is formed by using [AP-ID, AP-INFO] tuple which the AP-ID part is given by Proxy Router Advertisement (PrRtAdv) and the AP-INFO part is generated by the IMSI. This model assures the Interface ID's uniqueness.

The IMSI number is provided by Subscriber Identity Module (SIM), known as Universal Integrated Circuit Card (UICC) in UMTS, and Removable User Identity Module (R-UIM) in CDMA. The creation of Interface ID is explained as follows.

The IMSI consists of 15 digits. The IMSI number of the mobile device should be translated into binary to fulfill the 64 bits interface identifier as a part of IPv6 address. So the 15 digits of the IMSI is represented by ((15 x 4) + 4= 64 bits) hexadecimal to ensure the uniqueness of interface ID and is used to formed the CoA. In Figure 3 the given example of IMSI is 060-016-408641300.

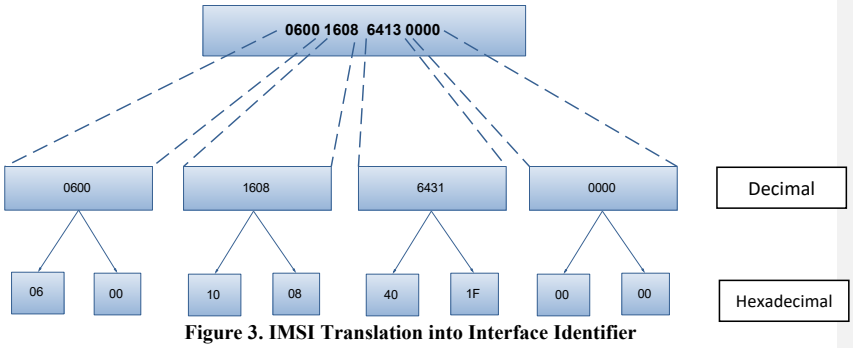

Figure 3. IMSI Translation into Interface Identifier

The translation is used for every four digits in decimal format which equal to 16 bits. For example we use the second four digits in the given IMSI number in Figure 3 which is 1608. First, we translate every two digits into hexadecimal (16 into 10) then continued with the next two digits (08 into 08). The completed creation of care-of address for the mobile node with the given prefix 2001 0DB8 85A3 FFFF is shown in Figure 4.

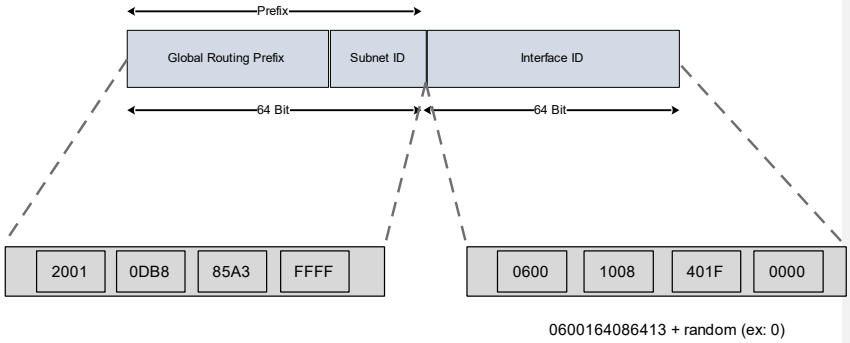

Figure 4. Care-of-Address forming

Once the CoA address is completely created, it can be immediately registered to the Home Agent and the Correspondent Node simultaneously. The CoA address will always become unique because the IMSI in every SIM card is always different yet it cannot be duplicated easily (Swenson et al., 2005).

SECURITY CONSIDERATION

The network provider originally has provided SIM with embedded authentication mechanism known as Authentication key (k_i). The k_i essentially is a 128-bit key that used by mobile network devices to authenticate the SIM. Each SIM has a unique key given by the mobile network provider at some points on personalization process at the beginning of registration on the mobile network service.

In real application the GSM cryptography has certain liability which may permit the extraction of the k_i from the SIM card and making a duplicate SIM card. To avoid this attack the provider may detect the fraud using Radio Frequencies Fingerprint (RFF) (Hall et al., 2005).

SIM clone attack on GSM technology can only be achieved by cloning the SIM card because the GSM phone does not have Electronic Serial Number (ESN) and Mobile Identity Number (MIN). Each mobile phone has a radio finger print in its transmission in which will remain unique despite it has the clone SIM. The mobile network provider may detect if there is any duplication occurs by comparing the RFF value (Hall et al., 2003).

Nowadays cloning the SIM card physically is almost impossible due to the embedded security system in the SIM card itself. Although the card successfully cloned, the forged SIM card cannot register to the network since the network will detect the two different location of SIM. Furthermore (Francis et al., 2010) proposed an embedded system to prevent hijacking which made the cellular device much more secure.

SIMULATION, RESULTS AND DISCUSSION

The FMIPv6 is considered faster than MIPv6 due to the temporary binding update in which allows mobile node to receive the data via data forwarding from PAR to NAR. Therefore we use the FMIPv6 as comparison for the simulation. We use the OMNET++ to simulate two models of the FMIPv6. The first one uses the DAD and the second one does not use the DAD. The simulation is conducted using the following mathematical model:

SC_x : Signaling Cost
T_{MP} : Packet delay between MN and PAR
T_{mn} : Packet delay between MN and NAR

T_{PM} : Packet delay between PAR and NAR in wired network
T_{new} : DAD latency, NCoA forming and so on.
T_{L3} : Time interval between the FBack received on the MN in PAR's link down.
T_{L2} : Link layer handover latency

$$SC_{FMIPv6\,IMSI-based} = 4T_{pm} + 4T_{mp} + BU_{CN} + BU_{HA} + 3T_{mn} \quad (1)$$
$$SC_{FMIPv6-DAD} = 4T_{pm} + 4T_{mp} + BU_{CN} + BU_{HA} + 3T_{mn} + T_{new} \quad (2)$$

Table 13. Average Handover latency

Handover	IMSI-Based FMIPv6	FMIPv6
1	1.03342221	1.165184
2	1.17689236	1.6800654
3	1.1805353	1.53957033
4	1.0051468	1.4523679
5	1.12594353	1.32641656
6	1.07777999	1.13353439
7	1.12345603	1.52614743
8	1.01281825	1.23721841
9	1.07272456	1.62268364
10	1.11693104	1.43253191
11	1.0860362	1.90776468
12	1.09805459	1.82401157
13	1.18120775	1.26715996
14	1.14331403	1.65163689
15	1.20093575	1.38609833
16	1.08150868	1.63915232
17	1.09687752	1.20610867
18	1.17989748	1.35786701
19	1.09627369	1.72433878
20	1.16359455	1.80250712
21	1.10554701	1.8512911
22	1.09129934	1.26042646
23	1.0475148	1.80311951
24	1.0758854	1.09594185
25	1.19301745	1.83935567
26	1.13864819	1.20308317

Handover	IMSI-Based FMIPv6	FMIPv6
27	1.10132009	1.45351258
28	1.01890202	1.71447376
29	1.0669737	1.80984714
30	1.02473235	1.91741215
31	1.10639593	1.92077072
32	1.10049534	1.16622477
33	1.17367566	1.27951072
34	1.07462367	1.82108677
35	1.11497363	1.88946151
36	1.15786377	1.32330058
37	1.03278763	1.3675107
38	1.10533115	1.17930364
39	1.13585967	1.97844208
40	1.08085522	1.53481326
41	1.06625376	1.69833492
42	1.12305398	1.92379483
43	1.16052816	1.8759107
44	1.10322325	1.60209932
45	1.03862007	1.78572516
46	1.06582052	1.85381515
47	1.1319531	1.88857111
48	1.00657478	1.67306949
49	1.07250797	1.32137332
50	1.19555083	1.66654106

Table 1 shows the linear movement handover completion time from 50 handover processes of the IMSI-Based FMIPv6 and the FMIPv6. As we can see from Figure 5 the IMSI-Based FMIPv6 always produces lower handover time compared to the FMIPv6. This fact shows that the IMSI-Based FMIPv6 handover process is faster than FMIPv6, which means IMSI-Based FMIPv6 efficiently reduces the handover processing time.

Figure 5 also shows that the average of handover completion time for the IMSI-Based FMIPv6 and FMIPv6 is 1.102781757 seconds and 1.629273966 seconds respectively. The IMSI-Based FMIPv6 manages to reduce the handover time by 63%. This fact indicates that the IMSI-Based FMIPv6 can reduce the handover time through implementing simultaneous binding update.

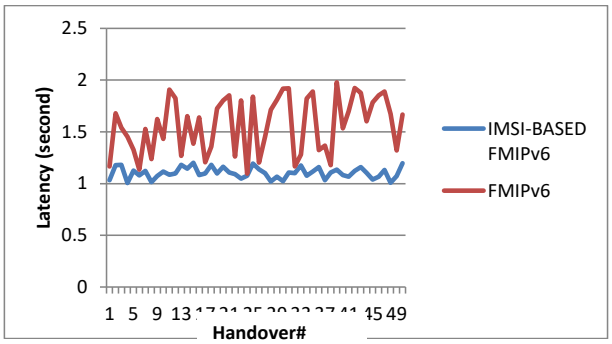

Figure 5. Handover Latency

CONCLUSION

The purpose of this paper is to propose an approach to reduce the handover latencies by eliminating the DAD procedure. The proposed mechanism ensures the uniqueness of an interface identifier by using the IMSI to create CoA for a mobile node in a subnet. The proposed mechanism is tested using mathematical model simulated in Omnet++ (Yousaf et al., 2008). In addition we compare it with the FMIPv6 and the result showed that the proposed mechanism is able to produce lower handover latency.

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HONEY BEE BASED TRUST MANAGEMENT SYSTEM FOR CLOUD COMPUTING

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ABSTRACT. Cloud computing has been considered as the new computing paradigm that would offer computer resources over the Internet as service. With the widespread use of cloud, computing would become another utility similar to electricity, water, gas and telephony where the customer would be paying only for the services consumed contrary to the current practice of paying a monthly or annual fixed charge irrespective of use. For cloud computing to become accepted by everybody, several issues need to be resolved. One of the most important issues to be addressed is cloud security. Trust management is one of the important components of cloud security that requires special attention. In this paper, the authors propose the concept that honey bee algorithm which has been developed to solve complex optimization problems can be successfully used to address this issue. The authors have taken a closer look at the optimization problems that had been solved using the honey bee algorithm and the similarity between these problems and the cloud computing environment. Thus concluding that the honey bee algorithm could be successfully used to solve the trust management issue in cloud computing.

Keywords: cloud computing, trust management, bees algorithm

INTRODUCTION

Trust management systems have been heavily used by distributed systems like peer to peer systems, cluster computing, grid computing and sensor networks. Trust and reputation management systems help nodes to select the trustworthy peer to communicate with based on the quality of service and quality of resources provided by the peer (Blaze, Feigenbaum, Ioannidis, & Keromytis, 1999). Cloud computing has been the new computing paradigm that makes computing resources be accessible anywhere, anytime and pay only for the services accessed (Buyya, Pandey, & Vecchiola, 2009). With the emergence of cloud computing, organizations and individuals can cut down the expenditure on computer resources drastically. For cloud computing to be acceptable for everyone several issues including security, legal and economic factors need to be resolved first. Organizations are reluctant to move their resources and computing to the cloud as the cloud security system has not been properly addressed yet. Trust and reputation management is one of the most important components of security. This paper proposes that the honey bee algorithm that has been used to solve complex optimization problems can be adapted to address the trust management problem in cloud computing.

CLOUD COMPUTING

Cloud computing has been called the 5th utility in the line of electricity, water, telephony and gas (Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009). The reason why cloud has been nomenclatured with such a name is that the cloud computing has been changing the way computer resources have been used up to now. Until the emergence of cloud computing, computing resources were purchased outright or leased in the form of dedicated hardware and software resources. Cloud computing has brought a paradigm change in how computing resources have been purchased. When the cloud computing becomes more pervasive like the Internet, the computing resources including raw computing power, fully fledged development platforms and customizable applications would be available as services over the Internet. Consumers will be able access these resources like any other utility and pay for only what is accessed.

Cloud providers host their resources on the Internet on virtualized systems and make them available to multiple clients. Multiple virtual computers can run on a single physical hardware sharing the resources such as storage, memory, the CPU and interfaces giving the feeling that each client has his own dedicated hardware to work on. Virtualization thus gives the ability to the providers to sell the same hardware resources to multiple clients. This sharing of the hardware resources by multiple clients help reduce the cost of hardware for clients while increasing the profitability of the providers. Accessing or selling hardware in the form of virtual computers is known as Infrastructure as a Service (IaaS) in the cloud computing terminology (Prodan & Ostermann, 2009). Once a client has procured infrastructure from a service provider, he is free to install and run any Operating System platform and application on it. Other kinds of services that are made available via the cloud computing model are Platform as a Service (PaaS) and Software as a Service (SaaS).

TRUST AND TRUST MANAGEMENT

The trust and reputation have their origin in the social sciences that study the nature and behavior of human societies (Yu, Shen, Miao, Leung, & Niyato, 2010). Trust has been studied by researchers in diverse fields such as psychology, sociology and economics (Gan, He, & Ding, 2009). Trust management systems play an important role in distributed systems such as peer to peer systems, grid computing, cluster computing and sensor networks (Cai, Li, Cheng, Fu, & Cheng, 2009; Vijayakumar & Banu, 2008; Mishra, Kushwaha, & Misra, 2010; Wu, et al., 2011; Tae & Hee, 2008). Trust management systems help client to select the right peer or server to communicate with and access resources. Without trust management systems, nodes in a distributed system would be affected by rogue nodes making the entire network infrastructure inaccessible.

HONEY BEE ALGORITHM

The bees algorithm is a population based search algorithm that mimics the food foraging behavior of honey bees. This algorithm starts by searching the neighborhood along with random search that is suitable for both combinatorial and functional optimization (Pham, Ghanbarzadeh, Koç, Otri, Rahim, & Zaidi, 2006). Honey bees travel over long distances in flocks looking for nectar in flowers in all directions. They coordinate their travel in such a manner that flower patches with large amount nectar will be foraged by large number of bees while the patches with less nectar are foraged by small number of bees (Beekman, Sumpter, Seraphides, & Ratnieks, 2004; Beekman, Gloag, Even, Wattanachaiyingchareon, & Oldroyd, 2008). Honey bees are social insects living in large colonies and carry out their jobs with precise coordination with each other by communicating through movements, odor, cues and food exchanges (Wilson, 2000).

At the beginning of the foraging process, scout bees are sent out on search of flower patches. These scout bees search for flower patches randomly moving from one patch to

another. When the scout bees return to the hive, the ones those found a flower patch above a certain quality deposit the nectar or pollen and perform the waggle dance. This waggle dance conveys all the information necessary for other bees to explore the flower patches with the highest quality (Pham, Otri, Afify, Mahmuddin, & Al-Jabbouli, 2007).

Algorithms based on the behavior of bees have been developed to solve complex optimization problems. Bees algorithm has been used in variety of fields like manufacturing, water management, wood defect classification, solving the travelling salesman problem, vehicle routing and data clustering in data management systems (Pham, Afify, & Koc, 2007; Pham, Koc, Lee, & Phrueksanant, 2007; Pham, Soroka, Ghanbarzadeh, Koc, Otri, & Packianather, 2006; Haddad, Afshar, & Marino, 2006; Marinakis & Marinaki, 2009; Marinakis, Marinaki, & Dounias, 2008; Pham, Otri, Afify, Mahmuddin, & Al-Jabbouli, 2007).

Applications of Honey Bee Algorithm

This section takes an in depth look at the problem domains honey bee algorithm has been applied. The main purpose of this analysis is to identify the similarities and differences between these application areas and cloud computing environment with special reference to trust management.

Pham, Afify, & Koc (2007) have applied the Bees algorithm to solve the problem of cell formation in cellular manufacturing systems. Cellular manufacturing systems have been used as an alternative to both job shops and flow line incorporating the strengths of both techniques. Cellular manufacturing is flexible like job shops at the same time it possesses the capability of high production rate similar to flow lines. In cellular manufacturing setup, machines with similar functions are placed together making them more robust to machine breakdowns. The main objective of cellular manufacturing is to exploit the similarity between components through standardization and assign them to a group of machines that are placed together. This concept reduces the distance travelled by components, inventory, cumulative lead times and waste resulting in improved efficiency and productivity. The main issue in cellular manufacturing is cell formation where the manufacturing systems are decomposed into groups called cells and component families requiring similar operations assigned to them. This assignment problem is known as NP-hard problem where an increase in problem size increases the computation time exponentially. The authors of this paper have solved this problem by grouping the machines and corresponding part families together in such a manner that intercellular movements are minimized.

Pham, Soroka, Ghanbarzadeh, Koc, Otri, & Packianather (2006) have used Bees algorithm for the optimization of neural network to detect wood defects. In this work, images of wood with and without defects were used to extract 17 features to train the neural network along with 12 wood defects and clear wood as outputs. The neural network used in this experiment had 51 hidden neurons in addition to the 17 input and 13 output neurons. For the purpose of optimization of the weights between the neurons, Bees algorithm had been employed, instead of traditional back propagation.

Haddad, Afshar, & Marino (2006) have employed the Bees algorithm to solve the water resources optimization problem. The issue addressed in this work was managing water resources from a single reservoir feeding an area that has time varying demand throughout the year. Also the input to the reservoir depends on the environmental and seasonal conditions. The honey bee mating algorithm based on the mating behavioral pattern of the honey bee has been used to arrive at an optimum solution to meet the demand. In a bee colony, a single queen bee mates with several hundred drones in a season for the purpose of reproduction. The similarity between this behavior and the reservoir environment has been exploited as a non linear constrained optimization problem.

Marinakis and Marinaki (2009) have studied the issue of the probabilistic travelling salesman which is a variation of the classic travelling salesman problem. The main objective of the travelling salesman problem is to come up with a strategy that results in the best route to visit a set of customers located in some metric space. The authors have adapted the honey bee mating optimization algorithm to solve this probabilistic routing problem.

Table 1. Comparison of Problems Addressed against Cloud Environment

Problem	Characteristics	Cloud Environment
Cellular manufacturing	Cell formation. Similar machinery and components are clustered together.	Service providers with similar QoS parameters clustered together.
Detecting wood defects	Multiple parameter optimization. Wood defects are categorized based on presence of multiple criteria such as appearance, roughness, color, defects etc.,	Trust in cloud computing is a combination of multiple parameters such as speed, integrity, cost etc. These parameters need to be combined to arrive at the uniform score.
Reservoir optimization	Managing the resources of a single reservoir to meet requirements of multiple customers with varying demands.	In cloud computing, different services are hosted on virtual servers in a single physical computer. This is similar to feeding different consumers with different needs from the same reservoir.
Probabilistic travelling salesman	Computes the best path to serve the customers based on a probabilistic demand by a single salesperson.	In cloud computing services are accessed by multiple customers from a single physical machine using virtual computing elements.
Vehicle routing	Computes the best path and fleet to accommodate varying demand of the customers.	In cloud environment, service providers and customers will be distributed over the Internet. Hence, it is necessary match the customer requirements with the service provider capabilities based on the SLA. This is similar to the vehicle routing problem discussed by the authors of this paper.
Data clustering	Identifying and grouping the objects with similar attributes together.	In cloud computing, it is necessary to identify the service providers with similar characteristics and group them together, so that customers can be allocated to these clusters based on their service requirements.

(Marinakis, Marinaki, & Dounias (2008) have addressed the vehicle routing problem, through the honey bees mating optimization algorithm. Vehicle routing problem addresses the issue of seeking to service a number of customers with a fleet of vehicles. The main objective of this problem is to minimize the distances travelled by vehicles in terms of distance, cost and time without compromising on the services delivered to the customers. Different vehicles have different capacities and each customer has certain demand which leads to a complex optimization problem. The authors have applied a combination of honey bees mating algorithm and the multiple phase neighborhood search – greedy randomized adaptive search procedure to solve the problem.

Pham, Otri, Afify, Mahmuddin, & Al-Jabbouli (2007) have applied the Bees algorithm to solve the clustering of data. Clustering partitions objects into homogeneous groups where the objects within a group (cluster) have similar properties while the objects in different groups have dissimilar properties. Clustering has been used in many applications such as image processing, data mining, information retrieval, market segmentation etc. Generally the clustering methods have the tendency to converge towards the local optima irrespective of the availability of a global optimum. In this work, the authors have proposed a clustering method integrating the k-means algorithm with the Bees algorithm that avoids the convergence towards the local optima. Table 1 shows the comparison of the problems addressed in the literature along with the similarity of these problems to that of the cloud computing environment.

On a critical look at the information provided in Table 1, the following can be inferred. The clustering of cloud service providers offering similar services or similar quality of service in similar to the clustering similar machine components in a manufacturing plant or data clustering in a distributed database system that is accessed by geographically distributed clients. Multiple parameters such as speed, integrity, cost etc., contribute to the computation of the overall trust of a service provider, this is in line with the problem addressed in the detection of wood defects. The probabilistic salesman problem addresses issue of how the best route can be computed to serve multiple customers, also in cloud computing multiple clients access the same physical hardware using virtual computing elements. Hence in both scenarios, a single resource needs to be optimized among multiple users. The vehicle routing problem is a typical network management problem where different resources and clients are located at different locations and they need to be routed to the right resources that would provide the best quality of service. From the above discussion, it can be that the issues resolved using the Bees algorithm and the cloud computing environment have similar features. Hence the Bees algorithm would be a suitable mechanism to address the trust related issues in cloud computing.

CONCLUSIONS

This paper took an in depth look at the trust issue in cloud computing along with the solutions devised for addressing various real world problems using the Bees algorithm. From the critical evaluation carried out on both cloud computing and Bees algorithm, the authors arrived at the conclusion that the Bees algorithm could be applied successfully to solve the trust related issues in cloud computing. Finally, the results of the critical review of the application of Bees algorithm to various problems and the corresponding component of the cloud environment have been presented in a table for easy reference.

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POLICY INCONSISTENCY DETECTION BASED ON RBAC MODEL IN CROSS-ORGANIZATIONAL COLLABORATION

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ABSTRACT. Policy integration and conflict resolutions among various organizations still remain a major challenge. Moreover, policy inconsistency detection approach with logical reasoning techniques which considers integration requirements from collaboration parties has not been well studied. In this paper, we proposed a model to detect inconsistencies based on role-based access control (RBAC) that considers role hierarchy (RH) and temporal and spatial constraints. A model to prune and collect only the required policies based on access control requirements from different organizations is designed. Policy inconsistency detection should be enhanced with logical-based analysis in order to develop security policy integration. We believe this work could provide manner to filter a large amount of unrelated policies and only return potential collaboration policies for conflict resolution.

Keywords: policy inconsistency detection, collaborative environment, role-based access control (RBAC), role hierarchy, constraints

INTRODUCTION

Nowadays there are increasing needs for sharing data that contain personal information among various cross-organizational collaborations. Thus, there is a need for a dynamic architecture in order to share data among different cross-organizations in collaborative environments since each organization may join or leave at runtime. However, often such data sharing may contain personal sensitive and confidential information, such as family composition and DNA. It still remains a major challenge to ensure security issues for such data sharing in collaborative environment.

Security concerns with confidentiality, integrity and availability of data. Thus, cross-organizational data sharing should focus on the security access control to avoid sensitive data from being accessed by unauthorized users. Collaboration between organizations for the purpose of data sharing will involve security policy integration since each organization may independently specify its own security policies based on its own interest. Policy integration is a process to integrate security policies from the participating organizations in order to govern the data sharing throughout the collaborations. Our access control policies are mainly designed for role hierarchies and context constraints in RBAC model.

During the policy integration phase, the policies to collaborate from different organizations are compared and evaluated through logical-based analysis. Various inconsistencies between access policies from different distributed units may occur when elements conflict with each other between different policies from collaborating parties. Thus,

inconsistency detection is not only important to achieve a conflict-free collaboration environment but also the availability, confidentiality and integrity in security issues.

However, the policy inconsistency detection approach with semantic reasoning techniques which considers integration requirements from collaboration parties has not been well studied. In this paper, we proposed a model to detect inconsistencies based on the role-based access control (RBAC) model that considers role hierarchy (RH) and temporal and spatial constraints. A model to prune and collect only the required policies based on access control requirements from different organizations is designed. Policy inconsistency detection should be enhanced with logical reasoning techniques in order to develop security policy integration. We believe this work could provide a manner to filter a large amount of unrelated policies and only return potential collaboration policies for conflict resolutions.

The paper is organized as follow. The literature review is discussed in the following section. This is followed by the presentation of our proposed model for policy inconsistency detection with logic-based analysis and classification of inconsistencies. The last section will conclude our work.

LITERATURE REVIEW

There are a few previous studies that use Description Logic (DL) reasoning to prove that two policies are suitable, or not suitable, for collaboration purposes (He & Yang, 2009; Huang, Huang, & Liu, 2009). DL that is encoded in these studies can be used to determine the satisfiability of a concept. A study in He & Yang, 2009 concentrated on the analysis to show that different types of collaboration impose different ways of integration. This proposed model has limitation as only some of the policy inconsistencies have been encoded in the authorization RBAC policy model which is limited in certain case studies. Three types of inconsistencies are identified in this work; role inconsistencies, credential inconsistencies, and privilege inconsistencies. Huang, Huang, & Liu, 2009 work extended the existing eXtensible Markup Language (XACML) architecture which can support policy conflict detection based on their proposed DL method, but this study will always omit the attributes of condition. DL is a famous knowledge representation because it can express concept and relationship between concepts. However, this satisfiability (SAT) solver based analysis is unable to present an integrated view of relationships among policies. Besides that, these works do not consider context constraints and role hierarchy.

Previous studies worked with similarity measurement to calculate the similarity scores between policies (Lin, Rao, Bertino, & Lobo, 2007; Yau & Chen, 2008). However, this work needs to be incorporated with other analysis tools in order to improve the result of conflict detection. The higher the score the more similar the two policies are. Otherwise, the request to access data is rejected by the data owner. The determination of similarity between structures in policies is computationally cheaper but less precise technique compared to matching them in full details based on logical reasoning or model-based checking (Bertino, Brodie, & Calo, 2010). The main drawback with this similarity score computation is that user intervention is required to prior match knowledge or tune parameters such as providing additional manual work to assign the weight value for emphasizing the importance of the target or condition similarity respectively. In summary from the above studies, the data owner always has the priority to do the access decision to maintain its data in the resource owner on which policy is most similar to data owner. However, each organization should have the right to claim ownership of the data. Thus, it is unreasonable to give the priority to the data owner to decide the chance for collaboration between organizations.

Mazzoleni, Crispo, Bertino, & Sivasubramanian, 2008 only discussed the semantic relationships on pair wise constraint elements among policies which always assume corresponding elements between policies are the same in value with each other. Oliva &

Saltor, 2000 presented a mandatory access control policy to endow tightly coupled federated database systems with a multilevel security system. However, this work is limited to specify the relationships between subject elements while the others elements such as constraints are always omitted in detection phases. Huang, Sun, Wang, & Si, 2009 identified the types of redundancies and inconsistencies during the policy redundancy and inconsistency checking. However, this work is limited to presenting for the inconsistency of intra-organization. We believe this method cannot scale well with a larger set of policies analysis among collaboration organizations.

Park & Lee 2007 presents an access control mechanism using temporal and spatial context information to patient information. Temporal context information classifies time into two types - doctor's regular working time and other time while spatial context information classifies location into three spaces; inner medical office, outer medical office in hospitals, and other places. In the RBAC policy application environment, context constraints play a critical role in order to maintain database security (Kumar & Newman, 2009). Thus, our work considers not only the temporal constraints, but also the spatial constraints in policy inconsistency detection.

Our study discussed the RBAC issues under context constraints and role hierarchy in a collaboration environment to further guarantee consistency policy integration in a collaboration environment. It is necessary for us to carry out a larger, yet feasible implementation that will provide the scenario required for more comprehensive policy integration.

THE PROPOSED MODEL

The Security Policy (SP) in our study is defined as follows:

SP= (*R*, *PM*, *C, E*), where *R* = Role (e.g., Physician), *PM* = Permission and is defined as a pair <*RE*, *A*>, where *RE* is Resource (e.g., patient information) and *A* is Action of data (e.g., read), *C* = Constraint, and E = Effect (e.g., permit or deny). Constraint information that is included in the policy is temporal and spatial contexts.

Each organization may specify its own security policies independently. Thus, our proposed model aims at filtering the unrelated policies and analyzing the types of inconsistencies which may occur among policies from different organizations for collaborations. The following describes our proposed model which consists of two phases, namely: policy pruning and policy inconsistency detection. Figure 1 shows our policy inconsistency detection model for security policy integration process.

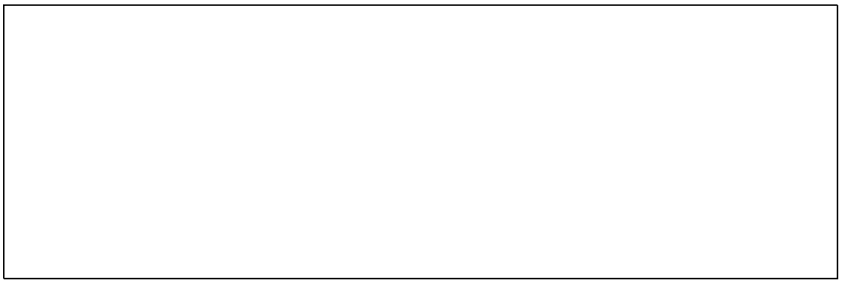

Figure 28. The Policy Inconsistency Detection Model.

Now let us explain how the policy inconsistency detection model can detect inconsistencies which always exist between collaborative organizations. For example, let us

consider three different hospitals which intend to collaborate with each other; hospital A with policies A_1, A_2, and A_3, hospital B with policies B_1, B_2, and B_3, and hospital C with policies C_1 and C_2 as specified below.

Organization A :

A_1: (Surgeon, Therapy Treatment $\vee$ Patient Personal Data, Read, 09:00 $\leq$ Time $\leq$ 17:00 $\wedge$ Inner Hospital, Permit)

A_2: (Specialist Physician, Treatment History, Update, Outer Office, Deny)

A_3: (Mental Nurse, Bone X-Ray $\vee$ Patient Personal Data, Read, Inner Hospital, Deny)

Organization B :

B_1: (Nurse, Bone X-Ray, Read, Inner Hospital, Permit)

B_2: (Specialist Physician, Therapy Treatment $\vee$ Patient Personal Data, Read $\vee$ Write, Outer Office, Permit)

B_3: (Laboratory Scientist, Laboratory Sample, Read $\vee$ Write $\vee$ Update, Inner Lab, Permit)

Organization C :

C_1: (Specialist Physician, Therapy Treatment, Read $\vee$ Write, (09:00 $\leq$ Time $\leq$ 12:30 $\vee$ 13.30 $\leq$ Time $\leq$ 18:00) $\wedge$ Inner Office, Permit)

C_2: (Laboratory Scientists, Blood Sample, Read $\vee$ Write $\vee$ Update $\vee$ Delete, Inner Lab, Permit)

Policy Pruning Phase

The policy pruning phase filters the policies from those organizations that are unrelated before the organizations engage in collaboration. If a pair wise policy similar with each others, then these two policies are the potential candidates for the checking in the next phase, which is the policy inconsistency detection phase, before a common set of integrated policies are generated. Assume that, $P_a = \{R_a, RE_a, A_a, C_a, E_a\}$ and $P_b = \{R_b, RE_b, A_b, C_b, E_b\}$. Five cases are identified as follows which show how the policy pruning phase works in our model.

$$R_a \neq R_b \tag{5}$$

For example, policy A_1 and policy B_1 will not have further checking since the analysis shows that these two policies are different based on the role element. Thus, referring to the case above, policy A_1 and B_1 will be pruned out in this phase.

$$if\,(R_a \leq R_b) \wedge (RE_a \cap RE_b = \square) \tag{2}$$

For example, policy B_3 specified "Laboratory Scientist" which is the junior role of "Specialist Physician" in policy C_1. However, the set of resources specified in B_3 is disjoint with the set of resources specified in policy C_1. Thus, referring to the case above, policy B_3 and C_1 will be pruned out in this phase.

$$if\,(R_a \leq R_b) \wedge [(RE_a \subseteq RE_b) \wedge (A_a \cap A_b) = \square) \tag{3}$$

For example policy A_2 specified "Specialist Physician" which is the same role specified in policy B_2. The resource, "Treatment History" which is specified in A_2 is a superset of "Therapy Treatment" which is specified in B_2. However, the set of actions specified in A_2 is disjoint with the set of actions specified in policy B_2. Thus, referring to the case above, policy A_2 and B_2 will be pruned out in this phase.

$$if\,(R_a \leq R_b) \wedge [(RE_a \subseteq RE_b) \wedge (A_a \subseteq A_b)] \tag{4}$$

For example, policy A_1 specified "Surgeon" role which is the junior role in policy B_2 since this policy specified "Specialist Physician" in the role element. "Therapy Treatment" and "Patient Personal Data" in policy A_1 is the same as the resource elements in policy B_2 while the action element of policy A_1 is a subset of policy B_2. This case satisfies case *4*, policies A_1 and B_2 are considered as potential pair wise candidates for collaboration which will be submitted to the policy inconsistency detection phase for further checking.

$$if\,(R_a \leq R_b) \wedge [(RE_a \supseteq RE_b) \wedge (A_a \supseteq A_b)] \vee [(RE_a \subseteq RE_b) \wedge (A_a \supseteq A_b)] \vee [(RE_a \supseteq RE_b) \wedge (A_a \subseteq A_b)] \tag{5}$$

For example, policy A_3 specified the "Mental Nurse" role, which is the junior role of "Nurse" in policy B_1. However, "Bone X-Ray" and "Patient Personal Data" in resource element of policy A_3 is a superset of "Bone X-Ray" in policy B_1. The action element of policy A_3 is the same as the policy B_1. Thus, the analysis between policies A_3 and B_1 is identified as role hierarchy inconsistencies before these two policies submit to the policy inconsistency detection phase for further checking.

It is not recommended to generate a set of policies shared by collaboration organizations based only on this phase. Those policies which are identified as potential collaborate candidates in this phase are submitted to the next phase, the policy inconsistency detection phase, for further details checking.

Policy Inconsistency Detection Phase

After the pruning phase is performed the unrelated policies are filtered while the related policies are further analysed. In this phase, the condition and the effect of the elements are checked. Two cases are identified to indicate that two policies are similar as follows:

$$if\;\; E_a \equiv E_b \wedge [(C_a \subseteq C_b) \vee (C_a \supseteq C_b) \vee (C_a \cap C_b) \vee (C_a \not\subset C_b)] \tag{6}$$

For example, policies A_1 and B_2 are considered similar to each other after the pruning phase. We found that policy A_1 is more restricted than policy B_2 with the respect of temporal and spatial conditions. In this case, it is infeasible to make decision without analysing the contents of the conditions in details since the further negotiation is needed in the inconsistency resolution. We classified these possible pair wise policies as constraints inconsistencies.

$$if\;\; E_a \neq E_b \wedge [(C_a \subseteq C_b) \vee (C_a \supseteq C_b) \vee (C_a \cap C_b)] \tag{7}$$

For example, policies A_3 and B_1 are considered similar to each other after the pruning phase. In the condition element, we found that the spatial information identified in policy A_3 is "Inner Hospital" with denied access decision which is the same as the spatial condition element in policy B_1 with permit access decision. We cannot simply make decision without analysing the details in this kind of cases. Thus, we classified it as authorization inconsistencies where further negotiation is needed in the inconsistency resolution.

CONCLUSION

To briefly conclude, our work is to present a policy inconsistency detection model, based on a role-based access control that considers both the role hierarchy and the temporal and spatial constraints in policy inconsistency detection. The policy inconsistency detection model presented is to identify various types of inconsistencies among policies. The policy

inconsistency detection solution is not limited to inter-organizational collaboration in the Healthcare domain, but is also applicable to other domains as well. The proposed policy inconsistency detection model can be considered as a generic model. We believe this work could provide a manner to filter a large amount of unrelated policies and only return potential collaboration policies for conflict resolutions. Thus, in the future we intend to extend this study to investigate the policy inconsistency resolution for each type of inconsistencies.

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INDONESIA TELECOMMUNICATION UNIVERSAL SERVICE ACCESS FUND

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ABSTRACT. This paper is looking on the issue of Universal Service Access Fund in Indonesia particularly on the performance of the telecommunication company to contribute based on the Act No. 36 of 1999 on Telecommunication. The material presented is this paper is only based on literature available. Toward the ends, this paper will help to establish the surrounding scenario on the overall performance of USAF in Indonesia.

Keywords: universal service access fund, telecommunication

INTRODUCTION

Over the last decade, the telecommunications sector has experienced rapid growth in almost every sector, ranging from cellular phone to broadband Internet, e-commerce, e-government, e-education and e-medicine. At the same time, the method of financing and type of financial resources used for the development has shifted radically especially for the area i.e. rural area, where business model for investment cannot be applied. An analysis of return on investment will not make sense when the level of investment required is high; whereas, the potential return is almost does not exist.

Traditionally, any kind of investment that has this kind of nature is usually come from government. For example, investment for ICT infrastructure for rural area or more well known as underserved area usually will be carried out by government through public fund. The Universal Access Service Fund (USAF) can comes from several resources such government allocation or donations from International Financial Institutions (IFIs). However, lately, this financial source has change to private based generation. The resources have been derived from certain percentage of telecommunication company income each year. The obligation to contribute can be created through the establishment of legal instruments (eg, communication law). The advantage of UASF with funds derived from the private contribution is not burdening the government funding especially low income countries.

Therefore this paper is intended to look UASFs issues closely especially on how the fund can be raised and managed. Towards the end, a special attention will be given on the UASF development in Indonesia. In addition a brief comparison study between Malaysian USAF and Indonesian USAF will also be included.

BACKGROUND

Basically, the source of UAS funds is generated from one or more of the following methods:

1. Government Budget (in a few cases, including one source of initial funding, Chile Fondo de Dessarollo de las Telecommunicationes);

2. Industry levies, the percentage of annual income to the licensed operator;
3. Various other sources are arranged like the competition license and frequency spectrum auction costs, and
4. Initial contribution from the government, subsequently financed by loans or grants from international donors such as the World Bank, this contribution as a source of initial funding to help UASF in the early years.

In Indonesia, since the Act No. 36 of 1999 on Telecommunication was set, there were some climate changes in the spirit of the telecommunications operation from monopoly climate to the competitive climate. The Government of Indonesia through the Minister of Communications, Agum Gumelar has launched a program with a target to deploy telecommunications facilities to all villages that have not been served until 2005. The construction of telecommunication facilities to rural areas has been initiated by building access to basic telephone service in 3010 villages across the country in which was inaugurated in Jakarta on December 18, 2003 (Satriya, 2004). However, the rollout of Universal Service Obligation (USO) which was being implemented by the local fixed network operator was not running on schedule. The Indonesian government decided to take over the project. Subsequently, the government has developed an initiative to pioneer the USO program in 2003/2004 financed through APBN with the intention of finding an alternative source in the future. (BTIP, 2008). USO target areas are lagging regions, remote areas and border regions. While the classification of the territory covers the area of mature (commercially ready), the semi-mature (high needs but not yet qualified commercially) and non-mature region (needs are unseen). In year 2003 (with state budget funds amounting to Rp. 45 billion) the government has built as many as 3051 units Telephone in 3013 villages spread over the area of Sumatra, Java, Kalimantan and Eastern Indonesia Region. Later in year 2004 (with state budget funds amounting to Rp. 43.5 billion) the construction continues with 2635 units Telephone in 2341 villages spread across Indonesia.

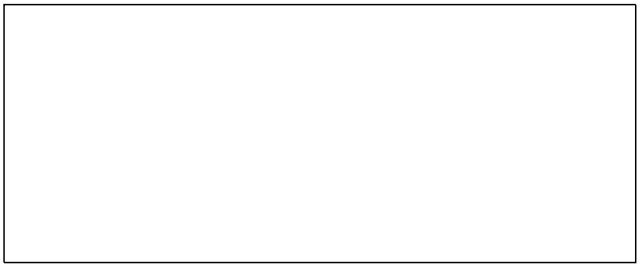

Figure 1. Indonesian Archipelago

Indonesia is an archipelagic nation with a total area of 9.8 million km2, 81.0% is ocean, consisting of 33 provinces, 268 districts, 73 municipalities, 4044 sub-districts and 69,065 villages (ITU, 2002) as shown in Figure 1. With a very large area and spacious, the telecommunication service can not be reached by all levels of society particularly those living in rural areas. As a result of the 250 million population of Indonesia, telecommunications subscribers are estimated to reach 8 million people (3%) for fixed line, 30 million (13%) for mobile, as well as tens of thousands (0.04%) for the satellite. Around 43,000 villages of the 67,000 unreached telephones access (Lang, 2006).

Through an agreement between the government and telecommunications operators, USAF in Indonesia is generated by the telecommunication operators at the rate of 0.75% over their gross revenue. This rate is established by the issuance of Government Regulation No. 28 of 2005 on the Maximum Tariffs of the State Non-Tax Revenue (non-tax revenues) by the Ministry of Communications and Information Technology (BTIP, 2008). Table 1 tabulates the

type of telecommunication services and their corresponding number of operator. In addition, Table 1 also shows the total percentage of contribution of the sectors to the total USAF.

Table 1: Telecommunications Operator USO Contributors

No	Telecommunication Service	Total Operator	% Contribution
1	PSTN	4	25.0
2	Fixed Wireless	4	1.3
3	Cellular	8	60.0
4	Data Communication	6	13.2
5	Network	20	
6	Network Access Provide	32	
7	Internet Service Provide	154	
8	Voice Over IP	24	
Total		252	100

According to BTIP Annual Report (2008), 252 service providers will contribute to the fund to finance the USO rollout project targeted in lagging regions, remote areas and border areas. But, this is far short of expectations because based on the BTIP 2008 Annual Report, out of 252 service providers that were suppose to contribute, many of them failed to do so. The following describes the situation.

- 66 companies did not contribute in 2005, 2006, 2007, 2008 Quarter I – III
- 129 companies did not contribute in 2008 Quarter II – III
- 52 companies did not contribute in 2007, 2008 Quarter I-III
- 5 companies did not contribute in 2006, 2007, 2008 Quarter II – III

Among the stated reasons for the failure to oblige to this the rule are as follows:

- Failure to provide correct and updated address (71 Companies)
- Unclear status of payment (30 companies responded via a letter stating they had made payment)
- USAF unable to track payments made by the contributors (80 companies made the deposit obligation directly to the account of USO)
- 71 companies had not declared their status on their deposit obligation

The above situations indicate that there are some of the challenges faced in managing USAF in Indonesia. The challenges are:

1. To obtain latest and correct addresses of telecommunication companies. This problem might be contributed by the inadequate enforcement of company registration rules.
2. To control the enforcement of the contribution. This could due to the lack of control by the government on these companies which may result in the lack of commitment by the companies.
3. To estimate the whole cost of USF rollout. This cannot be anticipated as the amount of the contribution cannot be predicted due to the lack of commitment from the telecommunication companies as well as changes in telecommunication industries.

As a result, it is not surprising if Indonesia is always left behind from several ASEAN countries in terms of telecommunications development. Based on a research conducted by Wattegama et al. (2008), Indonesia was ranked fifth after Singapore, Malaysia, Thailand and Philippines in terms of mobile penetration in 2007. In terms of telephone and computer usage, Indonesia was again positioned after Philippines and Thailand.

DISCUSSION AND RECOMMENDATIONS

In order to address the above mentioned problems, the Indonesian government needs to strategize her enforcement of the Act No. 36 of 1999. Article 16 paragraph (1) states that each

telecommunication and network provider or telecommunication carrier is required to contribute to the USAF. This is further emphasized in Article 45 that states "anyone who violates the provisions of Article 16 paragraph (1) is subject to administrative sanctions" which can lead to its' license being revoked. The government firmness in guarding the Law (No. 36) can lead the telecommunication companies to consistently contribute to USAF. Having a large number of potential contributors, the Indonesian government cannot guarantee that they will have bigger pool of USAF compared to her ASEAN counterparts such as Malaysia. With only 44 companies contributing to the fund per year, Malaysia managed to maintain her position not only as the second in the development of telecommunications in ASEAN (Pustral UGM, 2007), but also ranked 17th of 52 countries in terms availability of USA fund management. On the other hand, Indonesia is ranked 33rd after Nigeria and Paraguay (ITU-InfoDev ICT Regulation Toolkit Module, 2010).

In addressing the issues of governing body who manage the USAF, the Indonesian government need to assign an agency that is responsible for it. Such practice is being implemented by the Malaysian government and its effectiveness is proven by her ability to properly manage the fund. In the case of Malaysia, the assignment is made through the issuance of telecommunications law, called Act 588 of 1998. The act has clearly specified the establishment of a council named Suruhanjaya Komunikasi dan Multimedia Malaysia (SKMM) under the responsibility of the Ministry of Information, Communications and Culture.

There are some legitimate and understanding about UASFs implementation that does not succeed because it is not in accordance with the plan, but with strict monitoring showed that most cases like this happens due to the lack of proper implementation and is not according to the principles of UASF management. To develop UASF there are some things that must be considered, namely: the management and staff, accountability and transparency, approach of the principles efficiency, capacity management, accountability, fairness and transparency.

Being a large country with a total of 33 provinces, 268 districts, 73 municipalities, 4044 sub-districts and 69,065 villages (ITU, 2002), the Indonesian government receives a comparatively small amount of contribution to fund her telecommunication development. Table 2 shows and compares the percentages of contribution received by Indonesia and some of her ASEAN counterparts. It clearly shown that the contribution of providers and telecommunications services in Indonesia is very small compared to other ASEAN countries. So it is not surprising that Indonesia ranks fifth among the ASEAN countries in the development of telecommunications. Limited and insufficient financial support hinders the development of the Indonesian telecommunications sectors. Therefore, the Indonesian government needs to address this issue for the development of telecommunication facilities especially in the rural area.

Table 2. Funding Source of Neighboring Countries

Country	Funding Source
Indonesia	0.75%
Malaysia	6%
Thailand	4%
Vietnam	3%

Source: Intelecon Research (2001)

CONCLUSION

Indonesian law No. 36 of 1999 is very important law for telecommunication sector in Indonesia. The law has provides the government a mean to establish USAF which address directly the issues of providing the underserved area with equal opportunity to access the telecommunication technology. The law has specified the responsible parties who should contribute to the USAF as well as specifying the rate of their contribution. However the

enforcement of the law is a little bit loose. There are companies who should contribute but do not pay their portions. As a result, the projected USAF is not being reached which in turn will affect the overall planning and rollout of USA in Indonesia. Compared to her counterparts, Malaysia manages to collect sufficient amount to finance the USA program due to her strong enforcement of the corresponding law and effective monitoring mechanisms. It is also important for Indonesia to find further strategy to increase the size of USAF to support future USA rollout program. More innovative method of mechanism in determining the percentage of contribution based on the service demand can increase the amount of fund available in the future.

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MOBILE AD HOC NETWORKS UNDER WORMHOLE ATTACK: A SIMULATION STUDY

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ABSTRACT. Security has become the main concern to grant protected communication between mobile nodes in an unfriendly environment. Wireless Ad Hoc network might be unprotected against attacks by malicious nodes. This paper evaluates the impact of some adversary attack on mobile Ad Hoc Network (MANET) system which has been tested using QualNet simulator. Moreover, it investigates the active and passive attack on MANET. At the same time, it measures the performance of MANET with and without these attacks. The simulation is done on data link layer and network layer of mobile nodes in wireless Ad Hoc network. The results of this evaluation are very important to estimate the deployment of the MANET nodes for security. Furthermore, this study analyzes the performance of MANET and performs "what-if" analyses to optimize them.

Keywords: MANET, Networks Security, Wormhole Attack.

INTRODUCTION

The wireless arena has been growing exponentially in past few decades. We have seen great advances in network infrastructures as growing availability of wireless applications and the emergence of universal wireless devices like laptops, PDA, and cell phone [7]. Nowadays, mobile users can rely on cellular phone to check emails and browse the Internet. For example, travelers with laptop can use the Internet anytime and anywhere [11]. In the next generation of wireless communication systems, there will be a need for the fast deployment of independent mobile users. Important examples include establishing survivable, efficient, dynamic communication for emergency operations, disaster recovery, and military networks. Such network scenarios cannot rely on centralized and organized connectivity. There are currently two kinds of mobile wireless networks. The first type is known as infrastructure networks with fixed and wired gateways. Typical applications of this type of "one-hop" wireless network include wireless local area networks (WLANs). The second type of mobile wireless network is infrastructureless mobile network commonly known as the Ad Hoc network or wireless Ad Hoc network [5].

Ad Hoc network systems are independent systems which consist of a collection of mobile nodes that use wireless transmission for communication. They are self–organized, self-configured, and self–controlled infrastructureless networks [3]. In Ad Hoc network, the devices themselves are the network, and this allows seamless communication at low cost, self organizing and free deployment as shown in Figure 1.

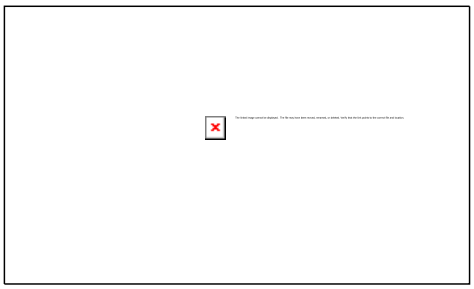

Figure 29. Ad Hoc Network [3].

Hence, mobile Ad Hoc (MANET) is different from other network solutions. Users can create their own network which can be deployed and configured easily and cheaply. On the other hand, the radio transmission range is small, therefore, communication partners are not often within direct radio range; so connections should be setup over multiple nodes and these nodes might change their location depending on node mobility. These changes cause frequent route break and force source to maintain connections to their distant communication partner. For all of these reasons, MANET is one of the more modern and challenging area of network security [11]. The nodes in MANET consider as routers. The routers are free to move randomly, and organize themselves at random; so the network wireless topology may change rapidly. Mobility and large network size combined with devices heterogeneity, security, bandwidth, and battery power constraints make the design of sufficient routing protocols as a major challenge.

MANET Security Issues

Security in MANET system is one of the main concerns to provide protected communication between mobile nodes in strange environment. Unlike the wired line networks, the unique characteristics MANET create a number of nontrivial challenges to security design like open peer-to-peer network architecture, shared wireless medium, inflexible resources constraints and highly dynamic network topology [3].

A security attack is an attempt to compromise the security of information owned by others. Any protected system might have weaknesses or vulnerabilities that can be considered as a target for attacker. Hence, one approach to design security mechanisms for any system is to look at the threats and attacks to the system through possible vulnerabilities. This approach should ensure that the system is secured under these threats, attacks, and vulnerabilities. Due to its nature, MANETs are vulnerable to several types of attacks. Even within the current available mechanisms, such as encryption and authentication, it still cannot perfectly prevent the attacks on the air-link [7].

In order to implement security in MANET, environment needs to be secured against attacks. Security services in MANET's are needed to protect from attacks and to ensure the security of the information. These services can be categorized into tow type, namely *communications security* and *computer security* as shown in Figure 2. Communication security protects against passive and active attacks through communication links or accidental emanations. This ensures that communication services continue with the required level of quality, and their information cannot be captured or derived by unauthorized node [1].

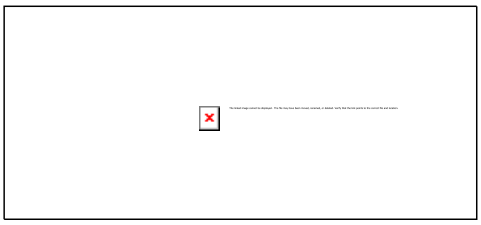

Figure 30. Information Security [1]

The Current Status of Security in MANET

The nature of mobile compute environment makes it very vulnerable to an adversary's malicious attacks. The use of wireless links renders the network susceptible to attacks range from passive eavesdropping to active nosy attacks such as wormhole attack, rushing attack, black hole attack, neighbor attack, and jellyfish attack. Unlike wired networks where an adversary must gain physical access to the network wires, or pass through several lines of defense gateways such as firewall, attacks on a wireless network can come from all directions and target at any node. Damages can include exploring secret information and node impersonation. It means that a wireless network does not have a clear line of defense and every node must be prepared for encounters with an adversary directly or indirectly [7]. There is no well defined place where we deploy to protect a single security solution. Moreover, laptops and mobiles are vulnerable to attack. Attackers may creep into the network through these subverted nodes which pose the weakest link and incur a domino effect of security breaches in the system.

The deployment of mobile Ad Hoc network is growing in the world. This leads to new challenges as large amount of data which may hold malicious content such as Worms, Viruses, or Trojans to move over these networks. There is a need to detect active and passive attacks. The network service providers (NSPs) are supposed to offer improved security features to customers as a value adding feature into the frame work of the network. In addition, network security administrators need to understand the vulnerabilities and the attacks in their environments with their effect on MANET before applying their deployment in the real environment to detect the threats and find efficient solutions for the MANET framework. Also, there are plenty of features existing in real life networks, but new standards and attack signatures are changing continuously at a rapid rate. Therefore, MANET should be upgraded with up-to-date security services.

This paper examines the performance of some of the aforementioned challenges features on MANET. The goals of this study are to determine the likelihood of an attack such as wormhole attacks in MANET; and to evaluate the performance of MANET, in terms of throughput, average jitter, and average end-to-end delay, with and without wormhole attack. In this study, the experiments are conducted using QualNet QualNet 4.5.1 GUI simulator running on Windows XP sp 2 operating.

WORMHOLE EXPERIMENT

Testing Scenario

We conducted our scenario using different combination of nodes for each experiment to evaluate the performance of MANET under wormhole attach. We configure some of the node as wormhole subnet and we have connected them to a wireless subnet. One CBR application is configured for all nodes. More than 100 packets are sent from a source node to the destination node. We enabled wormhole by making all parameter as *pass* in the wireless subnet.

Results

In the end of the test, many frames were intercepted by the wormhole node. In addition, a huge amount of frames were tunneled by the wormhole nodes. We noticed the number of frames replayed by the wormhole node is increased. We have noticed that many signals have transmitted by wormhole nodes are more than signals transmitted by others. Moreover, the broadcast packets received clearly from normal nodes are more than those received from wormhole nodes. Changing the wormhole parameter to *drop* in the experiment showed that many packets in wormhole nodes were dropped.

We have gathered all the results from the simulation and compared them to obtain the differences and the similarities between both situations, with and without wormhole, and how the attack affects the MANET network.

In the following, we show the effect of wormhole attack on MANET under this experiment in terms o, Total packet received, Throughput (bit/s), Average end to end delivery, and Average jitter.

Total Packets Received

The total packets received without wormhole gained comparing to those experiments with wormhole are shown in Figure 4.

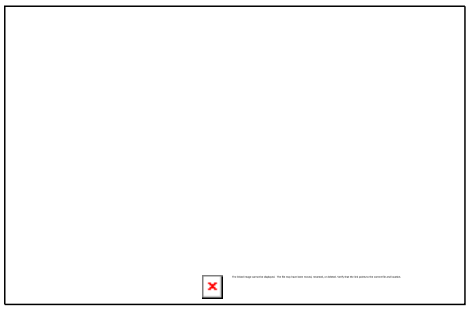

Figure 31: Total Packets Received with and without Wormhole

Throughput (bit/s)

The effect of wormhole on MANET regarding the throughput is shown in Figure 5. The results show that 80% of packets are received successfully when no wormhole attack is attempted. While, under the wormhole attack, the number of packets received is decreased to 10%.

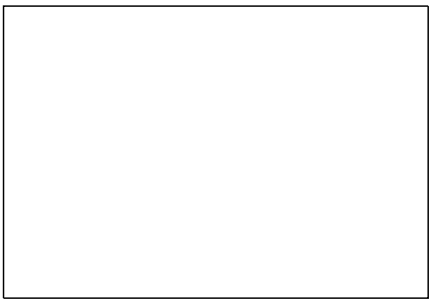

Figure 5: Throughput (bits/sec) with and without Wormhole

Average End-to-End Delay

It can be observed from Figure 6 that, under the condition where no wormhole attack is existed, there is an increase in the average end-to-end delay, compared to the effect of wormhole attack on the network. This is due to the immediate reply from the malicious node which does not need to check its routing table.

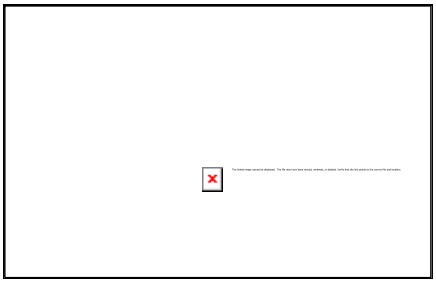

Figure 6: Average End-to-End Delay with and without Wormhole

Average Jitter

As shown in Figure 7, the average jitter between the nodes is more without the wormhole attack as compared to the case of wormhole attack. This is due to that malicious nodes provide the path to their destinations with a few number of nodes, or short path. Thus, average jitter between the nodes is reduced.

Figure 7: Average Jitter with and without Wormhole Attack

Comparing all the results obtained from Figures 5, 6, and 7, we can notice that the affect of wormhole on throughput values more than the affect on average end-to-end delay and average jitter values. That illustrated the main affect of wormhole attack on the value of throughput successful messages in MANET.

CONCLUSIONS

Attacks in wireless Ad Hoc are one of the mandatory issues and challenges in the network. There are a wide variety of attacks that target the weakness of MANET. The attacks in MANET can roughly be classified into two major categories, namely passive attacks and active attacks. This paper assesses the MANET under wormhole attack. Determining wormhole attack and evaluating the performance of the MANET are the main objectives in this paper. To achieve these objectives, QualNet 4.5 simulator was used. The work done in this paper consists of two scenarios. The scenario presented in this paper was meant to detect

the active wormhole attack and evaluate the performance of MANET under different conditions.

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RSA ALGORITHM PERFORMANCE IN SHORT MESSAGING SYSTEM EXCHANGE ENVIRONMENT

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ABSTRACT. Short Message Service (SMS) is a widely service for brief communication. With the rise of mobile usage it has become a popular tool for transmitting sensitive information. This sensitive information should be totally secure and reliable to exchange. This urgent need for secure SMS, led to drive for RSA implementation, which is considered one of the strongest algorithms in security since we are going to bring big security into small device. Our main goal in this project is to design an experimental test-bed application in order to use this application in evaluating the performance of RSA. This report explains and documents the process of implementing an RSA in Experimental SMS Exchange Environment using J2ME language which is available in several mobile devices on the market today.

Keywords: short message service (SMS), RSA algorithm, J2ME

INTRODUCTION

Most mobile operators encrypt all mobile communication data, including SMS messages but sometimes this is not the case. Even when encrypted, the data is readable for the operator. Although Global System for Mobile communications (GSM) traffic is usually encrypted, there is little or no security in some cases where the device is lost, stolen or otherwise accessed by an adversary. Among others these needs give rise for the need to develop additional encryption for SMS messages so that only accredited parties are able to engage communication (Hassinen 2003)(Peersman 2000).

Our approach to this problem is to develop a secure application that can be used in mobile devices to encrypt messages that are about to be sent. Naturally decryption for encrypted messages is also provided. The encryption and decryption are characterized by secret keys that all legal parties have to process. This application will be use in testing the performance of RSA algorithm in SMS exchange environment(Ratshinanga 2004). Several mobile device manufacturers have adopted Java as their platform offered for software developers. To certain extent Java applications are portable between devices of different vendors [3,4]. Some mobile device manufacturers provide an application programming interface (API) for SMS services. These facts make Java a natural choice for our application.

There are some security aspects related to secure SMS such as confidentiality, integrity and availability. By default, there is no encryption applied for SMS messages during transmission. Cyclic redundancy check is provided for SMS information passing across the signaling channel to ensure that the short message does not get corrupted. Forward error protection is incorporated using conventional encoding. Short message is assigned a lifetime

or validity period. Failure to deliver the message within the period causes it to be marked for purge. Some applications would allow secondary action to be taken when the lifetime expires (Stallings 2006)(Hwu 2006).

RELATED WORKS

RSA is an algorithm for public-key cryptography (Stallings 2006). It was the first algorithm known to be suitable for signing as well as encryption, and one of the first great advances in public key cryptography. RSA is widely used in electronic commerce protocols, and is believed to be secure given sufficiently long keys and the use of up-to-date implementations (Ratshinanga 2005). Figure 1 demonstrate the main three processes and their steps in RSA: key generation, encryption and decryption (Wagner 2001).

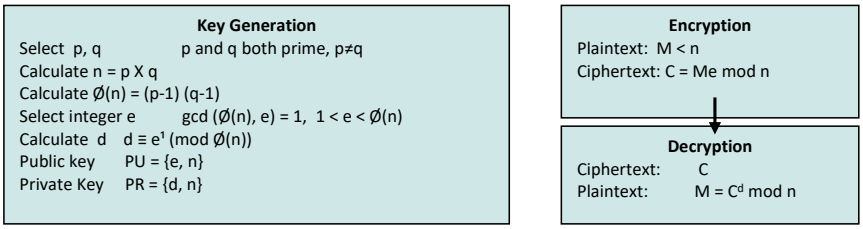

Figure 1. RSA Algorithm Mechanisms

Java 2 Micro Edition (J2ME) is a runtime environment designed for devices with very limited resources such as mobile phones or handheld computers. J2ME is comprised of CLDC (Connected Limited Device Configuration) and Mobile Information Device Profile (MIDP)(Harkey 2002). A program developed for J2ME is called a MIDlet. MIDlets use classes defined in Application programming interface (APIs) of CLDC and MIDP. There is no straight interaction between a MIDlet and the device itself, since MIDlets are run by the Java virtual machine (JVM) (Helal 2002)(Kolsi 2004). The architecture of J2ME is depicted in Figure 2. This architecture limits the functionality a MIDlet (Liu 2003) can have into those provided by the runtime environment.

Figure 2. J2ME Architecture Structure

J2ME do not have the crypto API of J2ME. Bouncy castle has Java implementations of cryptographic algorithms. Bouncy castle also has a package designed for J2ME (Piroumian 2002). So it can be used in this application because it has many cryptographic algorithms but the total size of an application will be very big. By Obfuscation way, Java applications are compiled into byte code and can be decompiled into Java source. Obfuscation "scrambles" the source code so that it is more difficult to decompile (Chun 1999). In obfuscation, classes and variables are renamed (a, b, c, d ...). Unnecessary classes are removed eg. Bouncy castle and the size of the MIDlet application decreases. Therefore, the total size of the application will be small and compatible with the memory of mobile device (Lindquist 2004)(Chat 2003).

According to (Hassinen 2003) in their paper an application for sending encrypted SMS messages using cryptographic methods based on theory of quasigroups is proposed. The encryption algorithm is characterized by a secret key. The research on cryptographic strength of quasigroup encryption is still in early stages. The cryptosystem has not yet undergone much scrutiny from the cryptographic community. Several widely used cryptosystems today

are conjectured to be safe. Hence, after extensive study by cryptographers they seem to be safe. This research has not yet been done to satisfactory extent on quasigroups. The application design itself doesn't restrict using any suitable encryption algorithm. Quasigroup encryption seems to be well suited for applications such as SMS encryption. The algorithm is compact and needs quite a small amount of memory which is an important aspect on mobile devices.

Another study was done by (Hassinen 2005). It showed how to send, receive, and store text messages securely with a mobile phone without any additional hardware. It also shows how to authenticate the sender of a message and how to ensure that the message has not been tampered with. The choice of Blowfish and Quasigroup encryption methods was motivated by his research interest (Hassinen 2005). His goal was not to find the fastest or the most secure algorithm, since additional algorithms can be implemented, if necessary, later on. One topic for future research is to implement and test other possibly suitable algorithms. According to our knowledge, several papers handle usage of SMS messages in different applications for industry, health care and personal communication but none of the articles address the security issues.

We can say that our research will be adding an improved application in SMS exchange field using the RSA algorithm knowing that most previous studies of this field conducted using symmetric algorithms and not asymmetric algorithm such as RSA. (Hassinen 2005) mentioned that there is no paper talking about the security issues. This was an incentive for us to develop a new application for SMS security as well as contribute on this field.

METHODOLOGY

The methodology adopted from that the development process of this application is an experimental process. The methodology basically consists of five phases; i) Preparing test bed ii) Coding iii) Compiling and Running iv) Testing and v) Verifying and Validating. In the preparing test-bed phase, the blueprint of the test-bed is devised. This is followed by the coding phase whereby the Java files and classes are coded. When the classes are ready we will compile it in the compiling and running phase. Then we run our new application through the emulator. Upon that, the application now is ready to test its performance. Finally, in the verifying and validating phase, where at this phase all the necessary configurations has been done by checking if the application fulfills the requirements which we need or not.

There are three main classes in this application with adding to another helping classes. The three main classes are: Send, Receive and RSAEncrypt. By using Send and Receive classes we can send SMS between sender and receiver without encryption. For encrypting the SMS we included the third class to the code which is RSAEncrypt. We can compile the classes by going to the next phase which is the compiling and running.

Java Application Descriptor (JAD) file will also be created. After the JAD has been created we can adjust the setting. This setting is also the same settings of the application. Figure 3. explain these settings of JAD file.

Figure 3. Settings of the JAD File (Project)

After adjusting the settings of the application, it now becomes ready to compile and run. The three main processes which are to enable bouncy castle and obfuscation, code compiling and application. We should notice that Sun's obfuscator has problems with projects that have more than 26 classes, so the following changes are necessary to ktool.properties file which is exist in this path: C:\WTK22\wtklib\Windows. Figure 4 illustrate the changes needed to enable obfuscation:

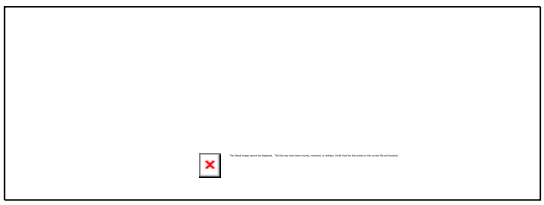

Figure 4. Changes needed to Enable Obfuscation

We compile the Java code classes by using J2ME Wireless Toolkit (WTK). There is a button which is called Build to compile and pre-verified the code. Figure 5 explain the output of code compiling process in the normal situation:

Figure 5. Output of Code Compiling Process

After successfully compiling, we need to run the application on the emulator device. Upon successfully running the emulator, we can launch our application to use it in sending and receiving encrypted SMS. Figure 6 illustrate how the application works:

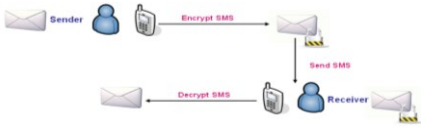

Figure 6. How MIDlet Works

ANALYSIS AND FINDINGS

We measure the effectiveness and the performance of RSA algorithm in the experimental SMS exchange environment. Our approach is to test Execution Time and Memory Usage. J2ME Wireless Toolkit (WTK) program support performance testing of the MIDlet application. We verify and validate our application by checking if the application fulfills the requirements.

The objective of our testing is to measure the efficiency and speed of RSA algorithm by using Application Performance Testing. Application Performance Testing (RSA Testing) is the process of verifying that an implementation performs in accordance with a particular standard, specification, and environment. Execution Time, Memory Usage and Network Traffic are tested in order to find advantages of RSA. It is not intended to be exhaustive and successfully passed test suite does not imply a 100 percent guarantee of RSA. However, it does insure with a reasonable degree of confidence that the RSA is consistent with its strength and speed.

We can examine the method execution time with the Profiler utility. The Profiler collects data from an emulator during runtime. By seeing how much time the method of RSA or any another methods take to execute, we can see what potential problems might exist in the application.

Profiling Data Display

In the Call Graph tree, we see folders for top-level methods. Opening a method's folder displays the methods called by it. By selecting a method in the tree shows the profiling information for it and all the methods called by it. For each method, we can see the following information: *Name:* The fully qualified name of the method, *Count:* The number of times the method was called during execution, *Cycles:* shows the amount of processor time spent in the method itself, *%Cycles:* is the percentage of the total execution time that is spent in the method itself, *Cycles with Children (*CWC*):* is the amount of time spent in the method *and* its called methods and *%Cycles with Children (%*CWC*):* shows the time spent in the method and its called methods as compared to the total execution time.

In this kind of testing we choose four methods in our application and examined the average time of execution for each of these methods: Encrypt Method, SendMessage Method, Decrypt Method and ReceiveMessage Method.

Table 1. Encrypt Method in Sender Side

Count	Cycles (ms)	%Cycles	CWC (ms)	%CWC
1 1 1	23.15	0.6	61.49	1.6
1	22.76	0.5	104.8	2.5
1	22.24	0.8	61.09	2.3
1	22.59	0.7	66.46	2.3
1	21.54	0.8	62.73	2.5
1	21.45	1	64.33	3.2
1	21.36	0.9	61.8	2.6
1	21.5	0.8	63.59	2.4
1	21.49	0.7	65.15	2.3
1	22.66	0.8	63.78	2.4
Avg Count	Avg Cycles (ms)	Avg %Cycles	Avg CWC (ms)	Avg %CWC
1	**22.07**	**0.76**	**67.52**	**2.41**

Table 2. SendMessage Method in Sender Side

Count	Cycles (ms)	%Cycles	CWC (ms)	%CWC
1	88.9	2.4	152.4	4.1
1	89.96	2.1	196.8	4.7
1	88.59	3.4	151.6	5.9
1	93.99	3.3	162.5	5.7
1	88.6	3.5	153.6	6.1
1	90.34	4.5	156.9	7.8
1	88.72	3.8	152.7	6.6
1	97.48	3.8	163.2	6.3
1	93.6	3.3	161	5.7
1	92.41	3.6	158.3	6.1
Avg Count	Avg Cycles (ms)	Avg %Cycles	Avg CWC (ms)	Avg %CWC
1	**91.26**	**3.37**	**160.9**	**5.9**

Tables 1 and 2, we can conclude that the number of times that Encrypt Method and SendMessage Method were called during execution is same and equal 1. The average execution times in seconds for Encrypt Method and SendMessage Method without children methods were 22.07 ms and 91.26 ms respectively. Also the percentage of time spent on a method's execution in respect to the time the entire program ran without children methods for Encrypt Method and SendMessage Method were 0.76% and 3.37% respectively. The average execution time in seconds for Encrypt Method and SendMessage Method with children methods were 67.52 ms and 160.9 ms respectively. Also the percentage of time spent on a method's execution in respect to the time the entire program ran with children methods for Encrypt Method and SendMessage Method were 2.41% and 5.9% respectively.

Table 3. Decrypt Method in Receiver Side

Count	Cycles	%Cycles	CWC	%CWC
1	21.07	1	63.82	3.1
1	21.22	1.3	67.09	4.2
1	21.01	1.4	63.73	4.5
1	22.18	1.6	66.02	4.9
1	31.93	2.5	80.59	6.4
1	22.16	1.6	65.78	5

Table 4. ReceiveMessage in Receiver Side

Count	Cycles	%Cycles	CWC	%CWC
1	0.766	0	179.8	8.7
1	0.767	0	241.8	15.4
1	0.757	0	97.31	6.9
1	0.776	0	17.41	1.3
1	0.756	0	18.51	1.4
1	1.102	0	23.27	1.7

1	21.92	1.8	65.12	5.6	1	0.75	0	16.66	1.4
1	21.08	1.9	70.86	6.4	1	0.759	0	18.25	1.6
1	21.9	1.8	66.16	5.4	1	0.758	0	21.2	1.7
1	22.1	1.7	68.41	5.4	1	0.76	0	17.76	1.4
Avg Count	Avg Cycles	Avg %Cycles	Avg CWC	Avg %CWC	Avg Count	Avg Cycles	Avg %Cycles	Avg CWC	Avg %CWC
1	22.66	1.66	67.76	5.09	1	0.795	0	65.20	4.15

Tables 3 and 4, we can conclude that the number of times that Decrypt Method and ReceiveMessage Method were called during execution is same and equal 1. And the average execution time in seconds, for Decrypt Method and ReceiveMessage Method without children methods were 22.66 ms and 0.795 ms respectively. Also the percentage of time spent on a method's execution in respect to the time the entire program ran without children methods for Decrypt Method and ReceiveMessage Method were 1.66% and 0% respectively. The average execution time in seconds for Decrypt Method and ReceiveMessage Method with children methods were 67.76 ms and 65.20 ms respectively. Also the percentage of time spent on a method's execution in respect to the time the entire program ran with children methods for Decrypt Method and ReceiveMessage Method were 5.09% and 4.15% respectively.

Time of Encryption and Decryption

Another test conducted was the time of Encryption and Decryption. We fix the size of SMS and then take 10 readings for the encryption and decryption time. We calculate the average time of encryption and decryption to use it in table 4.5, then we fix another size and so on, we start from size 12 until 84 and take 10 readings of average time of encryption and decryption. From able 5 we can calculate the encryption average time (EAT) which is equal 19ms and the decryption average time (DAT) which is equal 21ms.

Table 5. Encryption and Decryption Average Times

SMS Size (Byte)	Encryption Avg Time (ms)	Decryption Avg Time (ms)
12	28.1	28.2
20	7.8	7.7
28	17.4	17.3
36	9.4	12.5
44	12.6	9.4
52	6.2	15.5
60	21.9	26.6
68	23.1	25
76	31.1	33.1
84	34.1	38.2
Avg	**19.17 ms**	**21.35 ms**

Memory Usage Testing

We also conducted test for optimization of memory usage. The Memory Monitor Extension feature enables us to see how much memory is used by application during runtime and to see a breakdown of the amount of memory usage per object. The Memory Monitor displays usage information in Graph. The Memory Usage graph displays the following information namely the amount of memory used, the amount of unused memory available and the total amount of memory available at startup.

In Tables 6 and Table 7, we took five readings for the used and free memory at the sender and the receiver sides. After that we calculate the percentage of used and free memory to identify how much the application used the memory.

Table 6. Memory Usage in Sender Side

Used (byte)	Free (byte)	Total (byte)
48444	451556	500000
46336	453664	500000
47528	452472	500000
46272	453728	500000
46336	453664	500000
Avg Used (byte)	**Avg Free (byte)**	**Avg Total (byte)**
46983.2	**453016.8**	**500000**
% Used	% Free	
9.39664	90.60336	

Table 7. Memory Usage in Receiver Side

Used (byte)	Free (byte)	Total (byte)
42020	457980	500000
43244	456756	500000
44340	455660	500000
43244	456756	500000
43244	456756	500000
Avg Used (byte)	**Avg Free (byte)**	**Avg Total (byte)**
43218.4	**456781.6**	**500000**
% Used	% Free	
8.64368	91.35632	

Obfuscation Testing

In this test, two cases were experiment, the first one if we apply the obfuscation the total size of 40 bytes and the second case if we do not apply the obfuscation the total size of 584 bytes. Figure 7 illustrate the effects of obfuscation.

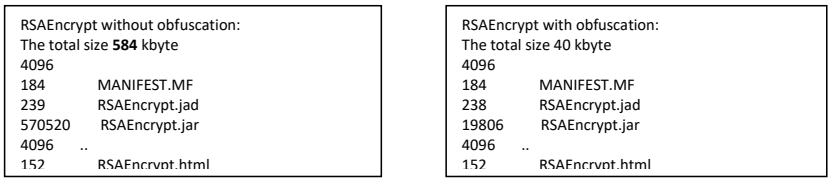

Figure 7. i) without Obfuscation **ii) with Obfuscation**

CONCLUSION

We have conducted several simple testing to make sure that RSA algorithm is operational in our experimental SMS exchange environment. The purpose of performance testing is to evaluate the RSA algorithm performance. The main factor that affect the performance of the testing is using of bouncy castle and obfuscation which allow RSA to be more efficient in this environment. We have successfully delivered a Secure SMS MIDlet application using RSA algorithm. All the designing, configuration and testing of the application with RSA algorithm have proven that it is possible to implement RSA in experimental SMS exchange environment. The process of designing, configuration, and testing described in the report shows the implementation of experimental RSA in Secure SMS application. This research can be further expanded in the future to incorporate other public key algorithms and comparing with them to identify the best public key algorithm for secure SMS.

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STRATEGY TO BLOCK TRAFFIC CREATE BY ANTI CENSORSHIP SOFTWARE IN LAN FOR SMALL AND MEDIUM ORGANISATION

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ABSTRACT. Anti-censorship software originally develop to fight internet censorship in China. The anti-censorship software such as Ultrasurf, Freegate, Gpass, GTunnel and FirePhoenixare become popular for the stubborn user who used the internet for thier own's purpose and disobey the poilicies . Since it is widely use by users in organisation local area network to bypass firewall policies, it become a threat to LAN organization. Hence, it cause a problem for network administrator who manage the internet utilisation and enforcing internet policies. For an organisation, uncontrolled internet usage lead the opened system vulnerability to viruses, backdoor, non-productivity activities and slow internet connection. Thus, this studies proposed strategies to filter and blocking traffic create by anti-censorship software in LAN. Method used in this project is **"design computer security experiment"**. Therefore, this project will guide the network administrator to control internet utilisation, protect organisation LAN and carried out implementation of the internal organization's internet policies.

Keywords: anti-censorship, block traffic, Ultrasur

INTRODUCTION

Computer technologies are changing rapidly. In the organization of LAN, to prevent users from accessing restricted web site and conduct activities such as downloading movie and accessing pornography web site has become a common internet policy. A war between network users and network administrator is never ending. Users will find a way or strategies to bypass firewall and network administrator will find a way to block and implement internet policy to protect LAN. Referring to (Aycock & Maurushat, 2008), "by using anti-censorship client software user are able to bypass firewall in LAN". There many choices of anti-censorship software in the market. According the Global Internet Freedom Consortium (GIFC, 2010), some example of Anti-censorship software are Ultrasurf, Freegate, Gpass, GTunnel and FirePhoenix. Internet censorship is a common practice among organization now days. According to Wikipedia (2010), censorship has define as "the use of state or group power to control freedom of expression, such as passing laws to prevent media from being published, propagated and access." However, for this studies censorship is define as "The use of group power to control freedom of accessing web services". In organization, task to implement internet censorship is given to network administrator. Network administrator need to monitor and control internet activities for the benefit of organization. In organization if users used anti-censorship software they can bypass an organization firewall. Network administrator should block users that had been used anti-censorship software from bypass firewall and access internet restricted website. Ensuring the users were not be able to access

restricted web site via anti-censorship software, required a system. The system functionally able to do traffic analysis and need to be execute at firewall level. Thus, the firewall is functionally to reject traffic requests from client that was using anti-censorship software while surfed. According to Becchi & Crowley, (2007), "firewalls with Deep Packet Inspection (DPI) capabilities are able to block traffic request from anti-censorship software". Somehow to have firewall with this DPI capability was expensive for a small organization. The purpose of conducting this study will carried out a strategy to filter and blocking traffic request from anti-censorship software which are able to used by a small organization at affordable cost.

PROBLEM STATEMENT

Ultrasurf became the most common anti-censorship application that has been used in LAN to bypass firewall. Ultrasurf communicated to target server using external proxy's server. IP addresses of all external proxies were always changes. It was very hard to do traffic filtering and blocking base on each proxies IP address. This required another strategy that able to do filtering and blocking. Ultrasurf used port 443 (https) and 80 (http) to communicate from user computer to external proxies server through an organization firewall. Since not many firewalls able to filter traffic request that went through https protocol, filtering this traffic was difficult to be done. Therefore, only the commercial firewall which is expensive able to provided filtering and blocking https packet. These required a solution that suitable for small organization to implement, which is less expensive and affordable. Thereby created a strategy on how to filter and block Ultrasurf traffic, transform the network administrator ability to control internet utilization and carried out implementation of internet policies. Network administrator also needs to ensure network is used for the benefit to all users in the organization.

LITERATURE REVIEW

Anti-censorship software such as Ultrasurf, freegate, gpass, garden, GTunnel, and FirePhoenix are software that can bypass firewall. Arccording to Wikipedia (2010), the most commonly website block by firewall are Pornographic, Social networks (e.g. Facebook, MySpace and Twitter) , Political blogs, YouTube, Nazi and similar websites and Religious websites. User will used anti-censorship software to be able to access listed category of web page. There is many anti-censorship software in the internet and some of them is fee to use. Arcoding to Global Internet Freedom Consortium, Ultrasurf are the most commontly use (GIFC, 2010) and Arccording to Kaiser, (2008) Ultrasurf was state as "Possible as The Best Proxy Server, 2008".

Recently, Ultrasurf not only been used in China to bypass the "golden shield project", but it also been used in LAN that applied internet restriction. By using Ultrasurf, users inside organization LAN are able to bypass firewall and access restricted website. According to Xia (2004), "Ultrasurf is extremely difficult to block". Ultrasurf is using port 9666 to communicate from web browser to the Ultrasurf services, but communication using this port only at local computer. Blocking this port at organization firewall will not function. Ultrasurf uses a secure socket layer (SSL) to communicate from local computer to their proxies. They have thousands of proxies, which mean to block IP proxies are not practical. It is not suitable because from time to time many more IP address being increasing in the list. It also used Port 443 and cannot be block at firewall. This is because Port 443 use for https communication. However, if this port is been blocked, website such mail.yahoo.com, Gmail.com and banking online system that used this secure socket layer to communicate failed to work. As mention in introduction, there are firewalls that able to block Ultrasurf. According to Kumar, Turner, & Williams (2006) and Piyachon & Luo (2006), filteration can be done by using SSL interceptor and perform DPI (deep packet inspection). Firewall that have DPI capabilities are able to filter traffic that come from anti-censorship software. This means it also able to block Ultrasurf. There are commercial firewalls that able to block anti-censorship software, but they

are expensive. Example of firewall that has this kind of capability is Sonic Wall and Symantec firewall. This type of firewall was considered expensive firewall for small and medium organization. For this project, open source solution is preferable since it is free for everyone.

RESEARCH OBJECTIVES

The aim of this study is to blocking traffic created by Ultrasurf from LAN to internet. In order to achieve the main objective, the specific objective has been planned as follows:

1. To identify how Ultrasurf connect to internet.
2. To produce strategy to block traffic created by Ultrasurf
3. To evaluate the strategy.

METHODOLOGY

The analysis of this study will be divided into 7 main phases. This methodology is adapted from (Peisert & Bishop, 2007). This methodology has be use for "How To Design Computer Security Experiment". For this studies the "Propose strategy" and "Validate hypothesis" phase was added. This change is made suite studies that will be conducted. Below are methodology used by peisert and bishop.

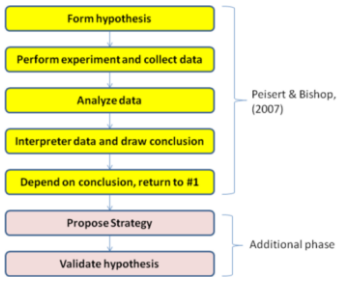

Figure 1. Methodology used in this studies

Phase 1 : Form Hypothesis

This phase will form the hypothesis. To form hypothesis information will be getting from literature review. To identify requirement for blocking Ultrasurf connection, the process of web accessing from Ultrasurf is listed.

Table 1. Process of connection and location it happen

Process of connection	Location	Ability to control by network admin
Web browser connect to Ultrasurf using localhost (ip 127.0.0.1) port 9666 and create as local proxy server.	Local Computer	No
Ultrasurf (discovery agent) connect to various external IP (external proxies server) using port https (443) and http (80).	LAN to WAN via Gateway	Yes
External proxies server will connect to restricted web site and passing back to proxies server.	WAN	No
Proxies server will encrypt (if using port 443) the content and send back to Ultrasurf (discovery agent).	WAN to LAN Via Gateway	Yes
Ultrasurf as local proxy server will pass the content to web browser.	Local Computer	No

The requirement to block ultra surf is identified. Process of "Ultrasurf (discovery agent) connect to various external IP (external proxies server) using port https (443) and http (80)." This process will use organisation gateway to go to internet. This process happen inside organisation and under supervise by network admin. In normal organisation gateway used to connect to internet. It become a centre for every computer in LAN use this gateway to connect to internet. These processes are identified as place to studies and conduct experiment, since it locate in the area where is controllable and centralize. As an outcome form this phase, a hypothesis "*it is possible to block Ultrasurf, if how it connect to internet is identify*".

Phase 2 : Perform Experimentation And Collect Data.

This phase carried out the possibilities by creating simulation to test. All the findings will be recorded. This phase is to gather information how Ultrasurf connect to internet. Experiment being conduct in 4 conditions :

a) Firewall **at router** block specify domain name **without** Ultrasurf installed and label as Exp : 1.
b) Firewall **at Squid proxies** block specify domain name **without** Ultrasurf installed and label as Exp : 2.
c) Firewall **at router** block specify domain name **with** Ultrasurf installed and label as Exp : 3.
d) Firewall **at Squid proxies** block specify domain name **with** Ultrasurf installed and label as Exp : 4.

All four (4) experiments were using 100 domain names for data sampling. Fifty (50) black list domains name was label as "Black list domain" and remaining fifty (50) labels as "white list domain". Blacklist domain was enter into firewall to block connection request from client.

Phase 3: Analyze Data.

Result of each experiment result was captured and labelled as below.

Table 2. Result Of Experiment

Domain Name	Exp: 1	Exp: 2	Exp: 3	Exp: 4
White List Domain	Yes	Yes	Yes	Yes
Black List Domain	No	No	Yes	Yes

The result of all experiment shown on table 3.2. This proved those clients installed with Ultrasurf are able to access black list domain. This way being used either than using filtering at router or proxy. During experiment 3 and 4, Wireshark is used to capture packet that transmit and receive data at client site. This provided with a data that can be used for future used. To get accurate data of various version of Ultrasurf has been used. From experiment 3 and 4 summaries of data are captured was listed in Table 3:

Table 3. Summary of Ultrasurf packet analysis

No	Version	Discovery agent in Ultrasurf try to connect using	
		Port	External Proxies IP address
1	9.4	80 and 445	199.67.185.130, 63.245.209.72, 192.88.209.56, 128.231.86.79, 59.106.108.86, 209.85.171.115, 210.59.144.3, 91.192.128.34
2	9.5	80 and 445	65.49.2.115, 65.49.2.123, 61.227.100.36, 66.245.217.15 65.49.2.123
3	9.9.2	445	65.49.2.113, 65.49.2.121, 61.228.183.115, 202.142.160.148, 122.122.159.213, 118.160.154.132

Phase 4: Interpreter and Draw conclusion

In this phase, it was confirm that it's possible to block traffic create by Ultrasurf as shown in previous phase, that it use http and https port to communicate with outside server and Ultrasurf used various IP that become Ultrasurf external proxies. This phase suggest that by blocking communication trough IP. It will block Ultrasurf connection. On this phase **objective 1 "To identify how Ultrasurf connect to internet" has been achieve**

Phase 5: Conclusion Based On The Experiment.

Based on the outcome from phase 4, the data drawn as conclusion. It support and agree with the hypothesis of this studies. Analysis from captured packet has showed:

1. Ultrasurf connected to various external IP address.
2. Connect used port 80 (http) and port 443 (https).
3. It uses TCP protocol for communication.

Phase 6: Propose Strategy

Based on all sources from the conclusion of the experimentation, this phase exposed a strategy on how to filter and block Ultrasurf. The guidelines are listed. All captured packet generated by Wireshark has been analysed. As an outcome from previous phase, one strategy has been established is: "To reject ALL traffic using TCP protocol port 80 and port 443 that try to connect based on IP address."

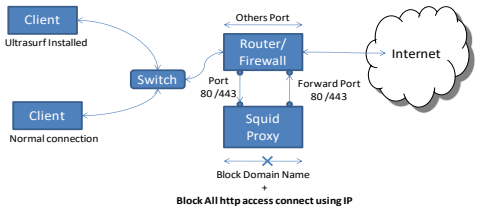

Figure 2. Propose System

Tables 3, Show that ultrasurf using port 80 and 443. Experiment 3 and 4 show that client installed with ultrasurf able to bypass router firewall and proxies firewall. In Squid proxy server can has configured as follow

```
acl blacklist_domain_contain url_regex -i
"/etc/squid/blacklist_domains_contain.acl"
acl blacklist_domain dstdomain "/etc/squid/blacklist_domain.acl"
acl access_by_ip url_regex \b(25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\.(25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\.(25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\.(25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\b
http_access deny access_by_ip
http_access deny blacklist_domain
http_access deny blacklist_domain_contain
http_access allow all
```

Figure 3. squid.conf

From the Figure 3 above, the importance squid parameter is "acl access_by_ip url_regex \b(25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\.(25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\.(25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\.(25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\b". Parameter "http_access deny access_by_ip" was used to filter all http and https access. This mean squid will deny user that try to connect to access http and https using IP address as URL.

```
.bigfishgames.com   .roadandtrack.com
.sex.com            .youtube.com
```

```
horny   porn   games   sex
```

Figure 4. squid.conf **Figure 5. Blacklist_domains_contain.acl**

Figure 4 and Figure 5 show additional file to support squid to blocked specific domain and any domain contained specific word in their domain name. On this phase objective 2 "To produce strategy that able to block Ultrasurf" has been achieve.

Phase 7: Validate The Hypothesis

Strategies that been applied into an organisation firewall and the effect been analysed and conclude either the strategies is working or not. Based on the proposed strategy that been used, Experiment 4 (Web filtering at squid with Ultrasurf Installed) has been conducted again to validate the requirement needed. Experiment 3 is not conducted due to time and cost constrain.

Table 4. Validate Result

Domain Name	Exp: 1	Exp: 2	Exp: 3	Exp: 4
White List Domain	Yes	Yes	-	Yes
Black List Domain	No	No	-	No

Table 4 showed result from experiment after propose strategy to block Ultrasurf has applied.

Figure 6. Ultrasurf unable to connect to internet

Figure 6 has showed that Ultrasurf unable to connect to external IP. All white list and black list domain cannot be accessed by user even those Ultrasurf was installed in their PC. This showed that user installed with Ultrasurf unable to access internet. Since this strategie cannot be applied inside firewall, Experiment 3 cannot be conduct.

CONCLUSIONS

After the experiment conducted, most of the firewall is unable to block anti-censorship software such as Ultrasurf. A strategy to combat anti-censorship should be introduced to protect organization. This project has been introduced a strategy to block user from accessing prohibited website. Squid proxy server has ability to provide a blocking IP address based on http and https connection. From these studies two techniques of implementation is proposed.

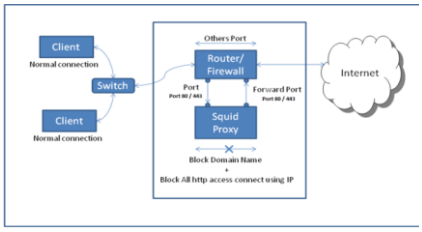

Figure 7. Router, Firewall and Proxy In a Box

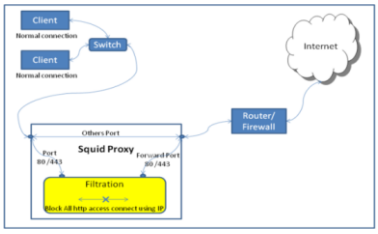

Figure 8. Independent Proxy

From the figure 7, it show the strategy to implementing restricting accessing website in single box. This box act as router / firewall and proxies. Figure 8 was proposed since this strategy was used squid to filter and block. Base on Experiment 3 (Firewall **at router** block specify domain name **with** Ultrasurf installed). This strategy cannot be applied directly in router or firewall. As show on figure 8 Strategy was applied outside a router/ firewall to filter and blocking ultrasurf. The key for this strategy is "**To reject ALL traffic using TCP protocol port 80 and 443 that try to connect based on IP address."** " these mean if user try to connect to internet using http or https it must use domain name, If user using IP address Squid will drop this network traffic request. Squid also able to be configure to allow connection using specific IP address. Squid as proxies server play a vital role on this strategy

FUTURE DEVELOPMENTS

This strategy of blocking Ultrasurf traffic request can be enhanced in many ways and there will always be new developments evolve in this anti-censorship technology. These reveal the new areas for researchers to explore. The following entries will briefly present the further enhancements specification:

i. **Performance.**
This research studies never touch about performance to process of the filtering traffic request. For an example, what will happen if 1000 user request at same time. Is squid server able to support and what is the best hardware specification to handle connection efficiently?

ii. **Squid new technology.**
Squid proxy server keeps updating their feature to meet the user's target. A question of "Are current squid configuration (Squid.conf) are working perfectly in all version of squid need to be answer.

iii. **Network model.**
In this project, traffic filtration is a key to block Ultrasurf traffic. Due to time constrain, only squid has be study to provide the traffic filtering. IPTables also can provide traffic filtering. How to use same concept and applied at IPTables phase.

iv. **Others type of anti-censorship software**
As mentioned in chapter 1, there are a many anti-censorship software available in the market. The software are Ultrasurf, Freegate, Gpass, GTunnel and FirePhoenix. In these studies only Ultrasurf has been tested. By using the same strategy it may work on others anti-censorship software as well.

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RESILIENCE AND SURVIVABILITY IN MANET: DISCIPLINE, ISSUE AND CHALLENGE

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ABSTRACT. The wireless technology has become essential part in modern life, and thus the consequences of network disruption is becoming severe. It is widely known that wireless network is not sufficiently resilience, survive and dependable and significant research and development is necessary to improve the situation. This paper provide a survey of vast disciplines in MANET, a resilience strategy is also presented on how to defend, detect and countermeasures malicious node. Current issues and challenges to achieve resilience and survivability is also presented for future direction

Keywords: wireless technology, MANET

INTRODUCTION

The usage of wireless technology has tremendously increased due to rapid proliferation of wireless lightweight devices such as laptops, PDAs, wireless telephones, and wireless sensors. They have been used in applications such as survivable, dynamic communication for emergency/rescue operations, disaster relief efforts, and military networks. These applications demand high security protection and resilience where any weaknesses identified needed to be addressed appropriately. In Mobile Ad Hoc Networks (MANETs), the nodes are mobile. As a result, the network topology may change rapidly and unpredictably over time. Furthermore, the network is decentralized; where all network activity including discovering the topology and delivering messages must be executed by the nodes themselves.

The dependency on mobile ad hoc application has gained interest to many industries. However, the increase dependencies on these sophisticated services make wireless network more vulnerable to problems. This will results in increasing consequences of disruption and becoming more attractive to attacks. Current research in MANET mainly focuses on routing problems but did not include resilience and survivability in their protocol design (Fei Xing, 2010). Resilience defines by P.G. James and H. David is the ability of the network to provide and maintain an acceptable level of services in the face of various faults and challenges to normal operation (P.G. James, 2010). This paper focuses on a broad overview of resilience and survivability concept in MANETs. Rest of this paper is organized as follows: section II present resilience and survivability discipline in MANETs. Section III will discuss resilience issues and mechanism. Section IV presents strategies for achieving network resilience and survivability in MANETs. Finally we conclude and present our future direction.

RESILIENCE AND SURVIVABILITY DISCIPLINES

Resilience covers broad disciplines in MANET. Figure 1 show disciplines of resilience in MANET, which is divided into two categories, tolerance and trustworthy.

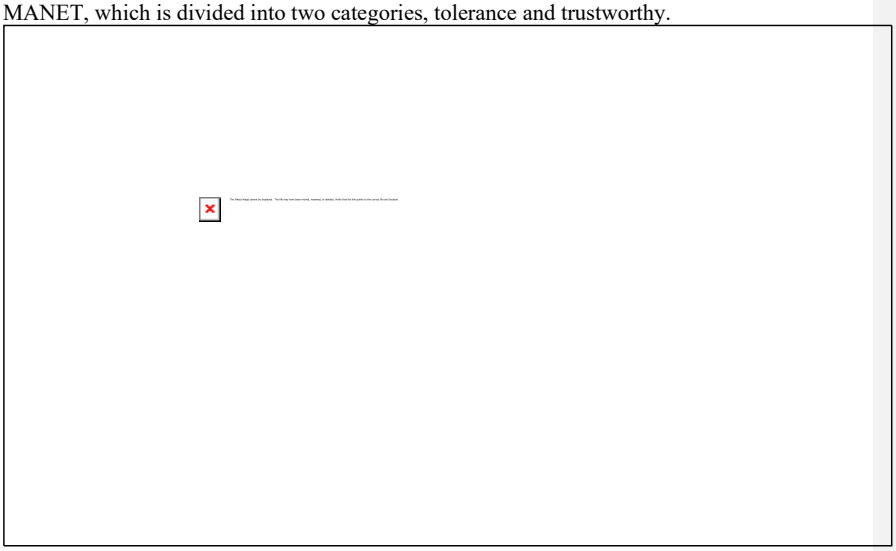

Figure 1: Resilience Discipline

It covers the area of survivability, intrusion and fault tolerance, dependability, security and performance (Sterbernz, 2010). Each discipline has a basis of action as part of resilience strategy. The first discipline is tolerance which can be define as how the systems react, counterpart, recover and allowed intrusion or failures at a tolerable rate to prevent it from generating system failures (Michele Nogueira Lima, 2009). The concept of tolerance comes from two classical areas of computer science which are fault-tolerant and intrusion-tolerant. However, intrusion tolerance in MANETs just started recently after the application on wireless mobile becomes wide spread. Techniques for tolerance can be classified as redundancy, recovery and replication.

- **Redundancy** can be achieved using multiple route paths in routing protocol. This technique uses multiple paths to transmit identical copies of the packets in each path to avoid packet loss in the case of attacks. In case the channel been attacks, the packets can be recovered from other sources.
- **Replication** uses technique to replicate the key and assume that the system operates correctly only if *f* out of *n* of its replicas is compromise.
- **Recovery** is the capability of restoring disrupted information or functionality within time constraints, limiting the damage and maintaining essential services.

Survivability in the context of MANET classified as tolerance concept. It refers to the capability of a system to fulfill its mission in a timely manner at the present of threats or failure (Yuan Zhou, 2009). It involves correlated failure of nodes due to attacks or network disruption. Survival properties are resistance, recognition, recovery and adaptability (Michele Nogueira Lima, 2009). Resistance is the capability of a system to repel attacks via user authentication, firewalls and cryptography. Recognition is the system capacity to detect attacks and evaluate the extent of damage. Recovery is the capability of restoring disrupted information or functionality within time constraints, limiting the damage and maintaining essential services. Conventional strategies applied for achieving recovery are replication and

redundancy. Finally, adaptability incorporating lessons learned from failures and adapting to emerging threats

The second discipline categories under the area of trustworthiness. It defines as assurance that a system will perform as expected (Pradeep Rai, 2010). The trustworthiness measures service delivery of network which are dependability, security and performance. In MANET, nodes are depended on other node(s) to route or forward a packet to its destination via wireless medium. Thus, nodes in MANET required highly reliability and availability of networks. Security is crucial in MANETs especially when it is involved highly sensitive transmission. In general, security mechanism in MANET follows two defense lines: one preventive and another reactive (Jie Li, 2008). The prevention is the first line of defense which protects the network form external. It is mainly achieved by securing routing protocols which prevent the attacker from installing incorrect routing updates at other nodes. On the other hand, reactive is the second line of defense which protects the internal attacks. It roles is to take action on demand to mitigate intrusion, it is actually act like intrusion detection systems (IDS). The last discipline in resilience is to measure performance of MANET. Performance refers to property of system that measures quality of services (QoS) such as delay, throughput or goodput, and packet delivery ration (Lee Bu Sung, 2003).

RESILIENCE ISSUES AND CHALLENGES IN MANET

This section describes current issues and challenges to MANET that motivate the need for resilience. MANET defined above as connected nodes which form dynamic topology without centralized operation. Unlike wired, nodes in MANET performed all routing activities within the node itself. Due to that, MANETs are more vulnerable to failures compared with wired networks due to topology changes, node misbehaviors, or even security attacks, which imposes a critical demand for the resilience of these networks.

The concept of resilience in MANET should guarantee the communication network between sender node and receiver node even if some of their hopping terminal failed or out of service area. Therefore the issue against nodes misbehavior and failures is critical to resilience-oriented applications. There have been a number of researches proposed to tackle resilience issues in MANET. Most of the researches proposed are solution to enhance QoS, ensuring data integrity and availability. However, issues on nodes misbehavior, security attacks and node failure is limited. The researchers also assume that nodes in MANETs are treated independently when it comes to measure impact analysis of the network.

In real situation, nodes in MANET should be correlated with each other. For example, if a node has more and more neighbors failed, it may need to load more traffic originally forwarded by those failed neighbors, and thus nodes might become failed faster due to excessive energy consumption. Similarly, it is also possible that the more malicious neighbors a node has, the more likely the node will be compromised by its malicious neighbors (Xing, 2009). This scenario will affect network resiliency in MANETs. Thus, it is important to look at the issues how these correlated behaviors will affect the network resilience in MANET. Various node misbehaviors will also affect network resilience in MANETS. The most important is its topological connectivity and delay-throughput. At this moment, current research still lacks of quantitative analysis to measure the impact of network resilience. It is good that if we can model and analyze the network impacts quantitatively based on a specific resilience metric mention above in the consideration of correlated node misbehaviors.

The challenges to the above issues come from random mobility pattern of the nodes, resources constraint, and malicious attacks. Network topology in MANET changes over time due to its random mobility pattern. The solution to the above issue must be self-adjustable to dynamic topology changes as well as node behaviors. Furthermore, MANET also has its

limitation in terms of it energy resources and bandwidth constraint. Most devices in MANETs are battery operated, thus, the solution should consider a low communication overhead and computational complexity. Another big challenge to MANETs is advance malicious nodes such as Dynamic DOS attacks. It is very difficult to detect the presence of attacks via node misbehaviors.

STRATEGIES TO ACHIEVE NETWORK RESILIENCE AND SURVIVABILITY IN MANET

Resilience and survivability in MANET required state-of-the-art strategies to maintain connection topology in the presence of attacks or random failures. In general, conventional survivability strategies rely on redundancy and replication to use the best route for data transfer in order to achieve network performance. To ensure the network achieve the objective of the services, for availability and reliability, redundancy techniques such as in routing discovery used multiple paths routing protocol to provide redundancy in data transmission. Multiple path routing protocols can use all routes found simultaneously and transmit the same data more than one time or can use them on demand or as an alternative. On the other hand, in security, replication technique uses to protect data confidentiality. Redundancy techniques such as certificate authority scheme (Foyer, 1999) can be applied by dividing the key into part and distributed among the nodes. The nodes will have replicates keys in case some of the keys have been compromised. Other techniques can be used is to split messages into pieces by the source node. Each of the messages is encrypted and sent out via multiple independent paths.

In quantitative approaches, survivability in MANETs is modeled and analyzed mathematically. Based on the model, the impact of network survivability can be measured according to specific resilience metrics. Moreover, various nodes behavior also can be analyzed quantitatively and how the nodes behavior will affect network resilience. The most important is its topological connectivity and delay-throughput. At this moment, current research still lacks of quantitative analysis to measure the impact of network resilience.

CONCLUSION

Wireless technologies have become essential to all aspect of modern life, and thus the consequences of network failure have become increasingly severe. It is widely recognized that wireless network is not sufficiently resilience, survivable or reliable. The researches in these areas are extremely important to improve network performances and services. There are many possible promising future directions in the broad topic of resilience as discuss above and problem in dealing with correlated nodes behavior and how it affect network resilience in MANET discussed elsewhere. However, modeling correlated node behaviors itself can be even more challenging task and really require urgent further research.

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DEVELOPMENT OF A SINGLE HONEYPOT SYSTEM INTERFACE

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ABSTRACT. Networking is crucial to any organization which interconnecting systems all around the globe. However, networking is exposed to the increase of threats that have been detected which reducing the organization's security level. Perpetrators of cybercrime will take this advantage to exploit other systems in their network. To enhance the security level of networking, Honeypot technology has been created to detect the unauthorized use of network. This paper focuses on development of batch files that execute a normal computer as a Honeypot. The main goal of this system is to capture information on every network attacks. Technically, this paper will guide user in Honeypot configuration process.

Keywords: Honeypot technology, cybercrime, Honeypot interface

INTRODUCTION

Network Intrusion Detection System is a system used to detect any illegal activities occurred in a computer network. There are various malicious network traffic and computer usage for instance network attacks against vulnerable services, data driven attacks on applications, host based attacks such as privilege escalation, unauthorized logins and access to sensitive files, and malwares.

In the advance of systems and superb technology, most users ignore the security part when using the technology. Honeypot is not new in cyber-technology. Honeypot acts as surveillance and manage to detect and capture the attackers of computer network system. The development of batch scripting which contains instructions for generating a single Honeypot will be introduced in the next section in this paper.

HONEYPOT

Referring to the definition of Honeypot by the author of Tracking Hackers, "*A honeypot is an information system resource whose value lies in unauthorized or illicit use of that resource"* (Spitzner, 2003). In a computer jargon, Honeypot is a tool to get information about the attacker. It is designed for inspection and attacked. Furthermore, network administrators can learn about activities that can harm and monitor the trends of these activities. Honeypot will give early warning if the system encountered with attacks. Despite that, Honeypot has its own drawback. If Honeypot is not walled off appropriately; this can benefit the attacker to break into a system by using it.

Type of Honeypot

Honeypot can be categorized based on its use. There are two types of Honeypot for this category; Research Honeypot and Production Honeypot. Research Honeypot are run by volunteer non-profit organization whose aim is to gather information about the black hat community. Compared to Research Honeypot, Production Honeypot is easy to use. It captures only limited information and usually used by companies or corporations. Production Honeypot falls into low interaction honeypots which means it is easier to deploy but give less information about the attack or attackers. Both honeypots help to mitigate risk in an organization by working independently.

Different level of interaction classifying Honeypots into:

Low-interaction honeypots have limited interaction. They normally work by emulating services and operating systems (Kyi Lin Lin Kyaw & Gyi, P., 2008). Tools are installed to emulate operating system and services. This type of honeypot has a small chance of being compromised. Low-interaction honeypots are useful to gather information at a higher level, *e.g.*, learn about network probes or worm activities, analyze spammers or for active countermeasures against worms.

High-interaction honeypots give complex solutions as they involve real operating systems and applications (Kyi Lin Lin Kyaw & Gyi, P., 2008). It observes the attacker's behavior, their tools, motivation and explored vulnerabilities.

BATCH SCRIPT

Batch files or it could be called batch programs or scripts are text files containing a series of commands that executed by command interpreter which also known as shell program such as command.com or cmd.exe. The shell program is a computer program that reads line of text that is entered by the user. It interprets line and the text was in the context of a given operating system or programming language. In simple terms, it can be said that the batch file ease work that requires repetition or a certain routine to allow user to create a batch script to automate a lot of orders. Commands for example *for, goto,* and *if*, allow us to perform conditional processing of commands in batch files.

Different platforms come with different batch file's extensions. DOS batch files have the filename extension **.bat**. Meanwhile, for Microsoft Windows NT family and OS/2, the batch files may have the filename extension **.cmd** or **.bat.** 4DOS and 4NT related shells use **.btm**. In OS/2, a file with a **.cmd** extension can also be a Rexx file and shell script is similar to batch file in Linux.

SPECIFICATION OF SYSTEM

The system has been developed using Visual Basic programming language version 6.0 (VB6.0). The development of this system involved the design on how to generate a list of command codes that will produce a batch script. This batch files will be applied in configuring a computer as a single Honeypot.

```
If stopWinDef = vbChecked Then List1.AddItem "NET STOP Windows Defender"
```

Figure 1. Example of Program Code in VB6.0.

Figure 1 shows one line code that displays check box for the selected service. NET STOP or NET START command codes are used in the command prompt (cmd.exe) to stop or to turn on any services in Windows operating system. Switched or ended the service in the system is intended to make the computer more vulnerable and to attract hackers to intervene into the computer.

Users can also select a list of ports to be opened for the construction of a Honeypot. Here is an example of segment code for setting an instruction to open a port in the system as shown in Figure 2.

```
If port137 = vbChecked Then List1.AddItem "netsh firewall add portopening TCP 137 NetBios137"
```

Figure 2. A Segment Code To Open A Port.

Development Process of a Single Honeypot

The flow of the process to generate a batch file is illustrated in Figure 3. Initially, user has to decide which services and ports they need to choose to attract hackers to attack Honeypot system.

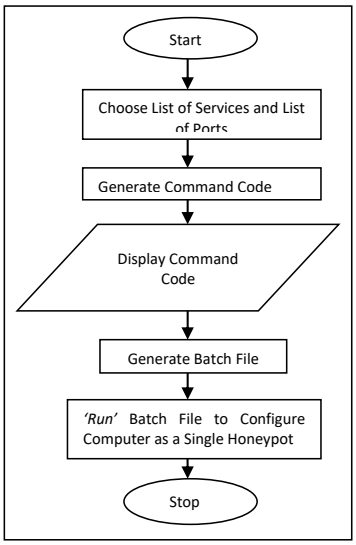

Figure 3. **Flowchart Of Generating A Batch File.**

Once the required list of services and port are selected, a command code will be produced and displayed. Batch files are delivered and stored in the specified directory. Eventually, the batch file runs the computer as a single Honeypot. The yielded batch files affected the starting or termination process of the computer, and opening the port for a computer that has a connection to the internet. Figure 4 demonstrates a segment code which output the direction.

```
@ECHO off
REG ADD HKLM\SYSTEM\CurrentControlSet\Control\ComputerName\ComputerName /v
ComputerName /t REG_SZ /d SERVER
REG ADD HKLM\SYSTEM\CurrentControlSet\Control\ComputerName\ActiveComputerName /v
ComputerName /t REG_SZ /d SERVER
NET STOP wuaUserv
NET STOP WindDefend
NET STOP wscsvc
NET STOP nla
NET STOP ProtectedStorage
NET START RemoteRegistry
NET START RemoteRegistry
NET START LanmanServer
NET STOP SamSs
NET START TermService
NET START RemoteAccess
NET STOP Netlogon
NET STOP PolicyAgent
netsh firewall set opmode mode=ENABLE
netsh firewall add portopening TCP 137 NetBios137
netsh firewall add portopening TCP 138 NetBios138
netsh firewall add portopening TCP 8193 Sophos8193
```

Figure 4. Segment Code Of Registry Editor.

```
REG ADD HKLM\SYSTEM\CurrentControlSet\Control\ComputerName\ComputerName
/vComputerName /t REG_SZ /d SERVER
```

Figure 5. Modification On Registry Editor.

The registry file editor in Figure 4 has been modified as depict in Figure 5. When user enters the name of Honeypot, for example, 'SERVER', it replaces the computer name. The produced batch file runs the code and it changes the value of Active Computer Name REG_SZ as stated in the Registry Editor as shown in Figure 6.

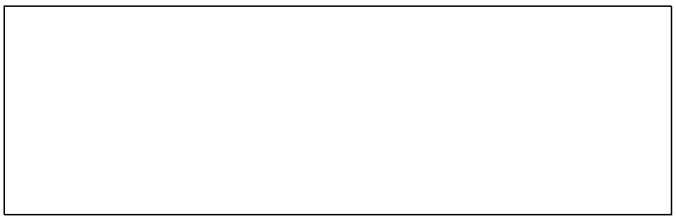

Figure 6. Registry Editor On Windows XP.

The batch files should be placed in a computer and it does the computer system configuration to serve as a single Honeypot that has a connection to the Internet.

Design of Single Honeypot System Interface

A single Honeypot system interface is designed to be user friendly and simple without having to remember all the commands to generate a batch file. A user only needs to select options through provided interface system.

Figure 7. Naming A Honeypot.

Figure 7 shows a user must name the Honeypot to attract hackers to attack the Honeypot system. The services listed in the *'Select Services in Your Honeypot*' have to be selected as presented in Figure 8. Cessation and initiation of any services listed aims to reduce the level of computer security that would act as a Honeypot. Hence, it eases hackers to intrude and interact with the system.

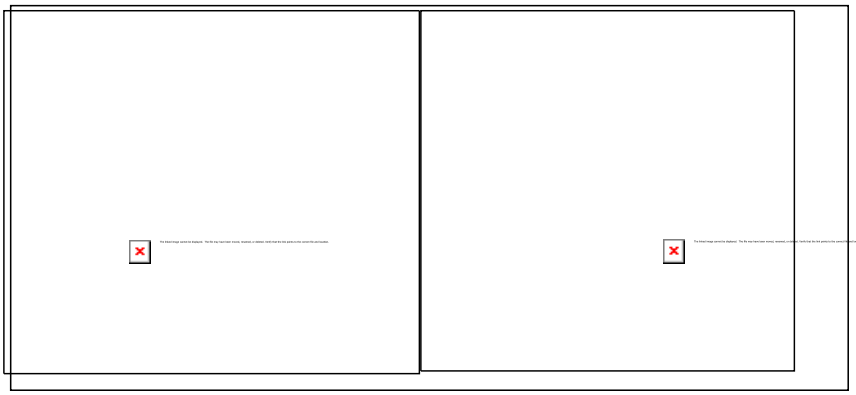

Figure 8. List Of Services And Ports.

Figure 8 shows the list of ports that need to be chosen by a user. These ports are used by hackers to break into a computer system which operates on Windows XP operating system.

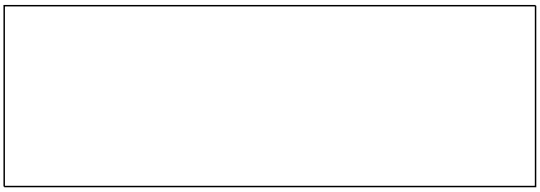

Figure 9. Batch Script Generated.

Once the list of services and ports has been selected, the system will generates a batch file as displayed in Figure 9. This file is finally stored in a specified directory.

Implementation of a Single System Honeypot Interface

The system interface was developed to help user in generating a Honeypot without having to remember all the instructions to generate Honeypot. Although, there are a few disadvantages arise from the proposed system. Honeypot raises the possibilities of enabled services can be disabled by intruder, thus, user needs to restart the particular service. Testing of the services used in the project could damage a computer operating system. Therefore, the virtual operating system should be applied to overcome such problem. However, not all services that able to operate in a real operating system can run in virtual situation. Typically,

the problem arises when the test involves the use of network-based services, for example, Network DDE and Network DDE DSDM services which cannot be implemented because there is a problem of other services that do not operate in a virtual operating system.

CONCLUSION

Due to the advancement of information technology, various forms of attack from hackers arise with intention to destroy data, information and so forth. Therefore, a system with improved security level is demanded with the purpose of protecting precious data and information. The development of low-interactive Honeypot system is an alternative method in learning the real circumstances in computer network. The aim of this research is to develop a system that can facilitate users in configuring Honeypot without entering any command codes. Apparently, users have options by selecting the list of services and ports in conjunction to build up a single Honeypot and run generated batch files.

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ABMMCCS: APPLICATION BASED MULTI-LEVEL MOBILE CACHE CONSISTENCY SCHEME

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ABSTRACT. Maintaining cache consistency in mobile computing system is a critical issue due to the inheritance limitations in mobile environment such as limited network bandwidth and mobile device energy power. Most of the existing schemes maintaining mobile cache consistency support only one level of consistency that is either strict or weak which is not suitable all the time, as various mobile applications systems have different consistency requirements on their data. Also majority of the schemes restrict the using of cached data for reading only which is limits the functionality of the caching system. In this paper, a new scheme is proposed to maintain the mobile cache consistency in a single cell wireless network called Application Based Multi-Level Mobile Cache Consistency Scheme (ABMMCCS). The main idea in ABMMCCS is to be suitable to various real mobile application systems, by supporting multiple levels of consistency based on the application requirements, while saving the mobile client energy power and reducing the consumption of the network bandwidth. The initial evaluation results show that, ABMMCCM reduces the number of uplink messages issued from the mobile client, which is assist in saving the mobile client energy and better utilizing the limited network bandwidth.

Keywords: mobile cache consistency, stateful approach, multi-level cache consistency scheme

INTRODUCTION

Recent expansion in wireless networking and the exponential development in mobile devices have emerged a new paradigm in distributed systems is a mobile computing. In this paradigm, users who carry portable devices have access to the desired information services and access data reside any where through a shared infrastructure regardless of their physical location or movement behavior. The mobile computing environments are suffering from many problems among which is the constricted bandwidth, limited resources on mobile devices, and disconnectivity (Safa *et al.*, 2008). Caching frequently accessed data in the mobile client has a vital role in improving the performance of the various mobile computing systems by increasing the availability of data in the presence of disconnectivity, reducing the data retrieval from the original server, relieving the bandwidth consumption, and reducing the latency in data access (Huang *et al.,* 2007). The replicas of the same data object distributed among multiple mobile clients need a consistency between them and with the original data resides in the original source. Due to the mobile environment inherited problems, maintaining cache consistency in a mobile environment is a complicated process.

In the literature, three levels of mobile cache consistency are introduced: *strong consistency* where the cached data item in the mobile unit is up to date with the original data

at the source, *delta consistency* in which the cached data in the mobile client is never out of date by more than a specific time with the original data at the server, and *weak consistency* level in which the data item cached at the mobile client is a copy of the previous version of the source data item at the source (Cao *et al.*, 2007). Most of the schemes in maintaining mobile cache consistency support one level of consistency for example strict (Barbar and Imielifiski, 1995; Chan *et al.*, 2005; Chuang and Chiu, 2008; J.C. and K, 2009; Madhukar *et al.*, 2009; Pamila and Thanushkodi, 2009; Safa *et al.*, 2008; Wang *et al.*, 2010; Xu *et al.*, 2002; Yi *et al.*, 2007), or weak such as (Chan *et al.*, 2005; Kumar *et al.*; 2009;Yuen *et al.*, 2000; Zhijun Wang *et al.*, 2004). Applying only one level of consistency on the cached data items is not appropriate all the time, as some applications allow some degree of weak consistency on the cached data and some critical cached data items have to be up to date with original data in the source. However most of the schemes restrict the cached data items in mobile units for read only which limits the caching system functionality.

Vora, (2005) proposed a stateful method called Multi-level Cache Consistency Protocol (MCCP). The protocol makes distinction between strict and weak consistency levels, and the mobile user able to issue update operations on its own cached data. There are some drawbacks on this scheme such as: a)the different levels of consistency it supports depend on the mobile client interest, which is not a good idea, as in real systems the data consistency depend on the application requirement, b)the process to determine the consistency requirements incurs overhead to the mobile client, it consumes the client's energy and bandwidth of wireless network especially the uplink channel, c)single data item may have many consistency requirements (depending on the number of the cached clients), which represent overhead on the base server to maintain its consistency. We proposed a scheme called Application Based Multi-level Mobile Cache Consistency Scheme (ABMMCCS) based on Multi-level Cache consistency Protocol (MCCP). ABMMCCS scheme preserves the advantages of MCCP and enhances its drawbacks.

The rest of the paper is organized as follows. Section 2 describes the proposed multi-level mobile cache consistency scheme ABMMCCS, its system architecture and main features, while the details design of the proposed scheme ABMMCCS is presented in Section3. Initial evaluation of the proposed scheme is reported in Section 4. The conclusion is offered in Section 5.

PROPOSED MULTI-LEVEL MOBILE CACHE CONSISTENCY SCHEME

System Architecture of ABMMCCS

Figure 1, shows a typical mobile computing environment. It consists of a number of Mobile Host (MHs)/Mobile Clients (MCs) and powerful fixed hosts that are connected through a wired network. Some of the fixed hosts, called Base Servers/Base Stations (BSs) are equipped with a wireless interface to communicate with mobile clients, which are located within a coverage area called a wireless cell (Madhukar *et al.*, 2009; Safa *et al.*, 2008). The client is free to move within its cell or out of cell range (handoff). Through the BS the mobile client is able to access to other networks by forwarding its functions. Also BS performs various functions such as handoff, mobility management(Vora, 2005).

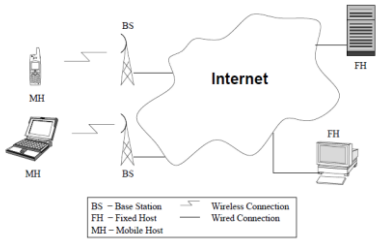

Figure 1. Mobile Computing System Architecture (Vora, 2005)

Main Features of ABMMCCS

ABBMMCCS scheme supports multiple levels of consistency (strict/different levels of weak) based on the application requirements. This feature enables ABMMCCS to be suitable in maintaining the cache consistency of variance mobile applications, also in ABMMCCS; each single data item has a single consistency requirement entry, which is decreases, the overhead of the base server in maintaining the consistency of the item. However; in ABMMCCS the mobile client is released from determining the consistency requirements of its cached data, which reduces the overhead of the mobile client, save its power energy, and better utilized the narrow uplink channel.

ABMMCCS SYSTEM MODEL

The components of ABMMCCS system model are: the Application System Developer (ASD), the Base Server (BS), and the Mobile Client (MC).

ASD Working Model

In ABMMCCS, the mission of ASD is to design data consistency requirements**.** In ABMMCCS, the consistency requirements of cached data items are based on the mobile application requirements. ASD specifies the granularity of data at which they would like to maintain application consistency, creates the Consistency Table (CT), and storing it on the database server. Each data item has a single record in CT with the following form:

$$(Did, P, £T)$$

Where *Did* is the data item identifier, *P* is the predicate condition on the data item (when violated the data item become inconsistent), and *£T* a time point after it the cached data item is no longer consistent, or a maximum delay time allowed to server before propagating the update to the cached client. If *P and time delay £T are null,* this indicates strict consistency; if one or both of *P and £T is null* this *indicates* a level of weak consistency.

BS Working Model

In ABMMCCS, the BS has three main functions; it controls the access to the data items, maintains the data consistency, and propagates updates to the mobile clients.

Data Access Control

In ABMMCCS BS controls the access to the data items based on its consistency requirements. The concept of lock is used as in MCCP; four types of locks are available on the data items. They originate from the data items consistency requirements and the operations available on the data items (Read/Write). There are two types of strict locks namely; *Strict Read Lock (SRL)* and *Strict Write Lock (SWL)* and two weak locks *Weak Read Lock (WRL)* and *Weak Write Lock (WWL)*. Table 1 summarizes the different lock types defined on a data item. The vertical axis represents the data item consistency (Strict /Weak), while the type of operations available on the data item (Read/Write) is represented in the

horizontal axis. Any cache lock request message issued by client, BS checks its compatibility with the item consistency requirements before accepts or rejects the request. Table 2 summarizes the compatibility of the lock types with the required operations. The horizontal axis represents the lock type currently exists on a data item, while the vertical axis represents the required operation from client.

Table 1. Lock Types Available to Client on the Data Items

Operation Type	Strict Consistency	Weak Consistency
Read	SRL	WRL
Write	SWL	WWL

Table 2. Compatibility of Lock Types with the Client Operations

Operation Required	**None**	SRL	SWL	WRL	WWL
Read	✓	✓	×	✓	✓
Write	✓	×	×	✓	×

✓ : Compatible ×: Incompatible

Maintaining Data Consistency and Updates Propagation

Based on the consistency requirements of the data item, BS determines the type and time of propagating the received updates on the data item to the affected clients. Four levels of consistency are discriminated based on the values of *Predicate condition (P)* and *time delay* (*£T*) namely; *Strict Updates Strict Notify (SUSN), Weak Updates Strict Notify (WUSN), Strict Update Weak Notify (SUWN),* and *Weak Updates Weak Notify (WUWN).* Table 3 summarizes the propagation of updates by BS based on the levels of consistency.

Table 3. Propagation of Updates Based on the Data Consistency Levels

Consistency Level	Immediate Propagation	Delay	All	Some
SUSN	Yes	No	Yes	No
WUSN	Yes	No	No	Yes
SUWN	No	Yes	Yes	No
WUWN	No	Yes	No	Yes

MC Working Model

The role of the MC in the model is to:

- Demand a required data item from the base server: the request message besides the required item contains the operation lock required on the item (read/write) and the lock period required.
- Send updates to the base server: The client holds a write lock on cached data item, sends each update directly to BS (the data item has weak consistency) or one update at the end of a lock period or if the client determines to release the item lock (strict consistency).

- Validate its cache: when the client received an update from BS, the mobile client sends an acknowledgment message to BS, and then validates its cache by committing or rolling back the conflicting operations with the received update.

INITIAL EVALUATION OF THE PROPOSED SCHEME

Compare ABMMCCS to MCCP with respect to the consumption of the MC energy power and the wireless network bandwidth, initially as a tentative result Figure 2 shows the possible number of messages transferred between MC and BS using ABMMCCS presented in (a) and MCCP in (b). It is depict from the figure that, using ABMMCCM to maintain

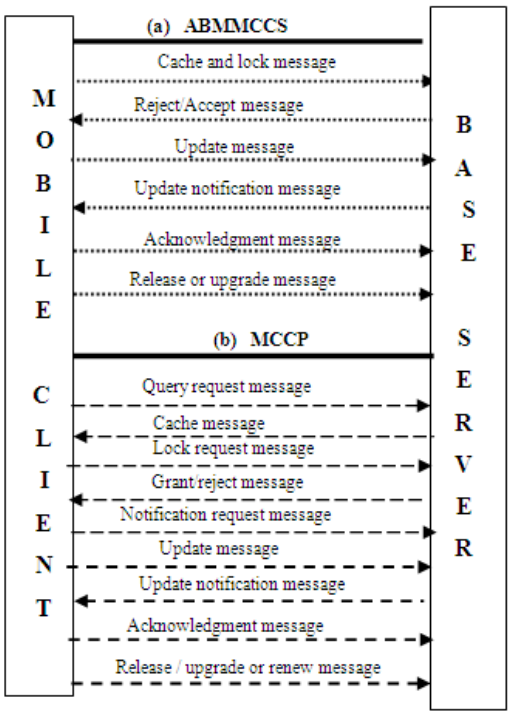

Figure 2. Caching Process - Messages Exchanges (a) ABMMCCS (b) MCCP

the mobile cache consistency, the number of uplink messages issued from MC decrease with the rate approximately 33% compared to MCCP which is help in saving the client's energy(by saving the power consumed in transmitting and receiving messages) and reducing the consumption of the limited uplink channel bandwidth.

CONCLUSION

In this paper we proposed a new scheme called Application Based Multi-level Mobile Cache Consistency Scheme (ABMMCCS). ABMMCCS suitable to various mobile application systems, by supporting multiple levels of consistency based on the application requirements, as

variance applications have different consistency requirements on their data. ABMMCCS is based on MCCP scheme (Vora, 2005). From the initial performance evaluation of ABMMCCS compared to MCCP, we could conclude that ABMMCCS supports multiple levels of consistency, while enhancing the consumption of mobile client limited energy power and the utilization of wireless network bandwidth. Simulation modeling and analytical study are to be considered in the future research.

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NEW IMPROVEMENT IN DIGITAL FORENSIC STANDARD OPERATING PROCEDURE (SOP)

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ABSTRACT. In today's digital forensic investigation, there are hundreds of specific and unique application software packages and hardware device that could be used in the investigation .Even with all this yet there are quite number of failure in SOP that being practiced by the current digital forensic investigator .In this research paper an improved SOP is being proposed. This proposed SOP will be flexible rather than being limited to a particular process of an investigation.

Keyword : Digital Forensic, Standard Operating Procedure,CyberSecurity Malaysia

INTRODUCTION

In today's digital forensic investigation, there are hundreds of specific and unique application software packages and hardware devices that could be used in the investigation (Yunus, 2008). Even with all this yet there are quite number of failure in SOP (Standard Operating Procedure) that being practiced by the current digital forensic investigator. There should be a biggest concern for every digital forensic investigator for the fragile evidence as this is always slipping out from digital forensic SOP (Sundresan Perumal &Norita Md Norwawi, 2010).

There are several research have focused on digital forensic investigation procedure .As the most basic four procedure that being identified are identification of digital forensic evidence , preservation of digital forensic evidence, analysis of digital forensic evidence and last is presentation of digital forensic evidence (McKemmish,2002).Refer figure 1.0 basic four procedure in digital forensic investigation.

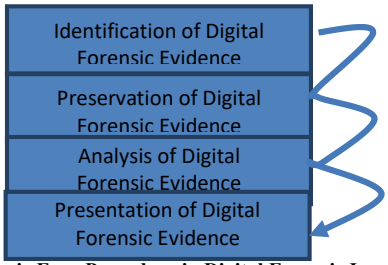


Figure 1.0 Show Basic Four Procedure in Digital Forensic Investigation.

EXISTING PROBLEM IN CURRENT DIGITAL FORENSIC STANDARD OPERATING PROCEDURE (SOP)

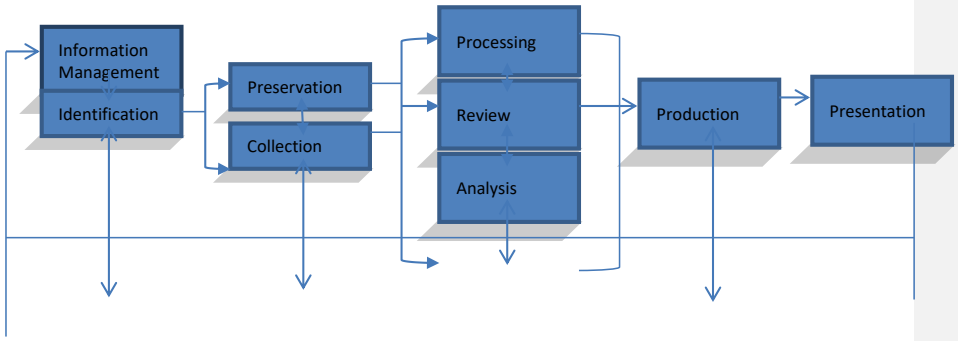
Executing evidence collection in digital forensic investigation are completely different compare to other type of evidence collection such as blood, tool mark and fibers (Brill & Pollitt, 2006). Standards operating procedures is the most important aspect for a digital forensic investigator to work. The reliability of the investigation starts from a strong SOP.

Creating a permanent set of SOP is something that is infeasible (Pollitt, 2008). The type of crime is growing very advanced, new tool and method for solving digital forensic problem are there, so with this in mind, a regular change is required in the existing SOP or else the SOP will be outdated and useless.

Different country will have different SOP to operate as there is always legal environment barrier that need to be followed.There was a time where digital forensic investigator requested for universally accepted SOP but was not been accepted since the procedure and protocol were not same in all over the country (Palmer, 2001).

The first electronic discovery reference model (EDRM) which is widely accepted as SOP framework created by George Socha and Thomas Gelbman (Socha and Gelbman, 2008). Refer figure 2.0, Electronic Discovery Reference Model showing stages from left to right.

Figure 2.0 shows Electronic Discovery Reference Model showing stages from left to right (Socha & Gelbman, 2008).



The electronic discovery reference model outline the key objective of the processing stage as below:

- Capture and preserve the evidence.
- Custodians.
- Capture and preserve the metadata.
- Establish the parent child relationship between source data file.
- Automate the identification and eliminate redundant evidence.
- Provide a means to programmatically suppress materials that is not relevant to the review based on criteria such as keyword.
- Unprotect and reveal information within files.
- Accomplish all this goals in a very cost effective manner.

IMPROVED DIGITAL FORENSIC STANDARD OPERATING PROCEDURE (SOP) MODEL.

Figure 3.0 show Improved SOP Model in Digital Forensic Investigation.

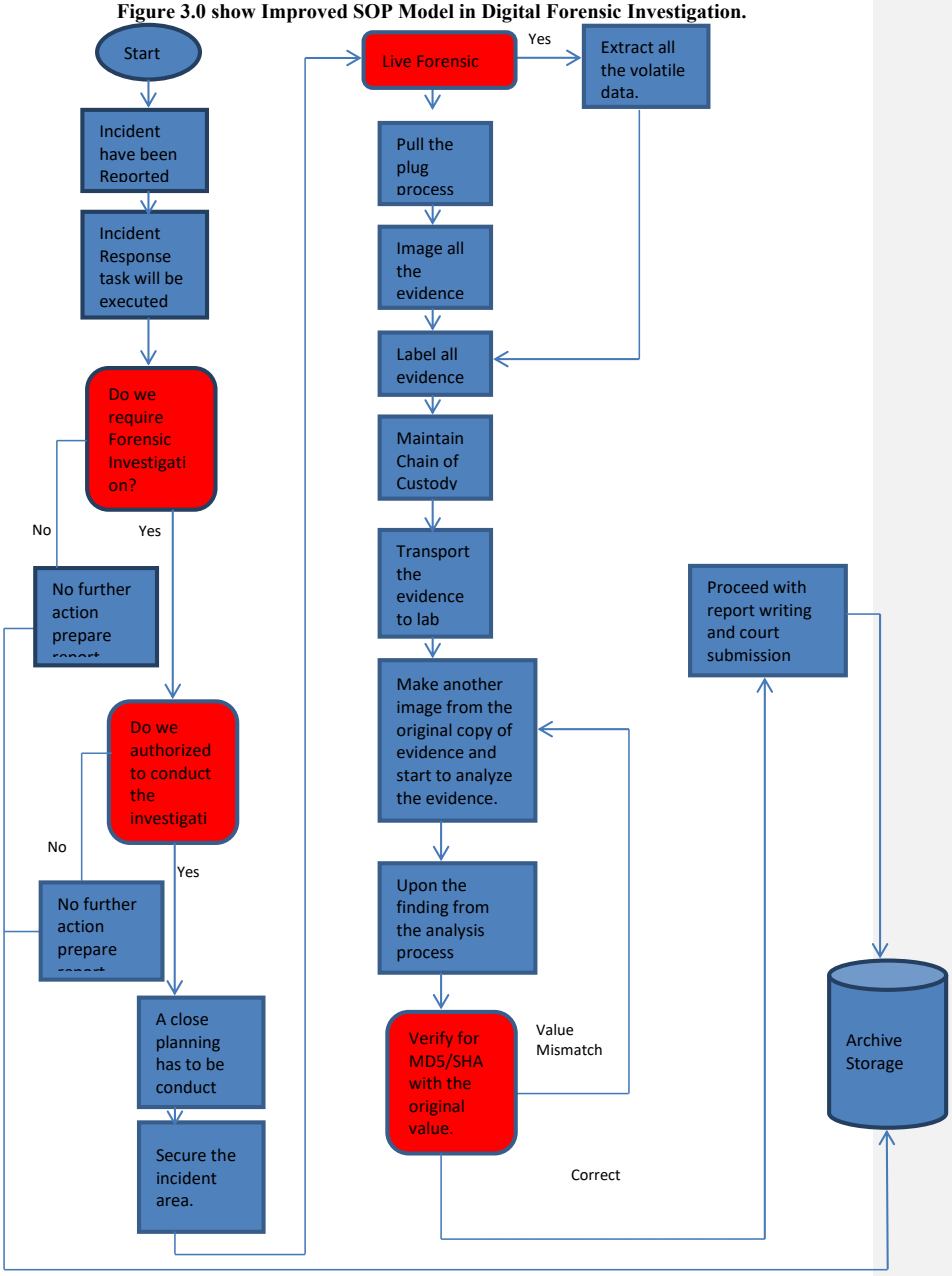


Figure 3.0, show improved SOP model in digital forensic investigation .Based on figure above it is very important for the digital forensic investigator to know the job before he continues.

According to the SOP model in figure 3.0 the first foremost itinerary need to be prepared in advanced before proceed to an investigation are *"Grab Bag"* which contain all the suitable tool, storage media and notes. The investigators need to make sure that they are well trained to utilize all the tool which is available (Baryamureeba &Tushabe, 2004). At the second level investigator have to make sure that they have been granted access to conduct the investigation and also to perform hardware seizure at the crime scene, this authorization could be obtain from a suitable manager, typically the person in charge of the incident management process, a senior manager or a police officer(Kohn et.al,2006) .

When the digital forensic investigator obtained the authorization to conduct the investigation the first thing they have to do is to secure the scene. The first task in evidence collection is , do not damage or corrupt the evidence platform particularly the primary evidence at the scene. Decide with an immediate if the suspected system power is up to conduct live forensic. In live forensic there are quite number of information that could be obtained from the memory such as clipboard content, device list, encrypted drives information, list of open network port, list of running process, and some general system information's.

If in a case of live forensic is failed or at the time of approaching the crime scene the suspected computer were power down then traditional digital forensic is going to be applied. Where the investigator required to create an image out of the hard disk drive. It is very important task to label all the evidence that collected at the crime scene. As the task continues, i physically secure both the original evidence and all the evidential copies, maintain a proper chain of custody. Upon all the evidence is being stored and it's time to start analysis process to identify the hidden data or deleted data on the evidence that have been collected .This stage may get highly technical but there are many tool exist to support this work. Once the necessary findings is done then the investigation officer need to verify that the evidence is not being tempered and the officer can proceed with report writing and court submission document preparation.

VALIDATION

The new proposed SOP is already being validated by two establish bodies as one is based in Malaysia that is CyberSecurity Malaysia, who is currently looking into most of the cyber forensic cases and another bodies is known as PeopleTech System, this is a Chennai India based digital forensic investigation lab. There were number of cases being tested by these bodies before endorsing the model to be stable and save to be practice by the digital forensic investigator and also incident response team.

CONCLUSION

In digital forensic analysis it is important for the investigator to understand that all the digital evidence depends on the case context and largely depends on the knowledge, experience, and expertise and thoroughness. Based on the improved SOP model the process flow need to be in cyclic, as digital forensic investigator need to repeat the process till a conclusion could be made.

FUTURE WORK

A**s** at the moment the SOP is only focusing on computer forensic, as in future the SOP model will be integrated into cloud computing forensic as todays modern computer environment have moved past the local data center with a single entry and exit point to a

global network. This technology require a huge forensic attention as in cloud computing it deals with high speed system for managing very large scale data sets. This platform have also raised question on complication for information security.

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A STUDY ON PRIVACY CONCERNS IN SOCIAL NETWORKING SITES (SNS) AMONG MALAYSIAN STUDENTS

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ABSTRACT. The rise in popularity of social networking sites (SNS) has led to various social and ethical issues such as privacy. The freedom to share and post information, pictures and to network with each other have raised privacy concerns among SNS members. We carried out a survey of 100 students at one of Malaysian universities to analyze their behavior on the SNSs in terms of awareness of privacy protection and what actions they have been taken. The survey results show that most of the students are aware of the customizable privacy settings but less than half of them change or modify them. This survey is important for understanding the user' approach to privacy protection, which in turn is important for our proposed privacy protection systems in future research.

Keywords: Social Networking Sites (SNS), Privacy, Disclosure

INTRODUCTION

Social networking sites (SNS) arise as a new type of communication tool, open to all categories of users whether young or old. SNS begin replacing face to face interaction as a primary communication medium due to the fact that the internet can be accessible everywhere nowadays. A user can have a chat session, sharing photos and viewing her friends' status anytime by just sitting in front of computer without going out of her home. Facebook for example has millions of members signing in every day as it is very convenient. It also can be used to reconnect long lost friends as well as to socialize with others. However, these types of technology have brought in various social issues and privacy concerns. Many users, especially the young generation, do not think twice about providing as much information as possible on their profile without realizing the privacy risks they will be facing. They are willing to disclose their personal data in order to get more friends and network with strangers, without having thought of the consequences of their action. These users ignore the fact that the advanced technology of Internet search engines like Google makes it possible for strangers to find their personal information and details in just few seconds. Employers have searched to find more information about their future employees or to monitor their current workers. The SNS itself does not warn the user of the dangers of disclosing their information to everyone, because the purpose of social networking is to share and communicate with others. Facebook had an "opt-in" policy (Stana & Burton, 2002) for their privacy setting, which means that a user's information can be searched and seen by everyone by default. This policy will catch out many new members and first-time users who are not aware of it or what it means to have their personal data leaked and disclosed to strangers. It will result in various privacy threats (Facebook website) and crimes like identity theft, harassment, spamming and phishing. Another concern is that most of the third party applications or also known as "apps" mentioned by Krishnamurthy and Wills (2008) in Facebook collect users' personal information

and contacts without permission and use or sell the data for advertising purposes. This shows that there will be many more threats and risks the user will face if they do not take active steps to protect their privacy, rather than relying on the social networking sites policies.

The objective of this paper is to explore the online behavior relating to privacy of students in Malaysia and to explore how users manage their existing privacy settings in SNS.

RELATED WORK

Personal information can be categorized into public and private. According to Petronio's Communication Privacy Management theory (2007), users should have clear ownership and control of their information in SNS. This means that all their information should be customized as either public or private through the configuration of privacy settings. Altman (1975), one of the authoritative scholars in privacy research stated that every user has a different level of privacy needs and control over who can access their data. There are many factors that influence user privacy including age, sex, culture and family background. One of the main reasons that users do not protect their privacy is the design of the privacy settings interface itself (Lampe et al., 2006). For an example, configuring privacy settings in most social networking sites are difficult because it requires the understanding of the many settings that can be modified and numerous ways of controlling those entire users' information to prevent other gaining access to their information. For an example, in one of the well known SNS sites, choosing the opt in privacy policy means that the default privacy settings for all users are to make their information public and accessible to everyone (Stana & Burton, 2002). Barnes (2006) stated that users more easily provide and reveal personal information on SNS than on other communication tools such as the telephone or face to face conversation. The reason that users share their information willingly is to gain more friends and contacts in SNS which has become a popular venue as they feel that they can express themselves more by socializing virtually than in real time. Hence, Krishnamurthy and Wills (2008) suggested that users' information in SNS should be divided into categories that can range from most confidential to least private. Information that is considered sensitive, such as home address, phone number and personal photos need to be made private to avoid the consequences of privacy invasion.

Another reason for joining SNS is peer pressure (Acquisti & Gross, 2006). Acquisti and Gross (2006) discovered that most users tend to follow their friends' lead in the amount of information disclosed and shared. This finding led to a research work by Bonneau and team (Bonneau et al., 2008) where they developed a tool known as a *Privacy Suite*, which enables a users to adapt their friends' privacy settings to their own. Although it appears a simple solution that saves time, it is not a long term solution. This scenario may actually cause more privacy issues and concerns since one user's preference may not suitable with others and some sensitive information may be leaked out.

Similar surveys have been done by researchers on privacy concerns and disclosure habits of university students. Acquisti and Gross (2005) found that only minimal number of students changed their default privacy settings in a SNS leaving their profile information visible and accessible to everyone. On the other hand, Govani and Pashley (2009) found the students were aware of the privacy risks but choose not to modify their privacy settings in order to get more friends and contacts. In conclusion, there are many concerns on the level of user awareness on privacy and how the privacy settings in SNS are set. Most of the empirical work is done in the Western countries while our paper attempts to explore the privacy awareness among Asian (particularly Malaysia) users.

METHOD

A survey was given to 100 students at one local university in Malaysia. We chose a university setting with the assumption university students are one of the most active SNS users. The objective of the survey was to collect data on students' information disclosure

behaviors and how they manage their privacy settings in SNS. We chose a well known SNS as a reference in this study. We did not face any problem finding participants as most of the students own an account in this well-known SNS. A follow-up interviews were also conducted with a few students to gain a more in-depth understanding of their perception of privacy levels and precautions and the difficulties encountered when configuring privacy settings. Similarities among students according to categories of gender, culture and age are identified. We chose the method of survey for the study because it allowed us to get great deal of valuable data in a short time, as well as we hoped increasing the awareness of students about protecting their privacy. The survey contained thirteen questions in formats including multiple choices; fill in the blanks, and short answer/personal opinion: these mainly focused on privacy and disclosure management.

RESULTS AND DISCUSSION

Analysis of the 100 completed survey forms from students gave some perspectives of Malaysian students' view about their privacy concerns on SNS. In the following sections, we discuss the views of the students about their privacy concerns based the majority answers to the survey paper.

Out of the 100 respondents, 79 of them are Chinese students followed by 15 Malay(native) students and 6 Indian students. The age of the participants ranged from 20 to 29 years old-some are graduate students, with the majority (78%) of the participants 22-23 years old. In terms of gender, 51% of participants were male and 49% female. Therefore, we are able to get a representative data in terms of gender.

Our questions focused on a particular SNS, a well known among the students. Question 1 asks the student's reason for joining the SNS. Based on the feedback from the students, 13 students joined to find a friend they knew, 22 students due to peer pressure, 59 students in order to socialize and network with friends, and 6 for "others reason" for joining SNS, including for game and for fun only. For the majority of the students, it is clear the reason of joining the particular SNS is mainly for socialization. They are keen to communicate and socialize in this online community; they are willing to exchange a lot of information during their communication. Hence, this question shows the users ignore the confidentiality of their information and protection of privacy for the sake of socialization and this is closely related to our survey regarding the privacy concern of the students. This gives us strong motivation for discussion of and research into the topic of privacy since information is very vulnerable nowadays due to Internet technology.

The subsequent questions ask about the student's privacy concerns before they began using and now when they are actively using SNS. The second question asks the students whether they read through the privacy terms when (or before) they signed up for their SNS account. The results are skewed where the majority of the participants, 88% responded that they did not read before or during signing up the SNS account. We found that only 12% of the participants answered that they read through the privacy conditions or terms. The responses to this survey question indicate that the participants are less concerned about the privacy policies provided by the SNS. This kind of attitude may eventually cause the users to violate the privacy rules without realizing that they are doing so, because they are not aware of the activities/information that are restricted in the SNS.

Question 3 and 4 asked for the participant's opinions about what sort of information they provided when they signed up for their SNS account and which kinds of information that they considered to be private and should not be disclosed to the public without the permission of the user himself. The types of information that survey participants considered private are shown in Figure 1. The information most frequently cited as private is phone number and home address; because public knowledge of this information could result in unwanted disturbance from strangers or people that the user does not wish to see.

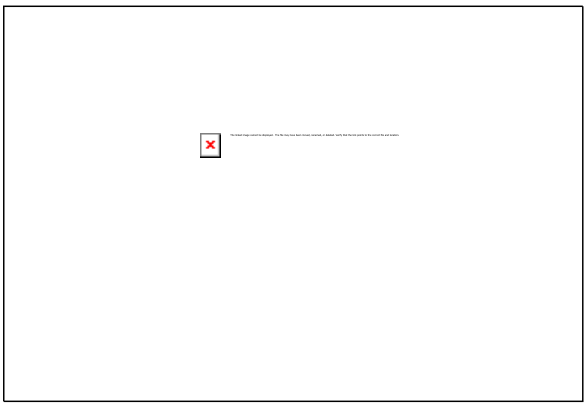

Figure 32: The Privacy level of users' information

Question 5 asks how often the users log in to their accounts. Most of the users (68%) log in daily, 22% log in several times per day, and 11% log in weekly or monthly. This shows that they are using the SNS to communicate at least once per day. This enables us to see how often users have the chance to be updated with new privacy setting of the SNS.

Question 6 asks whether the users are aware they can change their privacy settings in the SNS. The results show that almost all are aware, with 84% of participants' aware and 16% not aware. Question 7 explored how the users manage the privacy setting in SNS accounts. The distribution of responses to question 7 is shown in Figure 2. The results show that 45% of the participants manage their privacy by only adding the friends they know, 36% of the participants manage by customizing their privacy settings, 22% provide limited information in their account, and 4% said they did not really care about it. (Percentages sum to more than 100% because users could select more than one option) Responses to question 8 show that 95% of the participants think that privacy management is important for their SNS accounts. By combining the responses of questions 6, 7 and 8, we can see that most of the students do realize that they can control and manage their privacy settings in SNS, they realize the importance of privacy management in SNS, and they have or develop their own ways to manage and control their privacy in SNS. Therefore, we can conclude that the majority of the users do have high concerns about the privacy protection of their SNS account information.

Based on the responses of the question 9, we found that 89% of the participants do not trust the privacy protections that are provided by SNS and think that information posed to SNS is not safe and private. This strongly indicates that there is a need for higher level privacy protection tools to be built for and provided to SNS's users. Since a majority of the users manage their privacy by adding only friends they know, question 10 delves further into the user's selection of friends by asking whether they check the information of a friend that has been approved and accepted via a friend request, to confirm their real identity. 78% of the participants do check and confirm the identity of friend requests, but 22% do not. It is important for users to confirm the real identity of the friend that they have added, because some individuals may use a nick name for their profile which is unknown in order to protect their privacy.

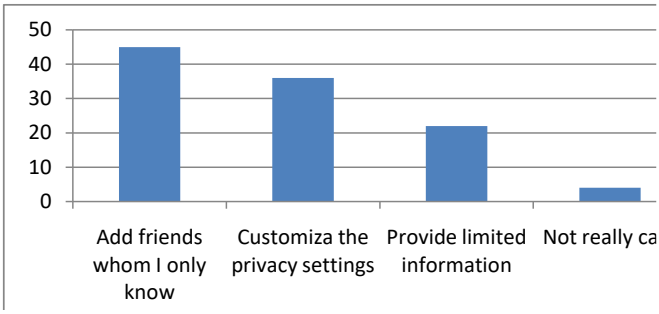

Figure 33: Method for protecting privacy

Question 11 is related to question 5; it further queries participants on how often they update their profile, especially the privacy part. This further tells us how often they keep up to date with new privacy configuration in their SNS accounts. 85% of the participants said they update their profile seldom or annually, 10% said monthly or weekly, and 5% said they had no fixed time for update. This shows that users seldom update their profile and therefore also their privacy settings. This is not a good sign for privacy management, users need to evaluate and update their privacy settings regularly instead of annually or never. This issue indirectly shows that users need a tool that will regularly alert them and help them to evaluate their privacy settings and help them with privacy management and updating whenever there is a need.

Question 12 asked participants whether they have ever misused information from another person's profile. 95% of participants answered no, the 5% that had misused someone else's profile said their purpose was not to do something harmful but just play a joke on their friends. However, misuse of another's profile is still an action of information violation and identity theft, and should be considered as serious as cyber crime. Therefore, the SNS should enhance their privacy protection level, so that, users' information can be more secure. Users also should change their attitude and know that identity theft is an unethical action. Users should cooperate with their SNS in privacy protection and management in order to create a more secure communication environment for users themselves.

Nowadays, SNS are fast becoming more and more useful communication tool; so, more and more privacy management and protection should be provided for secure communications. However, do users think that SNS will replace verbal communication in the future? Survey question 13 shows that 31% of the participants believe not. On the other hand, 69% do believe that SNS will replace verbal communication in the future, and the majority provided some arguments for this view, including the fact that that communication via the Internet can save time and reduce working stress.

CONCLUSION AND FUTURE WORK

In conclusion, user' concern about privacy issues on SNS is high. Survey results show that the majority of users are aware of the existence of the privacy settings provided in their SNS, but most of them are ignorant about specific policies and options; some users do not even care about privacy in their SNS. The survey also shows that users believe that part of the responsibility for privacy should fall to the SNS providers because they provide security levels and options for information protection that are not at the expected level and should be further enhanced. In reality, of course, the responsibility for privacy protection should lie with both SNS and SNS users, both should work together and give support and co-operation to each other in order to enhance the privacy protection of SNS, reduce cyber crime and enable a more secure communication era for the generation in future.

This survey can contribute to future analysis of the difference between Asian and Western citizens' privacy concerns to look more deeply into culture as the main factor that affects a person's privacy view as a whole. This survey also can contribute to the development of a privacy management system because it can help developers understand what users are concerned about in relation to privacy settings, and what users expect from SNS in privacy management. This will indirectly assist in the creation of a privacy management system that will fulfill all user expectation and protect users more securely in future.

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STUDENTS' AWARENESS IN INFORMATION SECURITY AND ETHICAL USE OF ICT IN MALAYSIAN SMART SCHOOL

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ABSTRACT. Malaysian smart school is one of the seven flagship in the Vision 2020 in making Malaysia as a technology hub. Most of activities in smart school such as teaching, learning, and administration are using Information and Communication Technology (ICT) as its tools. Nowadays the broad usage of ICT might lead to unethical behaviours among students in schools, and may direct to bigger issues if there is no or less action taken to prevent them. Therefore, the aim of this paper is to evaluate the students' awareness in information security and ethical use of ICT in Malaysian smart schools. The results showed that the students' awareness in information security is quite satisfactory. They are good in practicing information security effectively especially in practicing anti-virus. Unfortunately, the students' awareness in ethical use of ICT is not satisfied, and intellectual property component shows the most unsatisfactory results.

Keywords: smart school, ICT, students' awareness, information security

INTRODUCTION

The smart school flagship is one of the seven applications envisaged under the Multimedia Super Corridor (MSC) initiative. This smart school flagship was introduced by Tun Dr. Mahathir Mohammad, the former Prime Minister of Malaysia, to fulfill the Vision 2020. In the pilot, the Smart School Integrated Solution (SSIS) was rolled out to 88 schools in Malaysia at the cost of about RM300 million. The smart school project is implemented by the Ministry of Education (MoE), Malaysia. The MoE's industry partner is Telekom Smart School (TSS) that was awarded the contract to develop the project in collaboration with the MoE and the Multimedia Development Corporation (MDeC) (The Smart School Roadmap, 2005).

The Malaysian smart school is a place where all students can learn within a conducive learning environment. It offers various curricula with on-going evaluation, handled by professional administrators and teachers. The smart school combines the teaching and learning with technology to make teaching and learning processes easier, more fun, and effective. In the smart school system, technology is used for the purpose of learning and information processing and productivity tools, to enhance professional development, and to automate instruction.

The widely use of Information and Communication Technology (ICT) caused the probability of cyber crime and unethical behavior towards students or done by students are high. This issue had been proved by Rezgui and Marks (2008) in their researched that shows higher education institutions facing problems in increasing security threats and attacks. The growth of ICT also has raised many ethical issues, including issues in intellectual property,

privacy, property rights, integrity, and confidentiality (Agarwal & Garcia, 2006). As the ICT broadly used in education institutions, students, teachers, and parents have facing numerous ethical challenges (Meyenn, 2001). ICT with the use of internet had become a door for students to explore websites or places that sometimes difficult to be monitored by teachers and parents. Meyenn in his study had stated that students' moral development now takes place within the context of a rapid increase in the use of IT in schools and home. From an early age students, as they explore the use of IT, make decisions and choices that require the application of ethical and moral judgments".

Thus, awareness in information security and ethics in ICT are important in order to avoid cyber crimes and violation to privacy in ICT usage (Jung, 2009). Several methods for training awareness had been introduced by using policy and Security Education Training Awareness (SETA) methods. By evaluating the awareness in information security and ethics in ICT, the right methods can be chosen and developed for training awareness. Therefore, the aim of this study is to evaluate students' awareness in information security and ethical use of ICT in Malaysian smart schools. The specific objectives of this study are:

i. To identify components of information security and ethics in ICT within Malaysian Smart School.

ii. To investigate the awareness in information security and ethical use of ICT in Malaysian Smart School.

LITERATURE REVIEW

According to the Smart School Road Map (2005), "*The Malaysian Smart School is a learning institution that has been systemically reinvented in terms of teaching-learning practices and school management in order to prepare children for the Information Age"*. Smart schools are differs in many aspects from standard schools, students in Smart Schools are able to learn depends on their need, availabilities and their learning skills. These are the resultant from the Smart School concepts where student are exposed to the information technology system.

Threats to Information Security

Threats in information security are continuing existing threats in ICT that never ended. The CyberSecurity Malaysia reported that 674 computer security incidents had been handled from January to March which mentioned in their MyCert 1st Quarter 2009 report. They also reported that new malicious constantly release in the ICT world. These incidents and malicious problems are not only attacking and effecting organizations, it also may affect the safety of information and data in Malaysian smart school. Many tools and methods had been used in order to secure the information security in smart schools. One of the methods is by implementing the information security policy. Information security policy is considered essential for information security which will help to control and prevent any cyber attacks and malicious problems that might arise (Karyda, Kiountouzis, and Kokolakis, 2005).

Despite of information security policy implementation, it is still not enough in securing and ensuring the safety of the data and information. The policies and procedures are only the basis for effectiveness of a program (Desman, 2002). According to Desman (2002), the information security is a people issue, rather than a technical one. People are the important subject in ensuring information security by their security awareness and cautious behavior (Albrechtsen, 2007). This shows that the awareness in information security and ethics in ICT are very important in order to ensure the security and safety of the data and information.

ICT Ethics

Ethics in information and communication technology (ICT) refers to appropriate acts and behavior using ICT. It is influenced by both moral and circumstantial factors (Jung, 2009). Ethics in computer usually had been called as "computer ethics". Sometimes it also referred as "information ethics", "ICT ethics", "cyber-ethics", and "global information ethics" (Bynum and Rogerson, 2004). Several researchers had defined the ethics in computer into several definitions, for example Walter Maner, Deborah Johnson, James Moor and Donald Gotterbarn (Tavani, 2001).

The Importance of Awareness in Information Security and ICT Ethics

The awareness in security means the knowledge and understanding in security to protect from attack, harm, or damage caused by ICT usage. Awareness in security is important to reduce human error, theft, fraud, and misuse of computer assets (Drevin, Kruger, and Steyn, 2007). Even with the best technology in security are useless if there is no awareness in security. This is because people play the most important roles in ensuring the information security in ICT. People are the key to provide an adequate and appropriate level of security (Wilson and Hash, 2003).

In order to strengthen the awareness in information security, National Institute Standards and Technology Special Publication 800-12 (NIST SP800-12) had concluded that information security training awareness program are needed to ensure people aware of their security responsibilities. It also helps them in changing their behavior towards ICT usage. According to NIST SP800-12 in its article mentioned that this training awareness will "improved awareness of the need to protect system resources; developing skills and knowledge so computer users can perform their jobs more securely; and building in-depth knowledge, as needed, to design, implement, or operate security programs for organizations and systems". There are three security components that will ensure the successful of information security in ICT, namely Information Security Awareness, Information Security Policy Awareness, Ethics Awareness in ICT.

METHODOLOGY

Sampling and Data Collection

The sample of this study are the students of Malaysian smart schools. We distributed the survey in two smart schools (i.e. School X and Y) in Kuala Lumpur because these two schools are among the active smart schools in Malaysia. The overall students in School X are 1187 students, and School Y are 1228 students. The respondents for this survey are students from form one, form two, and form four. The survey used for this study is adopted from Al-Hamdani (2006). The total respondents that participated in this survey were 323 students from School X and 411 students from School Y. The analyses were done using statistical package SPSS Version 16.

RESULTS AND DISCUSSION

Sample Profile

The demographic profile of the surveyed respondents was presented in Table 1 and Table 2, which include gender and level of study.

Table 1 : School X- Students' Demographic Profile.

	Frequency (N)	Percentage (%)
A. Gender		
Male	87	26.9

Female	236	72.8
B. Form/Level		
Form 1	103	31.8
Form 2	211	65.1
Form 4	9	2.8
Total	*323*	*100.0*

Table 2 : School Y-Students' Demographic Profile.

	Frequency (N)	**Percentage (%)**
A. Gender		
Male	152	36.9
Female	259	62.9
B. Form/Level		
Form 1	234	56.8
Form 2	66	16.1
Form 4	111	27.0
Total	*411*	*100.0*

Information Security Awareness

Information security consist of three components; password, data backup, and antivirus. The result showed that the respondents who use password is 18.8% male respondents answered frequent and 49.4% answered very frequent from School X while from School Y, 25.2% frequent and 44.4% very frequent (see Figure 1 and Figure 2). Whereas female respondents from School X answered 19.5% frequent, and 47.9% very frequent while female respondents from School Y answered 22.8% frequent, and 46.7% very frequent. The results also showed that more than 80% respondents from both schools aware of the importance of anti-virus. They did install anti-virus in their computer and always use anti-virus frequently. The overall results from Information Security Awareness section showed that student from both School X and School Y aware of the importance about information security. More than half student from both schools did practice security very well in order to secure their data and information. The result also showed that male respondents practice security better than female respondents.

Figure 14. Students' Awareness in Password Practices in Smart School X.

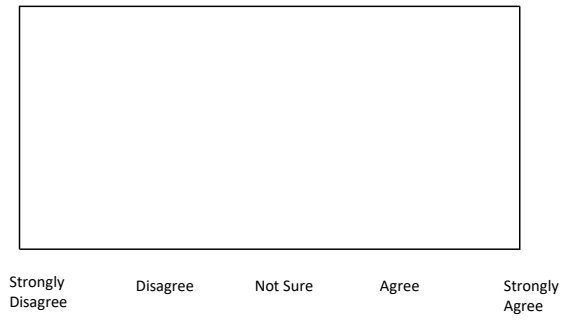
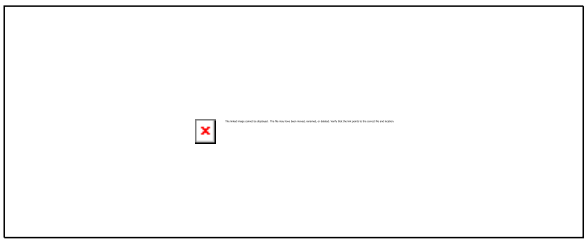


Figure 2. Students' Awareness in Password Practices in Smart School Y.



Ethical Aw

Components in ICT ethics consists of three components, that is, intellectual property, appropriate use of computer, and piracy. The result showed that the highest percentage of respondents who had used idea or writing from other people to do their school assignments is female respondents which from School X is 39.8% answered frequent, 9.3% answered very frequent while School Y is 27.5% answered frequent, and 8.1% answered very frequent (see Figure 3 and Figure 4). This result indicateed that more than half respondents had violated the intellectual property right. It also showed that most students still lack of awareness in intellectual property violation. This section also showed that piracy activities are common among students. The result showed that the respondents who did this activity were 49.8% respondents from School X and 80% from School Y. Based on the analysis, most respondents agreed that these activities are bad but they still do it. The overall of these results showed that the ethical awareness in ICT among students is very low.

Figure 3. School X Students' awareness in intellectual property's issue.

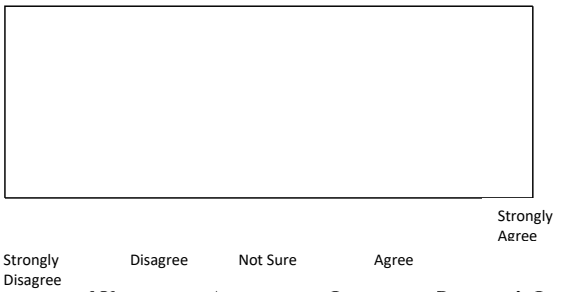
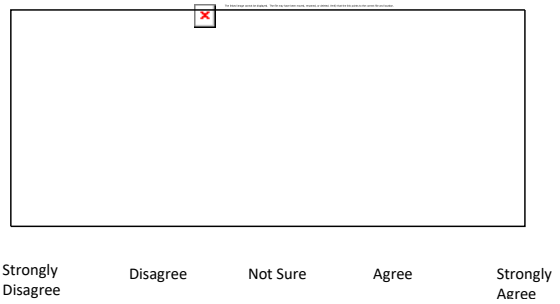


Figure 4. School Y Students' Awareness in Intellectual Property's Issue.



CONCLUSION

This study evaluates students' awareness in information security and ethical use of ICT in Malaysian smart schools. The results revealed that the students' awareness in information security is quite satisfactory. They were good in practicing information security effectively especially in practicing anti-virus. Unfortunately, the students' awareness in ethical use of ICT is not satisfied. The results showed that the percentages of respondents who behave unethically while using ICT equipment are not quite satisfactory. From three components of ICT ethics which had been identified in this study, the intellectual property component shows the most unsatisfactory results. Half of the respondents stated that they had used idea or writing from other people intellectual property for their school works. These results could assist Ministry of Education to observe the level of students' awareness in information security and ICT ethics among students in smart schools, and identify the appropriate awareness raising method that can be employed to enhance the level of awareness. In the future, study should be done to more smart schools in Malaysia especially schools that are located in rural areas, in order to see the difference level of awareness among students between smart school in urban and rural areas.

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THE EFFECTS OF INTERACTIVE VERSUS PASSIVE DIGITAL MEDIA ON MUSEUM LEARNING

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ABSTRACT. This paper demonstrates a comparative study of three modes of digital media exhibits (high-interactive VR, passive video, and low-interactive kiosk). This study attempts to compare the effects of the participating digital media towards visitors' learning outcomes and to determine visitors' perception on their learning experience upon using one of these exhibits. The content of these exhibits focuses on historical and architectural information of a UNESCO World Heritage Site Fatehpur Sikri which majority participants were hardly went there and not even heard of it. This study attempts to perform experimental method with the use of designated tasks, short-term memory recall, questionnaire, and interview in the real museum settings to obtain real users' comments and feedback. The following section of this paper continues to describe the participating digital media. The subsequent section demonstrates the experimental design and procedures. It then presents the results and further discusses the findings. Finally, this paper concludes based on significant findings and proposes possible future research direction.

Keywords: museum learning, interactive, passive digital

INTRODUCTION

Looking into characteristics of informal education particularly in museums, there are diverse learning theories of informal learning and mental models that constituted learning in museum context such as the contextual model of learning (Falk and Dierking, 2000), the complex behaviour of visitors (Pujol and Economou, 2006), and the significance of such studies to be embodied in overall museum experience (Pujol and Economou, 2008). In museum context, the historical interpretation, storytelling, contextualizing objects, allowing artistic means of expression, and creating emotional response to visitors are keys to successful museum visits (Roussou, 2004, Pujol and Economou, 2006). The concept of Cultural Presence (Champion, 2006) has been argued to have impact towards learning cultural heritage. In specific age of group, school children rated the interactive ICT systems higher than traditional teaching methods in terms of user experience (Michael et al., 2010). Due to the complex nature of visitors' behaviour, the research methods used are normally by interviews (Pujol and Economou, 2007), a mix of observation and questionnaire (Forte et al., 2006), and short-term memory recall and observation (Pujol and Economou, 2009). These past studies have concluded that the use of information and communication technology (ICT) including virtual reality (VR) is capable of providing those rich elements of learning experiences to museum visitors.

This paper demonstrates a comparative study of three modes of digital media exhibits (high-interactive VR, passive video, and low-interactive kiosk). This study attempts to compare the effects of the participating digital media towards visitors' learning outcomes and to determine visitors' perception on their learning experience upon using one of these exhibits. The content of these exhibits focuses on historical and architectural information of a UNESCO World Heritage Site Fatehpur Sikri in Agra, India. This study performed experimental method with the use of designated tasks, short-term memory recall, questionnaire, and interview in the real museum settings to obtain real users' comments and feedback. The remaining of this paper describes the participating digital media and the experimental design and procedures. It then presents the results and analyses the findings. Finally, it gives conclusions and possible future research directions.

DESCRIPTIONS OF PARTICIPATING DIGITAL MEDIA

The VR Application for Learning Architectural Heritage (VRARCH)

The VRARCH system uses a single wall projection with keyboard and mouse as its input devices. This system provides visitors a navigational experience walking through the monuments in Fatehpur Sikri (see Figure 1). The navigational experience of the users is basically derived from the learning objectives of this VRARCH prototype based on the requirements made by the museum expert. The development of VRARCH has been thoroughly discussed in Puteri Shireen et al. (2008) and Puteri Shireen and Juliana Aida (2008).

Figure 1. VR Modules of the VRARCH

During free navigation, visitors may click the rotating cube to initiate a video showing either historical or architectural information regarding the attraction or monument. The information may be shown in text, still images or movie files. Users are expected to recall historical information of Fatehpur Sikri and the builder, Emperor Akbar, and the function of specific monuments and to recognize its structural significance.

The Video Excerpt

The video entitled Ancient (Abandoned) Islamic City of the Mughal Empire is selected. Produced by the History Channel, the content of the six-minute video is assumed to be valid and the reliable (see Figure 2 for the screenshot).

Figure 2. Screenshot from the Video Excerpt

The content of the video is then analyzed to capture the historical and structural information delivered in order to derive relevant questions for the recall session. At least four major points were identified including the history of Fatehpur Sikri and the Emperor Akbar, the overview of Fatehpur Sikri, the construction of water reservation and irrigation system, and the red sandstone architectural masterpieces of particular monuments at Fatehpur Sikri.

The Interactive Kiosk

The interactive kiosk used in this study was based on the Web site entitled The Arts of the Mughals before 1600 by the Metropolitan Museum of Arts. Figure 3 illustrates the screenshot from the interactive kiosk showing the richness of text description with top and right blocks of hyperlinks to images and other resources.

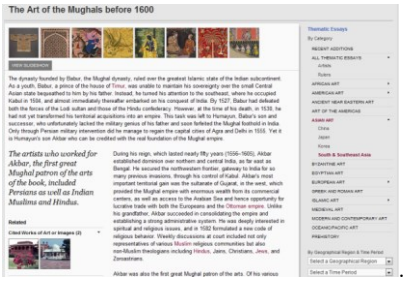

Figure 3. Screenshot from the Interactive Kiosk

During the recall session, users are expected to recall information under the given keywords and to recognize listed images of particular monuments.

OPERATIONAL DEFINITIONS

The following are major terms used and their operational definitions:

- Usability refers to ease of use, perceived usefulness, and usable.
- Sense of immersion or Presence is defined as the sense of being in a place virtually and may be affected by quality of image, field of view, display resolution, and accuracy of scale.
- Learning experience refers to users' motivation and satisfaction towards using the media.
- Recall tests refer to a set of questions that has been derived based upon the low-level of knowledge (recall and recognize) in the Bloom's taxonomy.

EXPERIMENT

The museum is a two-storey heritage building with its nature of exhibition combining arts and sciences under a single roof. It was selected because it is the only museum in this country that delivers VR content projected using a half-dome projected system. The VRARCH was installed in an auditorium at the upper level that can fit up to forty people and projected onto a large wall projection. As space is limited, the video and the Kiosk were also exhibited inside the auditorium as per layout illustrated in Figure 4.

This museum has no architectural heritage exhibit and the possible association with the experimental content is Islamic arts exhibition gallery in the ground level. The experiment was conducted during the operational hours of the museum from 1 till 10 December 2009 in conjunction with Malaysian school holidays.

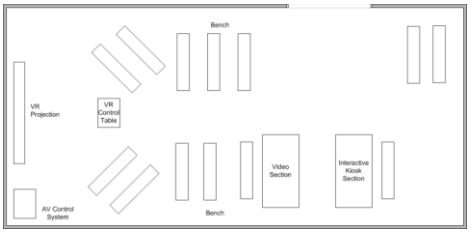

Figure 4. Experimental Setup in the Museum Auditorium

Methods

Participants and Design. The participants were 104 museums visitors who were randomly assigned to use one of the participating digital media. Table 1 illustrates the experimental design that consists of four phases.

Table 15. Experimental Design.

Treatment	Phase 1	Phase 2	Phase 3	Phase 4
VR	Task Performance	Recall Test	Usability, Presence	Learning Experience
Video	Task Performance	Recall Test	Usability, Presence	Learning Experience
Kiosk	Task Performance	Recall Test	Usability, Presence	Learning Experience

There were 46 participants in the VR group, 35 in the Video group, and 23 in the Kiosk group. For computer use, 33 and 32 participants reported as very often and often respectively and 38 participants reported as rarely use computers. Only 26 participants have previous VR experience. All of them have never been to Fatehpur Sikri although seven have heard of it from printed sources and documentary. As predicted, all of them are familiar with the keyboard and mouse input devices.

Procedure. Visitors were invited to participate in this study upon their informed consents, meaning that they volunteered to participate and may withdraw from the experiment at any point of time without penalty. Then, they were asked to choose the learning media of their preferences. Due to curiosity to try something new, most of them have chosen the VRARCH over others. To curb this situation, it is decided to direct visitors to use a specific learning media. For example, the researchers had to direct the visitors to use the kiosk since many were not so keen to read information on the screen. Visitors that participated in this experiment are later referred as participants.

During the experiment, at least two evaluators were there, one was to answer participants' enquiries and another was to mark time stamps and did the video recording, and both observed the participants and gathered other qualitative data such as participants' expressions and conversations if they did the session in pairs or in groups. In most cases, participants were free to use the learning media and complete the designated tasks themselves. Evaluators would help them upon necessary and at critical incidents that halted participants to complete their tasks.

Participants were briefed on the objectives and the expected output of the experiment. Demographic information on age, gender, occupation, computer competency, VR experience, familiarity with 2D and 3D input devices as well the content of application was collected. Then, participants were given five minutes to get familiar with the learning media before doing the designated tasks and later the recall session. Each learning media has different set of designated tasks to complete. For example, using the VRARCH, the tasks were designed to

allow participants to experience walking through the monuments and appreciate the craftsmanship of structural elements. Afterwards, participants answered the recall tests comprising of open-ended questions, true/false statements, and matching images or sketching structures. Participants completed a questionnaire in scale 1 (strongly disagree/very unsatisfactory) to 5 (strongly agree/very satisfactory) on presence, usability, and learning experience. Post-experiment interview questions were then carried out to gauge upon their learning experience as well as feedback and suggestions for prototype and overall improvement. Finally, debriefing was done and a token was given to participants upon completion. The designated time to complete the experiment is 40 minutes for VR, 35 minutes for Video, and 35 minutes for kiosk. The Malay versions of the experimental instruments were also prepared and distributed upon participants' request.

RESULTS AND DISCUSSIONS

Descriptive Analysis

Table 2 depicts the mean scores for satisfactory level on the overall presence, overall learning experience, overall usability (using Likert-scale 1 to 5 from very unsatisfactory to very satisfactory) and learning mean score for total recall tests (0 up to 10 marks).

Table 2. Mean Scores on Presence, Learning Experience, Usability and Recall Tests and Corresponding Standard Deviations for Three Groups.

Digital Media	Presence		Learning Experience		Usability		Recall Tests	
	M	SD	M	SD	M	SD	M	SD
VR (N=46)	3.50	0.86	3.82	0.95	3.58	0.93	3.98	2.47
Video (N=35)	3.53	0.68	3.37	0.62	3.67	0.80	5.03	1.79
Kiosk (N=23)	2.55	1.00	3.50	1.10	3.05	1.15	4.70	1.92

All mean scores on usability are near satisfactory. This suggests that these groups are homogeneous in terms of usability and as their level of satisfactory is almost the same, it is then feasible to compare among these groups on other dependant measures.

According to Table 2, video has the highest mean score on presence (3.53±0.68) among others. VR slightly comes next (3.50±0.86) followed by the interactive kiosk (2.55±1.00). VR has the highest mean score on learning experience (3.82±0.95) followed by the kiosk (3.50±1.10) and video (3.37±0.62). On recall, Video scores the highest mean (5.03±1.79), kiosk scores next (4.70±1.92), and VR scores last (3.98±2.47). In order to determine whether there is any significant difference between these mean scores and hence the effect, further statistical analysis that is one-way analysis of variance (ANOVA) was conducted.

Analysis of Variance

One-way analysis of variance (ANOVA) was conducted to determine the effect of each learning media to overall presence, overall learning experience, and overall usability. The confidence interval used was 95% or 0.05. This analysis assumed that the group variances are equal ($p>0.05$).

It is found that there is no significant difference on the mean scores of learning experience and usability when compared among the three groups of learning media, $F(2, 64)=1.506$ and $F(2, 71)=2.795$ respectively, $p>0.05$. It is then concluded that there is no effect of using the

three learning media on the mean scores of users' learning experience as well as for the mean scores of usability. In our case, the homogeneity of usability scores is much anticipated in order to have a benchmark to compare the learning media for other measures. In contrast with interview results where respondents preferred VR because it is a newer technology compared to Video and Kiosk, participants may feel similar satisfaction on their learning experience when they are able to get the required information regardless of the learning media.

There is a significant difference on the mean scores of overall presence between the three groups, $F(2, 73)=9.907$, $p\leq0.05$. In order to determine which groups are contributing to this significant difference, the post hoc tests using Tukey's HSD was conducted.

First of all, when the VR group is compared to the Video group, it reveals a no significant difference ($p>0.05$) but when compared to the Kiosk group, it reveals a significant difference ($p\leq0.05$) with the effect size of 0.95. Secondly, when the Video group is compared to the VR group, it reveals a no significant difference ($p>0.05$), but when compared to the Kiosk group, it reveals a significant difference ($p\leq0.05$) with the effect size of 0.983. Thirdly, when the Kiosk group is compared to the VR group as well as the Video group, it reveals significant differences ($p\leq0.05$) with the effect size of 0.95 and 0.983 respectively.

These results show that the mean scores on overall presence of both VR and Video are comparable but the mean scores differ significantly when each of them is compared to the Kiosk. According to post-interview, this is because visitors were found to be more engaged to VR and Video that possess images and sounds compared to Kiosk that displays more text. The existence of navigational freedom and relative visual realism in VR also found to help visitors felt presence. For Video, visitors acknowledged the use of real images and clear narration to feel presence.

One-way ANOVA was also conducted to determine the effect of each learning media to the recall tests. The confidence interval used was 95% or 0.05. This analysis assumed that the group variances are equal as $p>0.05$. It is found that there is no significant difference on the mean recall test scores when compared among the three groups of learning media, $F(2,101)=2.517$, $p>0.05$. So, it can be concluded, there is no significant effect to the overall recall test if the visitors were using VR, Video or Kiosk.

These findings are similar to those of Pujol and Economou (2009) where visitors, regardless of the types of digital exhibits they explored, can recall the information in their short-term memory plus the previous knowledge they had. In this experiment, it is found that even with no previous knowledge visitors can shortly recall the information regardless of the types of digital media they explored.

CONCLUSIONS AND FUTURE WORK

This paper has demonstrated an experiment to determine the effects of three digital media on museum learning. Major findings are (i) there is no significant effect of using the three learning media on the mean scores of users' learning experience as well as for the mean score of usability; (ii) there is a significant difference on the mean scores of overall presence between the three groups; and (iii) there is no significant effect to the overall recall test if the visitors were using VR, Video or Kiosk. It is also found that even with no previous knowledge visitors can shortly recall the information regardless of the types of digital media they explored.

Another experiment has been conducted to replicate this experiment in different museum nature and different experimental setup. Future work is to conduct analysis on the effect of gender and age towards museum learning and to use mix method of experimentation and observation to confirm the experimental findings.

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DIGITAL PERSUADER@PMLE : AN INNOVATION TO SOCIETY

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ABSTRACT. The main purpose of this paper is to highlight one innovation that would benefit to the society in handling children dental anxiety. Digital persuader@PMLE namely as a Persuasive Multimedia Learning Environment is a multimedia edutainment courseware (CD based) that caters children dental anxiety by persuading and motivating the children to gain confidence in attending dental check-up. It is an application from a persuasive technology whereby the computer is used to change what people think, feel and do in a better ways. Design strategies of this innovation are combining persuasive and multimedia design strategies. Interviews have been conducted in assessing the effectiveness of the digital persuader@PMLE among the children who have feelings on dental anxiety. Results of the study showed that the interviews session had achieved positive effects on the reduction of children dental anxiety.

Keywords: Persuasive Multimedia Learning Environment (PMLE), children dental anxiety, persuasive technology

INTRODUCTION: CHILDREN DENTAL ANXIETY PHENOMENON

Dental anxiety is categorized as a type of generalized anxiety disorder (GAD) which is characterized by excessive worrying about a variety of dental events, including those in the past, present, and future (Network, 2001). In treating children who have dental anxiety, it could be overcome by two key players; dentist and parents. However, there is a lack in literature discussing advantages of overcoming anxiety from children's perspective where children do not have a self-mechanism to overcome their anxiety or fears (Sobihatun, 2010). This view is supported by Do (2004) suggesting that children are left with little knowledge of how to possibly address their dental associated fears. Townend (2000) also supported this view. They found that children unanimously reported that they had received no dental anxiety education at school. This phenomenon also happens in Malaysian primary school education. The dental health education unit from Malaysian Health Ministry confirmed that they do not include dental anxiety education at schools.

The phenomenon has been proved by Sobihatun (2010). She has had conducted a survey which was held among 43 primary schools children from rural area. Result from the survey showed that 58% from the respondents experienced dental anxiety. Observation method has also been used to investigate dental anxiety among the children. From the observation during dental treatment at two primary schools, the researcher found that dental anxiety exists among the children whose age range from seven to nine years old due to the refusal to attend the treatment such as crying, shaking, hiding, and running away from the nurses.

As this was the case, Sobihatun and Wan (2010) have designed and developed an innovation called a digital persuader@PMLE (Persuasive Multimedia Learning Environment) which is a multimedia edutainment courseware (CD based) that caters for children aged seven

to nine year old who problem has associated with dental anxiety. The digital persuader@PMLE will persuade children while they are exploring, interacting and experiencing the content of it. This approach could be a self-mechanism for children to overcome their dental anxiety. It also can be used by parents, dental practitioner, teacher to educate and motivate the children in gaining confidence when attending dental visit. Overall design of this novel idea is based on its theoretical design strategies which discussed in the next section.

FROM DESIGN STRATEGIES TO AN INNOVATION

Design strategy for digital persuader@PMLE has taken such an approach by combining the macro and micro strategies (Reigeluth and Merrill, 1978). Macro strategies are concerned with the selection, sequence, and organization of the subject-matter that are to be presented, also described as the overall strategic plan (Gibbons, Fairweather, Anderson and Merrill, 1997). Micro strategies are characterized as presentation strategies because they are concerned with the details of each individual presentation to the learner (Chen, 2001).

As for digital persuader@PMLE design strategies, macro strategy is a persuasive design principle (Fogg, 2003), whereas micro strategies are the principles of multimedia design (Mayer, 2001) and design guidelines for children (Gilutz and Nielsen, 2007) as illustrated in Figure1. Persuasive design comprises studies on carefully planned information activities, where the goals are related to some kind of change in the behaviour of the receivers (Petterson, 2000). The design strategies has been applied to guide the design of the content and interface of the digital persuader@PMLE which illustrated in Figure2. Digital persuader@PMLE is claimed as an innovation to society whereby this is a novelty invention in the scope of children dental anxiety education.

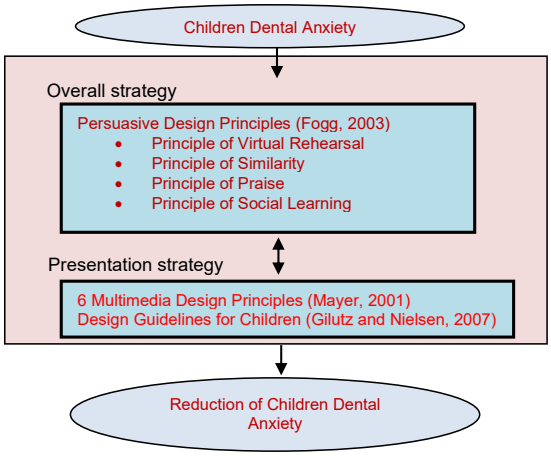

Figure 34. Design Strategies of digital persuader@PMLE

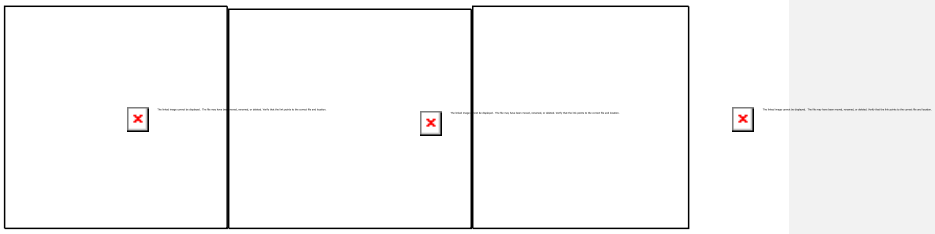

Figure 2. Digital persuader@PMLE snap-shot screens

ASSESSING DIGITAL PERSUADER@PMLE: INTERVIEWS WITH THE CHILDREN

Participants for the structured interviews were selected from ten primary school children who had feelings of dental anxiety. The data collected during the interviews were derived from four structured questions as stated as follows:

i. Which item in the dental anxiety dimension that you find least anxious about?
ii. Which item in the dental anxiety dimension that you find most anxious about?
iii. Do you still feel anxious about having dental check-up after exploring digital persuader@PMLE?
iv. Do you feel that digital persuader@PMLE can help in minimizing your dental anxiety?

Children dental anxiety dimension were adopted from Smiley Faces Program (SFP) by Buchanan (2005). The SFP is a dental anxiety measurement for children which consisting five dimensions of children dental anxiety. All five dimensions are the major causal factors of children dental anxiety. Table 1 illustrates the dimensions in the SFP.

Table 1. Dimensions of children dental anxiety (Buchanan, 2005)

1. Going to the dentist tomorrow
2. Sitting in the waiting room
3. About to have a tooth drilled
4. About to have tooth taken out
5. About to have an injection

Results

The following responses came about during the interviews, according to the sequence in which the above questions were asked. Figure 3 and Figure 4 illustrates the interviews results for questions i and ii. Whereas, Figure 5 and Figure 6 illustrates the interviews results for questions iii and iv.

From Figure 3, 50 percent of the least anxious dental anxiety dimension was “about to have tooth taken out” , followed by 30 percent was about “going to the dentist tomorrow” and 20 percent was about “sitting in the waiting room”.

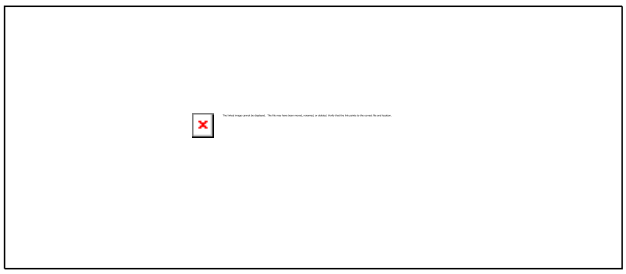

Figure 3. Interviews results for questions i

While, from Figure 4, researcher has found that 70 percent of "about having an injection" was chosen as the most anxious dental anxiety dimension which score, followed by 30 percent of "about having a tooth drill".

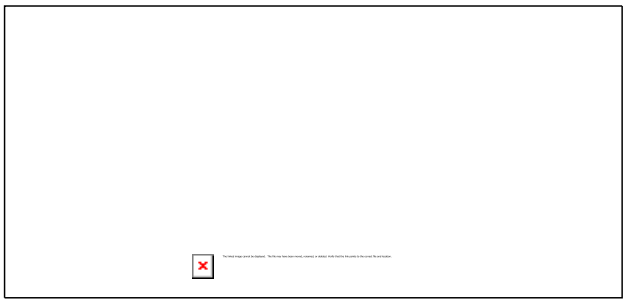

Figure 4. Interviews results for questions ii

80 percent or eight out of ten interviewees responded that they did not feel anxious anymore after exploring digital persuader@PMLE. While, the remaining 20 percent or two interviewees responded that they still felt anxious after exploring digital persuader@PMLE. These were the results achieved from the conducted interview sessions as depicted in Figure 5.

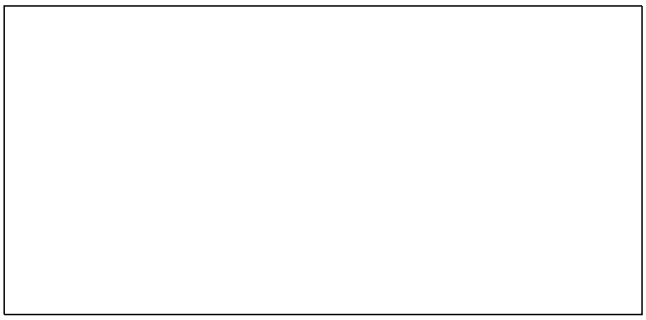

Figure 5. Interviews results for question iii

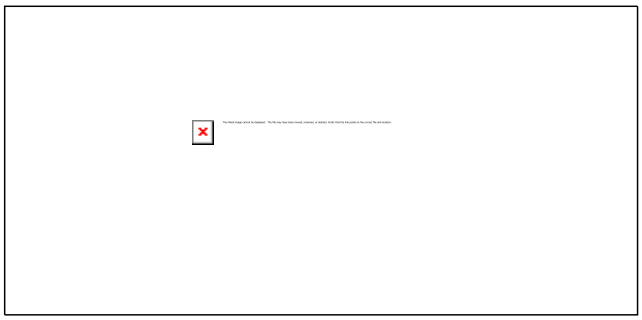

Figure 6. Interviews results for question iv

Furthermore, 100 percent or all of the interviewees believed that digital persuader@PMLE can help in minimizing their dental anxiety as illustrated in Figure 6. The figure shows that there were significant results in reducing the children's dental anxiety and in improving the children's confidence as well.

In summary, the interviews results had proved that digital persuader@PMLE could contribute in assisting children to feel better about dental check-up as well as dental treatment. The interviewees who were exposed to the digital persuader@PMLE agreed that their anxious feeling towards dental matters was minimized.

CONCLUSION: VALUE TO SOCIETY

Overall, the findings of digital persuader@PMLE project indicated that children have interest to explore the CD as a digital persuader as well as learning aids to reduce their dental anxiety. Social learning has been embedded in PMLE as a persuasive technology in building up children's confidence to dental visits (Sobihatun Nur and Wan Ahmad Jaafar, 2009). Therefore, this innovation might be used to educate our society, especially children to have self-confidence so that they can confidently communicate and give their cooperation in the society.

Furthermore, this innovation will eventually helps towards sustainable development of the society by reducing dental anxiety especially among children in Malaysia. When the anxiety is reduced, indirectly the oral health awareness will be increased in the society and dental diseases could be decreased. Therefore, the government could reduce expenses on dental treatment due to the increasing of dental health.

In general, applying the usage of persuasive technology could be a driving factor to reduce as well as to improve human psychological problem, particularly overcoming the problem, in handling emotional or feeling aspects.

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E-COMMERCE (B2C) EVALUATION PRACTICES: A PILOT STUDY ON JORDANIAN CONSUMERS' PERSPECTIVES

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ABSTRACT. Many websites fail to help companies reach their objectives because they neglect consumers need in their websites developments. Since consumers are considered as the key success factor for sustaining B2C business, companies must therefore identify their consumers' behavioral characteristics. The pilot study aims to investigate the quality factors of B2C websites from consumers' perspectives. Specifically, the study investigates the current practice towards quality development on Jordanian B2C websites in terms of degree of satisfaction, online buying habits of B2C consumers, obstacles and constraints surrounded B2C ecommerce websites, and factors that consumers consider when evaluating B2C websites. Data was collected through questionnaire and interviews. Descriptive statistics such as mean, frequency calculation, and percentages were used for analysis. Out of 33 quality factors, 17 have been found to be important. These are: web site visibility; safety; serviceability; price savings; high responsiveness; online shops credibility; enjoyment and entertainment; websites information; the value of the web; promotion activities; clarity; relevance; diversity of goods, services and information; current and updated web documents; user-friendly web interface; trust or trustworthiness; and accuracy and authority of web documents.

Keywords: B2C, ecommerce evaluation, consumers' perspective

INTRODUCTION

The internet has developed a highly competitive market for companies to increase market share. In order for companies to be competitive, consistent increase in consumers is much desired. Companies must know consumers' behavior characteristics in order to meet demands as consumers are considered as the key success factor of companies. Evaluating a website helps to create a higher quality website that meets consumers' needs and organization objectives. An assessment on consumer related factors could expose that an e-commerce direction is the way to establish better business opportunities for the companies and to considerably take competitive advantage in the market space (St-Pierre, 2001). E-commerce can be defined as a business process of selling and buying products, goods, and services through online communications or via the internet medium (Li, Sun, & Wang, 2005).

However, many websites fail to help companies reach their objectives because quality of the websites is not taken into account in websites development (Lee & Kozar, 2006; Tan & Tung, 2003; Husain, Ahmad & Yahaya, 2009). In order to ensure quality of websites, factors that contribute to the quality must be identified. Since the web is a dynamic medium, factors related to this medium are changing with time, thus, making identifying factors on online

consumer behavior very difficult and critical (Biscoglio et al., 2007). Continuous refining of these factors is extremely needed (Joia & Olivera, 2008).

Several ecommerce evaluation models fail to take user factors into account in their websites development (Olivera & Joia, 2005; Joia & Olivera, 2008). In terms of evaluation, the literature pinpoints to scarce studies on websites quality evaluation from consumers' perspective, which means the consumers' perspective in the websites evaluation is ignored (Loiacono, Watson & Goodhue, 2002; Lee & Kozar, 2006; Wang & Zhou, 2009). According to Fasanghari & Roudsari (2008), e-commerce websites evaluation in consumers' perspective is still in the initial stage and exploration on this aspect is much needed.

This paper presents the findings of a pilot survey that was conducted in Jordan. Particularly, this paper highlights the current practice toward quality development on Jordanian B2C websites. Aspects such as the degree of satisfaction, online buying habits of B2C consumers, obstacles and the constraints surrounded B2C ecommerce websites, and factors that consumers' consider when evaluating B2C websites are discussed.

METHODOLOGY

This pilot study was conducted via survey using structured questionnaire. According to Greenfield (1996) a pilot study has two main purposes; namely to identify the reliability and validity of the questionnaire based on users' responds and to fine-tune the questionnaire design.

Survey technique was used for conducting an empirical study in Jordanian firms. This technique was chosen as it has been known to be suitable for a descriptive study - that is, the study aims to describe the current practices of websites development and describe the online buying habits of Jordanian consumers. In addition, this technique is suitable for a study that seeks to answer questions related to "what" or "how many/much" (Yin, 1994).

The survey used questionnaire and interviews as media for collecting data. Questionnaire was used due to reasons such as cost effectiveness, ease of analysis, wide area coverage, and integrity assurance (Kirakowski, 2000; Robson, 1993). Random face to face interview and discussion with users and developers were conducted to increase the reliability of the questionnaires and present views/ opinions from companies' perspectives. The discussions with independent developers, direct users and other staffs that are related to a specific issue or module of the websites were made to help generate the conceptual structure of websites characteristics and formulate an initial evaluation framework. A clear understanding about the obstacles and constraints that surround B2C ecommerce websites were identified. The survey was conducted in three main phases; that is, questionnaire design and formulation, data collection, and data analysis. The following sections explain the phases involved.

Questionnaire Design and Formulation

In this phase, a questionnaire that used a five-point Likert scale was developed. Examples of questions are "what is the overall satisfaction towards the websites", and "what are the main constraints surrounding B2C ecommerce websites developments". A scale of 1 represents *strongly disagree*, 2 refers to *disagree,* 3 refers to *neutral*, 4 refers to *agree* and 5 refers to *strongly agree.* In addition, several "yes/no" question were included. Several questions require respondents to rank user-related quality factors that are considered as contributing factors to achieve high quality websites applications. The ranking scale is between 1 to 5 where 1 refers to "*not considered"*, 2 refers to "*low consideration"*, 3 refers to "*average"*, 4 refers to "*high consideration"* and 5 refers to "*very high consideration".*

Data Collection

Seventy questionnaires were randomly distributed through postal service to telecommunication companies in Jordan and interviews were conducted at selected

companies. Out of seventy questionnaires that were distributed, fifty-six were returned (80%). During the interview, the time required to answer the questionnaire was measured and any difficulties on answering the questions were recorded. The aim was to check the reliability of the questionnaire and obtain feedbacks on items in the questionnaire that may require modifications were gathered.

Data Analysis

Steps involved in data analysis include editing and preparing data for analysis process (Coakes & Steed, 2003). Simple descriptive statistics analysis such mean, frequencies, and percentages were used. The steps were conducted using SPSS 14.0 for Windows.

FINDINGS

Results from analysis are presented in subsections which are based on the group of items in the questionnaire.

Demographic Data

The sample of the respondents consisted of 73.2% male and 25.8% females. The disproportionate of male and female could be due to more males tending to buy over the net. The majority of the respondents were from twenty two to thirty year's old (59%). Second and third highest were respondents that were thirty one to forty (29%) and seventeen to twenty one (7%) years of age. The least was respondents that were above forty (5%). This differentiation can be explained due to the nature of the human behavior. Older (more 40) and younger (less than seventeen) tend to be less interested in conducting electronic purchasing.

In terms of educational level, the analysis on respondents' background showed that 75% of the respondents have university degrees, 23% have advanced degrees and 2% have seminary certificates. This shows that educated people are mainly the ones who conduct transactions electronically.

Distribution of Online Buying Habits for the Consumers

The greatest number of respondents used the internet for searching the best deal (61%). 21% used it to enquire about products they want to purchase and 18% of the respondents used the internet for pleasure. No respondents have been found to use the internet because of conveniences. This indicates that majority of users seek for useful information from the internet.

Current Practice on Websites Quality Developments

Results showed that the degree of satisfaction on the quality of Jordanian B2C websites as compared to other countries' websites were poor. 32.1% of the respondents were very dissatisfied, 32.1% are somewhat dissatisfied, and the rest were neutral (35.7%). Table 1 shows the results.

Table 1. User Satisfaction on Their Websites

Degree of satisfaction	Frequency	Percent
Very dissatisfied	18	32.1
Somewhat dissatisfied	18	32.1
Neutral	20	35.7

The respondents were asked to indicate the current models, mechanisms, and technique that the companies hold or followed to evaluate and developed their websites. Results showed that 82% of the companies do not follow any models and 17.9% stated that they followed certain quality models. Also, they were asked on any mechanisms they used to obtain

information on their consumers' needs. Results showed that 57% of the companies do not have any mechanisms or procedures to identify their consumers' needs. 42.9% of the respondents followed several mechanisms such as obtain feedbacks from customers directly through their websites, help desk services, polls, SMS, and forums. Therefore, there is essential need to provide mechanisms and procedures that the companies can follow to meet the consumers' needs.

In terms of technique to evaluate B2C websites, results showed that 70% of the respondents answered negatively – that is, no technique was used to validate and verify their websites. The rest (30%) used techniques such as website auditors and standard quality measures and processes. This shows that only limited techniques were being used to validate and verify the companies' websites. Therefore, there is a need for a standardize technique to validate and verify the companies' websites

When asked if there are any methods or processes being provided by the country to validate the companies' websites, the results were: 16% of them answered positively, claiming that some methods such as payment gateways and markup validation services are available. 84% stated that no methods were available. Therefore, there is urgent need to provide methods and processes for websites evaluation and developments due to the lack of the methods and processes provided by the country to validate the companies' websites. According to above scenario, B2C ecommerce quality evaluation framework which includes mechanisms, methods, and technique is needed for B2C ecommerce websites evaluation and developments. Table 2 shows the breakdown of results.

Table 2. Current Practices on Websites Development

Current practice for quality evaluation models	Answer	Frequency	Percentage
Quality models or framework used for websites evaluation and development	no	46	82.1
	yes	10	17.9
Mechanisms or procedures followed to meet the consumers needs	no	32	57.1
	yes	24	42.9
Methods provided by country to validate organization websites	no	47	83.9
	yes	9	16.1
Techniques used to validate ecommerce websites	no	39	69.6
	yes	17	30.4

When the respondents were asked on whether their websites meet the target of quality, majority of the companies (51.8%) mentioned that their websites are considered as quality if they meet their organizations' objectives, 16.1% mentioned that they received positive feedbacks from the websites' owners, 12.1% obtained good feedbacks from their team of developers. 7.1% said that their websites are considered as quality when their websites meet their consumers needs, while, 10.7% mentioned that quality is met when their websites meet users satisfaction. Although, the consumers are considered as the key success factor for the companies, their perspectives were not taken into consideration in the websites developments. Therefore, consumers' perspective must be included in the websites evaluation and developments.

Respondents were also asked to select reason(s) why e-commerce companies fail based on a list of reasons. From the results, it was found that that 66.1% agreed that consumers' aspects were ignored during websites development, 15.59% stated that the websites were lacking of some quality attributes/factors, while, 12.54% agreed that the quality of the websites were neglected during the development phase. However, ignoring the consumers' perspective in the websites evaluation and developments is considered as the most important

constraint that influences the success and failure of the ecommerce companies. Figure 2 shows the results in detail.

Quality Factor from Consumers' Perspectives

Respondents were asked to rank a list of quality factors that can be used for evaluating B2C websites and be used as criteria for developing B2C websites. Results were established by calculating the mean score and selected the appropriate interval to represent the all means value for the factors. The appropriate interval used is from 3.43 and above.

Out of 33 factors identified in the literature review, only 17 were found to be important and were considered from the consumers perspectives which are: web site visibility; safety; serviceability; price savings; high responsiveness; online shops credibility; enjoyment and entertainment; website information; value of web; promotion activities; clarity; relevance; diversity of goods, services and information; current information; user-friendly web interface; trustworthiness; and accuracy and authority were important factors in evaluating B2C websites. Other factors with lower mean score (less than 3.43) were considered as not commonly used in evaluating B2C websites.

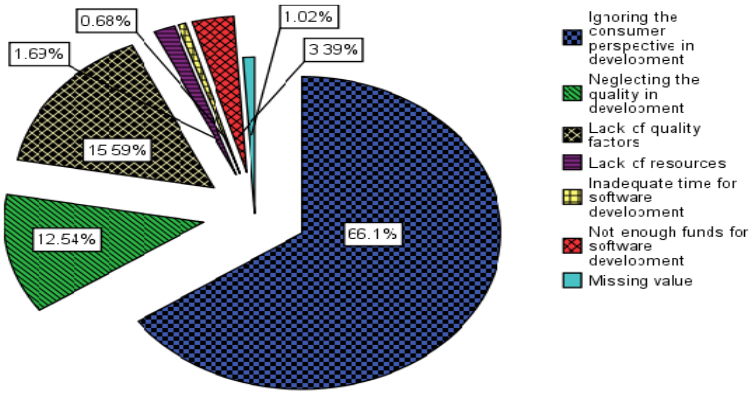

Figure 2. Distribution of reasons on why B2C websites fail.

CONCLUSION

The availability of B2C websites plays a significant role in helping companies achieve competitive edge and become sustainable. In order for companies to be competitive, consistent growth in market share must be achieved and the use of quality B2C websites is necessary. Evaluation of websites help to create a higher quality product that meets consumers' needs and organizations' objectives.

An investigation on the current practice towards quality development of Jordanian B2C websites was made through a pilot study. A survey on fifty-six Jordanian telecommunication companies revealed some interesting outcomes. Results from the samples show that most consumers are not satisfied with their companies' websites. In addition the findings indicate that most B2C websites' developments do not follow certain quality models, mechanisms, or techniques. Many respondents claimed that the Jordanian government did not provide any standard methods that companies could follow in implementing their websites. Based on the results, it can be summarized that most of the B2C websites were developed without taking into consideration the quality and consumer perspectives. This is because most companies

relate quality with achieving organizations' objectives and do not based on meeting consumers' needs and satisfaction.

The findings of this study which includes identification of websites quality factors, online buying habits of B2C consumers, obstacles and the constraints surrounding B2C ecommerce websites, and factors that consumers' consider when using B2C websites will be gathered and use to construct an ecommerce evaluation framework.

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ISSUES AND CHALLENGES FOR MOBILE LEARNING IN JORDANIAN UNIVERSITIES

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ABSTRACT. The present state of mobile learning in Jordan is investigated in order to provide a meaningful direction for the future development of universities in Jordan. The benefits of mobile learning are elaborated and its current status including challenging issues from the perspective of mobile learning acceptance. A qualitative survey was conducted to investigate the perceptions of mobile learning amongst university students in Jordan. The results revealed some discouraging facts for the future of mobile learning in Jordanian universities because of culture, trust and technology services quality.

Keywords: mobile learning, Jordanian universities

INTRODUCTION

Traditional lecture-based education methods rely heavily on both printed materials (e.g., teaching slides, textbook sand laboratory work). This form of learning activities has significantly restricted learner engagement and motivation because it comes at the price of making interaction between learners and lecturers harder and inefficient (Freeman & Blayney, 2005; Traxler, 2005). Instead, to a greater extent, e-learning and m-learning has overcome these limitations of the traditional lecture-based learning activities, and highly applicable to other learning activities such as life–long learning (Sharples, 2005). Mobile learning is obviously seen as a new generation of learning paradigm which follows the traditional lecture-based learning and complimentary e-learning pedagogy (Ryu & Parsons, 2009). The term e-learning refers to learning methods which use electronic channels in order to deliver the instructional content and e-learning is also referred to as web-based learning; technology based learning; online learning; networked learning (Gotschall, 2000; Trombley & Lee, 2002) While the term mobile learning (m-learning for short) has been defined as e-learning that uses wireless transmission and mobile devices (Attewell, 2005).

MOBILE LEARNING IN JORDAN

Universities have made significant investments in cooperating technology systems to support different aspects of students' learning (Armatas et al. 2005). These include learning management systems, all of which work on the assumption of attracting students into the online environment of the university. In Jordan, for instance, m-learning is introduced to students as e-learning using mobile wireless technology. E-learning is not a recent phenomenon to Jordanians (Al-Jaghoub et al. 2009). M-learning initiatives in Jordan are being undertaken mainly by universities. The main players of m-learning are

public institutions of higher education. However, from the total of twenty seven universities, only a few universities in Jordan such as Princess Sumaya University (PSU), Mutah University (MU), University of Jordan (UJ), Hashemite University (HU), Jordan university of science and technology (JUST) and Yarmouk University (YU) are among the universities that promote the use of mobile learning implementations (Al-Zoubi et al. 2008; Ministry of Higher Education & Scientific Research, 2010). Figure (1) shows examples of m- learning in university education in Jordan.

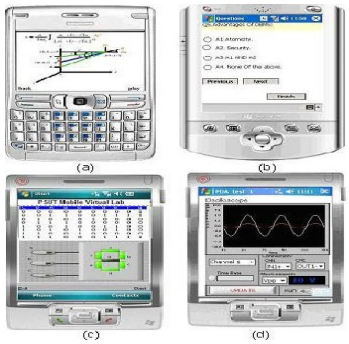

Figure 1. Examples of Mobile Learning in University Education in Jordan.

Source: Al-Zoubi et al. (2008)

BENEFETS OF MOBILE LEARNING

According to Attewell (2005) as quoted by Becking et al. (2005) and Yousuf (2006) there are several benefits to use mobile learning. These include helping learners to improve literacy and numeric skills, recognize their existing abilities, identify where they need assistance and support, overcome the digital divide, make learning informal and raise self-esteem and self-confidence. Moreover, it is a portable form of learning from one place to another. Mobile learning also provides real time and location independence and can be used for independent and collaborative learning experiences. With the advantages it has, mobile learning is applicable in education institutions such as schools and universities .The portability of mobile technology allows the learning environment to be extended beyond the classroom. The personal nature of mobile devices makes them well-suited for learning applications outside of formal education.

ISSUES AND CHALLENGES IN MOBILE LEARNINGIN IN JORDAN

In spite of the many advantages of mobile learning, there are challenges to overcome whether technical, pedagogical or administrative. Sariola (2001) as quoted by Keegan (2002) states that although learners use mobile phones extensively, there has been a lack of wide spread adoption of mobile learning in educational settings. The reasons were mainly technical, stemming from the screen size of the mobile devices and the cost of mobile services.

Despite adopting mobile learning in many higher education institutions such as Jordan, mobile learning in many developing countries are still not encouraging and look less impressive (Adesope et al. 2007; Al-Zoubi et al., 2008). Part of the reasons is due to the fact that most developing countries are located to the South and far from technologically advanced countries. The distance and other issues have prevented the

countries from receiving and deploying new technologies such as mobile learning at the same rate as the advanced countries.

In Jordan, there are many issues and challenges that need to be overcome in order to enhance the acceptance of m-learning and help practitioners' efforts and decision makers in the Ministry of Higher Education and universities in relation to m-learning implementation. A study needs to be conducted in order to detect the main factors that influence of mobile learning acceptance among the students in Jordanian universities.

Methodology

A study was conducted in 2010 at Jordanian universities with a purpose to detect the main factors that influence of mobile learning acceptance .Twenty semi-structured interviews concerning about m-learning acceptance and the factors that might influence students behavior intention to use m-learning was carried out. Each interview started with a general description and with the goals of the research. The researchers made sure not to influence the participants by giving them our opinion or other participants' thoughts. The conversations were friendly and easygoing discussions. All participants were mobile phone users and they used mobile phones mainly for personal communications purpose. In fact, this study utilized only the coding types, which are the preliminary steps, of grounded theory method to analyze data collected.

Findings and Results

The respondents were from the age of "18-25", 40% were female and 60% male. It is Surprising that 30% of the students indicated that they have used a mobile device for education or learning (5% were female and 25% male).Device ownership statistics reveal some interesting numbers. Approximately 35% of students owned a mobile wireless computer, and 20% of students owned PDA, and roughly 45 % owned handheld devices. As expected, experience mobile device usage is high, with a majority of students having three plus years of experience.

In terms of average amount of time spent using mobile device daily, 20% of students spent less than one hour the using mobile device for learning or educational purposes, 10% spent 1-3 hours daily on learning activities.

The results as shown in Table 1 explain that many factors could influence student's behavior intention to use m-learning. From twenty participants, only six of them involved with the universities m-learning. This shows that the use of m-learning in the university is still at the infant stage and the acceptance of m-learning in Jordan is not popular among the users of mobile phone. Furthermore, it was found that students are still unaware of m-learning applications and the advantages that m-learning can provide. It was also revealed that 75% of female and 67% of male students are unwilling to use mobile technology in education. However, 70% of the students didn't use mobile learning implementations. That means there is a lack of m-learning awareness because this service is still widely unaccepted. Moreover, a limited number of universities adopt m-learning. In addition, there are culture issues, miss trust in the university and mobile wireless technology. More importantly, quality of services has not satisfied the students' requirements, which include security, privacy, accessibility, interface design, content quality, personalization, Reliability and Response. These findings in Jordan are similar with a few other studies in many developing countries (Barker et al. 2005; Motlik, 2008).

Table 1. Interview Results

Participants	Age\Gender	M-learning user	Results of conversations
Participant 1	19\Female	No	I am unwilling to use m-learning, I don't trust mobile technology as a tool in education.(Trust issues)
Participant 2	20\Male	Yes	The quality of services has not satisfied my needs (content quality and security issues)
Participant 3	23\Male	No	I am not aware of m-learning as it is not interesting. I would prefer a bad situation that I know about to an uncertain situation which might be better such as m-learning.(culture issues)
Participant 4	22\Male	No	I heard about it but never tried it, (family, friends influences), and I don't know about it is benefits.
Participant 5	19\ Female	No	I am not aware of m-learning, I would like to try it soon. social influences by the lecturers (culture issues)
Participant 6	22\Male	No	I am unwilling to use m-learning. My university is not honest with me. (Trust)
Participant 7	24\ Female	Yes	The quality of services has not satisfied my desires (Accessibility, Privacy and Security issues)
Participant 8	21\Male	No	I heard about it but never tried it. My university doesn't adopt mobile learning.
Participant 9	20\Male	No	I am not aware of m-learning. Friend's opinions are important when doing something; using mobile phones for fun.
Participant 10	24\Male	Yes	I am unwilling to use m-learning again. My university does not keep it is promises and commitments.(Trust)
Participant 11	19\Male	Yes	The quality of services has not satisfied my needs(content quality, Personalization and privacy)
Participant 12	19\Female	No	I am not aware of m-learning, I cannot use it. Social influences (Family, Community), (Culture issues).

Participant 13	22\Female	No	I am not aware of m-learning, I hope to try it social influences (Family, Community). (Culture issues).
Participant 14	23\ Female	No	I did not use it. My university neither adopts mobile learning nor keeps promises and commitments to provide this facility.
Participant 15	19\Male	Yes	The quality of services does not satisfy my needs such as (Interface design, Personalization , privacy ,Reliability and Response)
Participant 16	20\Male	No	I heard about it but never used it. I think that any error could mean loss of marks and money.(Trust)
Participant 17	21\Male	No	I did not use mobile learning. My university did not adopt it. I would like to try it soon.
Participant 18	22\Female	No	I heard about mobile learning but never try it .I Respect traditional learning and I believe it is better. (Culture issues)
Participant 19	22\Female	No	I heard about mobile learning but never try it. My university doesn't adopt mobile learning.
Participant 20	25\Male	Yes	I will not use mobile learning again because the download is not fast and I don't trust university.

Conclusion

Mobile learning environments in Jordan were investigated amongst twenty students at public universities. A qualitative survey was conducted to investigate the perceptions and the intention to use mobile learning. The results reflected dissatisfaction about mobile learning in Jordanian universities environment, students are still unwilling to use mobile learning. In addition, the results revealed some discouraging facts for the future of mobile learning in Jordanian universities because of culture issues, trust in the university and mobile wireless technology issues. In addition, quality of services has not satisfied the students' requirements which include security, privacy, accessibility, interface design, content quality, personalization, Reliability and Response.

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DEVELOPING AN EZE-COMMERCE TRANSACTION SYSTEM FROM OPEN SOURCE USING TRIZ METHODOLOGY

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Abstract. Zen Cart E-Commerce Transaction System an open source material was thoroughly studied by identifying its components, then we use TRIZ Methodology to identify its shortcomings and then we developed a type of transaction system.

In this paper we elaborate the development process using a methodology called TRIZ and introduce a simple transaction system called Eze-Commerce.

Keywords: E-Commerce transaction system, TRIZ, Open Source

INTRODUCTION

Nowadays, ecommerce business become familiar and popular because it is easy and save time in practicality since our lifestyle is very hectic and rushing. E-commerce is sharing of business information, maintaining business relationships and conducting business transactions by means of the Internet based technology. Online shopping is a form of electronic commerce where the buyer is directly online to the seller's computer usually via the internet. There is no intermediary service. The sale and purchase transaction is completed electronically and interactively in real-time such as Amazon.com and eBay.com.

Although e-commerce has been widely adopted by malaysian company in different industries , e-commerce in Malaysia is still in infancy because Malaysia can be considered a late starter given the recent spate of internet. The application of E-commerce in Malaysia even though is encouraging, but it is still at its infant stage

The future of e-commerce seems to be very bright for Malaysia. However, it can only remain so if there is consumer trust and confidence in it. Security is one of the most addressed issue in implementing trust mechanisms because the main concern about e-commerce is whether it is safe to conduct online transactions as to protect businesses from fatal blow to business.

Another security issue that need attention is the interrupting part of the value chain, as the web enables consumers or anybody to have direct access to content providers. This accessibility allows the possibility of picking and choosing content that affect the decision on the transaction. Thus a serious attention need to be addressed in order to build confidence of the agencies in using the internet as an effective marketing tools that need a strategic deployment of security, technology and cost effective concerns.

E-commerce is still new in Malaysia but this trend become popular among Malaysian. So, they just apply free e-commerce cart to run the business because lack of experience and exposed without realize the weaknesses of that software. So, we enhance the existing software and give some recommendation and advice so that they will be aware with this vulnerabilities and take further action on that.

The e-commerce business become very popular but the user still lack of knowledge and experience and do not really exposed to the real e-commerce scenario.

Zen Cart is an online store management system. It is PHP-based, using a MySQL database and HTML components. Support is provided for numerous languages and currencies, and it is freely available under the GNU General Public License (Zen Cart, 2010)

Zen Cart truly is the art of e-commerce a free, user-friendly, open source shopping cart system. The software is being developed by a group of like-minded shop owners, programmers, designers and consultants that think e-commerce could be, and should be done differently. (Zen Cart, 2010)

Some other "solutions" seem to be complicated programming exercises instead of responding to users' needs. Zen Cart puts the merchant's and shopper's requirements first. Similarly, other programs are nearly impossible to install and use without an IT expertise. Zen Cart can be installed and set-up by anyone with the most basic computer skills. Others are so expensive but not Zen Cart. It's free. (Zen Cart, 2010)

Zen Cart will deliver the ultimate online shopping experience to your customers. Navigating through your merchandise offerings is a breeze with Zen Cart. The program provides several "Spotlight" lists in addition to the traditional category-to-product links. Once a product is added to the shopping cart, secure checkout is a simple process.

After providing the billing information, customer chooses the shipping method (multiple shipping methods including real-time internet shipping quotes are built-in). Next, a payment type is chosen from one of the popular payment modules. (PayPal and AuthorizeNet are just 2 of the included modules). Last, the customer reviews the order, shipping and payment choices, and confirms the order. You are immediately notified of the order and customer automatically receives an e-mail confirmation. (Zen Cart, 2010).

After doing SWOT Analysis (Netmba, 2010) on The Zen Cart System we come out with new features for our design which we called Eze-commerce, about 40% modification of Zen Cart has been done. This new system comes after discovering weaknesses of the previous system as stated previously. Several aspects has been upgraded in order to make Eze-commerce user and administrator friendly homepage, remove all the unused banner and customize it properly, add forgotten password for admin, create new logo for Eze-commerce and upgrade define pages editor.

EZE-COMMERCE SYSTEM

In order to implement a new system based on the previous system, this project uses TRIZ (Theory of Inventive Problem Solving) as a process model to complete this project. The TRIZ is a new methodology which is a systematic approach to inventions was originated by Genrich Altshuller in Rusia during the 1940's. TRIZ is an evolving science of innovation and the body of TRIZ knowledge constantly grows with new tools and methods being added. TRIZ is a philosophy, a process and a series of tools based primarily on the concept of resolving contradictions. Engineering contradictions are the crux of many issues to date where compromise or trade-off is needed to balance between an improving versus a worsening characteristic. This is what's happening in current manufacturing environments and we probably are able to live with it for now; but as technology advances and equipment are being pushed harder, the equipment will break or deteriorate further. The manufacturing environment encompasses any kind of industry which uses equipment or tools in their manufacturing process. (Yeoh Teong San et al, 2009)

Based on the typical problem solving process, TRIZ is able to complement and enhance the 1-3 steps of the problem solving process (Yeoh Teong San et al, 2009): For this project, the tools that we used were php MyAdmin 2.10.2, Xampp, MySQL, Adobe Photoshop, PHP 5.0 and Apache 2.2

We identify the important component of the system, i.e. admin, customer, payment, shopping cart, catalog, and security. Using Trimming method to eliminate components from a system to reduce or eliminate the disadvantages or harmful functions of the trimmed components. In so doing, Trimming increases the efficiency and reduces the cost of the system. Here, we have identified several things to be trimmed and upgrading based on the Inventive Principles 32 (Color change) , 10 (Preliminary action), 2 (Taking out), and 26 (Copying).

SYSTEM TESTING AND EVALUATION

The system testing is done by several users that act as different characters which are administrator and customer. The result from this testing is very important because it can help find errors and problem in this system. The result of system testing done by several users explained in the section below.

User 1: System administrator

In the administrator login/interface, he/she will enter the username and password to login as administrator. The admin was set up the username and password as admin in order to sign in to program chair section. After admin enters the username and password, the ENTER button need to be press in order to login as administrator.

At the configuration component, the admin can manage their store, minimum and maximum value, images, customer detail, shipping/packaging, product listing, stock, logging, email options, attributes settings, Gzip compression, sessions, regulations, GV coupons, credit cards, product info, layout settings, website maintenance, new listing, featured listing, all listing, index listing, define page status and EZ pages settings.

The task contains in the Catalog component are Categories/Product, product types, product price manager, option name and value manager, attribute controller, download manager, option name and value sorter, manufacturers, reviews, specials , featured products, sale maker and product expected.

The admin can manage the payments, shipping and order total at Modules component.
To organize the customer, order, group pricing and Pay Pal IDN, just click Customer button.
At the Location/Taxes button, there are countries, zones, zones definitions, tax classes and tax rates as subcomponent.

Currencies, languages and order status can be managed at Localization button. To view products viewed, products purchased, customer order total, products low stock and customer referral, just click at Reports button. At the tools button, the admin can manage template selection, layout boxes controller, banner manager, send email, newsletter and product notifications manager, server/version info, who's online, admin settings, email settings, email welcome, store manager, developers tool kit, EZ pages, define pages editor and install SQL patches.

At the button Gift Certificate/Coupons, there are coupon admin, gift certificate queue, mail gift certificate and gift certificate sent. To add record artists, record companies, music genre, media manager and media types, click at Extras button. To logout from admin, click Logoff.
In case the administrator forgot their password, they just click at 'resend password' and fill the email address and click "Login". Then the admin will be logged in automatically.

User 2: Customer

This section discusses on the customer for this shopping cart. The customer have the limited access for this application compared to administrator. Figure below show the page that can be view and access by the customer. Firstly, the user must click Login button to login. For the registered customer, they must enter their email and password before press LOGIN button to login.

Then, the Figure 1 shows the homepage for customer.

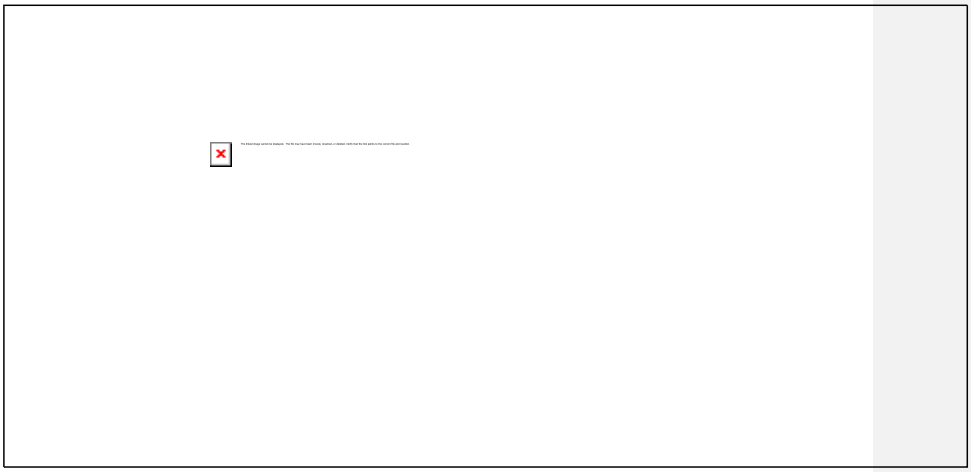

Figure 1 Customer's Homepage

To check the available products, just click Categories button.

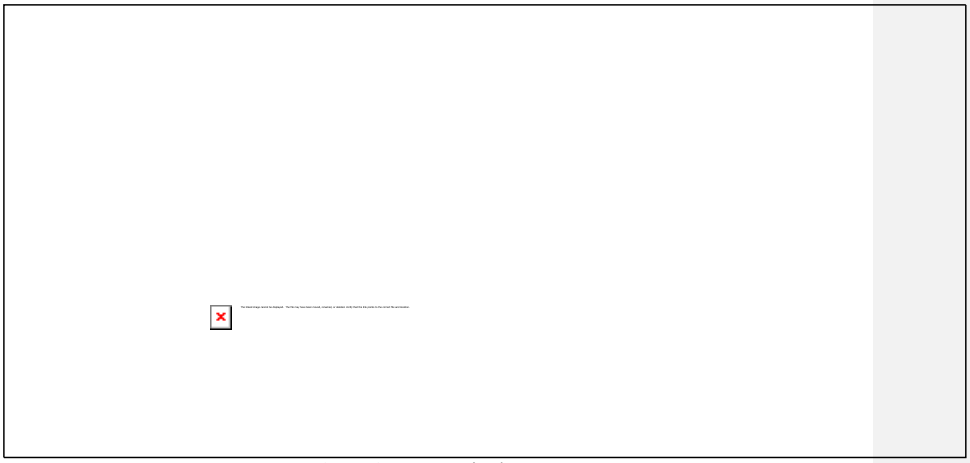

Figure 2 - Categories button

To add to cart, just enter the value in the box provided and click "add this to my cart" button Then , customer's shopping cart will displayed. Click "Go to checkout button" to check the shopping cart. To check your delivery information, click Checkout button

A full blown investigation and testing was conducted and it has been proven that this system run properly and meet the specification required. It means that the implementation and upgrading process is successful. The next chapter is the final chapter of the thesis. It will discussed the conclusion and recommendation of the project.

For this project, we have modified Zen Cart almost 40% to become Eze-commerce. The weaknesses of the Zen Cart system has been identified to produce this system. We discovered all the components to be included in our new system. Several weaknesses that we found from previous system based on the SWOT analysis, has been remedied especially on the user and administrator interface,

removing all the unused banners and customized it properly, add forgotten password for admin, create new logo for Eze-commerce, and upgrade define pages editor as stated at the previous chapter.

During system analysis, there were a lot of challenges and problems encountered in doing SWOT analysis. In order to solve the problems, efforts have been made and varieties of solutions were applied to solve it. First is we have to install the Zen Cart software many times before doing the upgrading because of the invalid username and password for administrator. Second is this system has many components that should be look into, so we decided to look into the important components only due to the time constraints. Third, it took a long time to understand the long coding of line in order to understand the function of the system.

Since the technology change rapidly, it leads to the cyber crime cases. So, it is important for the administrator to upgrade this system in term of security. They will have great loss if they take for the granted the security issues. In e-commerce, even the system down for a few seconds, it will effect the organization and their income.

CONCLUSION

E-commerce in Malaysia is still in its infancy because Malaysia can be considered a late starter given the recent spate of internet. Eze-commerce is a new software for shopping cart and it is quite good for those who is beginner in e-commerce. However, there are still weaknesses that should be pay attention. Maybe the recommendation that has been given will help them to implement this software. Besides, they have to alert with the new technology and information to ensure that their business run smoothly. Last but not least, the merchant should cope with the new threats and attacks in the internet because e-commerce is widely exposed to the hackers.

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DIFFUSION OF E-PROCUREMENT AMONG SUPPLIERS IN MALAYSIA

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ABSTRACT. This paper is discusses the factors influencing the adoption, usage and impact of e-procurement or ePerolehan (eP), among Malaysian suppliers. To achieve this aim, a framework that consists of technological, organizational, environmental, governmental and individual factors (TOEGI) is proposed. The TOEGI framework identifies the factors influencing the adoption of eP among Malaysian suppliers from the comprehensive perspective. It leads to the diffusion of eP among Malaysian suppliers which in turn assist the achievement of eP vision and mission.

Keywords: adoption, usage, impact, diffusion, TOEGI framework

INTRODUCTION

The global internet network works 24 hours a day, 7 days a week and 365 days a year, indicating that it can be accessed anytime and anywhere in the world. This facilitates the growth of electronic transactions. In other words, the Information and Communication Technology (ICT) influences the way an organization undertaking its business dramatically. Small, medium and large firms cannot close the eyes to the need to integrate information networks into their strategies, operations and performance (Saeed & Abdinnour-Helm, 2008). Companies that exploit the ICT have the ability to get closer to their customers than their competitors.

Currently, the governments around the globe, including Malaysia had started to bring into electronically deliver services to citizens. Malaysia launched the Multimedia Super Corridor (MSC) project in August 1996. Its main strategy is to expedite Malaysia's entry into the information economy, while gearing itself towards the status of a developed nation in 2020. One of the MSC seven flagship applications are e- government (eG) and the Malaysia's eG application is ePerolehan. eP has, in recent years, been used as a means to significantly reduce costs as it enables quantity purchases, encourages wider choice of buyers and suppliers, better quality, improves delivery, reduces paperwork and lowers administrative costs (Hsiao & Teo, 2005). Minahan (2001) defined eP as the process of utilizing web based technologies to support the identification, evaluation, negotiation and configuration of optimal groupings of trading partners into a supply chain network, which can respond to changing market demands with greater efficiency.

The eP system in Malaysia is developed by Commerce Dot Com Sdn Bhd. (CDC). According to CDC (2010), highlighted in the Taskforce of eP Committee Meeting Number 3/2010 (report until February 2010) by Unit eP, MoF, only 71,270 eP enabled suppliers out of 170,796 suppliers registered and active with MoF while the 66,144 eP unabled/ inactive,

suppliers whose registration has expired and never renew to be eP enabled again. This low adoption rate highlights the concern of Malaysian firm's readiness and capability to compete in the global market. eP has been identified as the most important element of e-business operational excellence (Barua, Konana, Whinston & Yin, 2001). The excellence is in the form of cost saving and operational efficiencies (Hawking, Stein, Wyld & Foster, 2004). Failure to increase the rate can reduce Malaysian supplier's competitiveness in the world. Forrester Report of January 2001, eG Fails the Grade, there are seven biggest obstacles to achieve the success of eG. The obstacles in order of priority are cultural issues, procurement processes, government coordination, skills, legislature issues and technical issues (Evans, 2003). It clear that the second major problem create by procurement processes for failure of eG. Thus there is a critical need to increase eP adoption rate in Malaysia. This is what this paper intends to contribute.

This paper is expected to contribute towards theory and practice. Theoretically, a comprehensive conceptual framework covering possible influencing factors in understanding the adoption of eP among suppliers are proposed. This conceptual framework integrates the appropriate Information System (IS) literature in order to enhance knowledge of technology adoption from the Malaysian supplier perspective. It also contributes towards theory by empirically confirming the appropriateness of various constructs and validating a conceptual framework in the context of Malaysian suppliers.

THE INTEGRATION OF THE FIVE ADOPTION MODELS

There are similarities and differences in the theoretical construct of the Technology-Organization- Environment (TOE) framework (Tornatzky and Fleischer, 1990), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis & Davis, 2003), Theory of Planned Behavior (TPB) (Ajzen, 1985; 1988; Ajzen & Fishbein, 1980), Decomposed Theory of Planned Behaviour (DTPB) (Taylor & Todd, 1995) and Social Cognitive Theory (SCT) (Compeau & Higgins, 1995a; 1995b). In a general perspective, they all are similar in that they tend to explain the adoption of technological innovation. On the other hand, the models are inconsistent in their focused context and the terminologies they use. These factors are typically used as independent variables that influence technology adoption either positively or negatively. Considering the definitions given in each model from its originators and previous studies, it could be argued that some factors are close to each other and can be merged into a single factor. Therefore, the present study combines related factors to reduce the repetition. Some factors are renamed and some terminologies are used as they are. From the above literature, it is clear that no single adoption model is dominant or superior to another from the previous researches (Celuch, Goodwin & Taylor, 2007; Kohn & Husig, 2006). Several researches employed a single model while many of them merge more than one model to better explicate the adoption situation of a particular technology innovation (Celuch et al., 2007; Kohn & Husig, 2006).

This paper conceptual framework proposed consists of the technological factors, organizational factors, environmental factors, governmental factors and individual factors (TOEGI) for the eP adoption, while industry type acts as a controlled variable (Figure 1). The determinants of technological, organizational, environmental and governmental factors are adapted from TOE framework. The four determinants of individual factors, namely, performance expectancy, effort expectancy, social influence and facilitating conditions are adapted from UTAUT. The attitude determinant is adapted from TPB and DTPB. The self efficacy determinant is adapted from the SCT. Hence, taking this argument, a comprehensive research framework is now developed in the next section.

THE PROPOSED FRAMEWORK OF EP ADOPTION

A comprehensive research framework that consist of technological, organizational, environmental, governmental and individual factors (TOEGI) and also industry type as a controlled variable is then developed (Figure 1). In summary, technological factors consist of perceived direct benefits, perceived indirect benefits and perceived cost. The organizational factors include firm size, information sharing culture and IS committee. The environmental factors consist of business partner influence and competitor influence. The governmental factors include rules and regulations, incentives and promotions. Last but not least, the individual factors consist of performance expectancy, effort expectancy, social influence, facilitating conditions, attitude and self efficacy. The list of constructs, summaries of hypotheses are presented in Table 1.

Table 16. Summary of Research Hypotheses.

HN	Independent Variables	Dependent Variables
H1	Perceived direct benefit	Adoption of eP
H2	Perceived indirect benefit	Adoption of eP
H3	Perceived costs	Adoption of eP
H4	Firm size	Adoption of eP
H5	Information sharing culture	Adoption of eP
H6	IS committee	Adoption of eP
H7	Business partner influence	Adoption of eP
H8	Competitor influence	Adoption of eP
H9	Rules and regulations	Adoption of eP
H10	Incentives and promotion	Adoption of eP
H11	Performance expectancy	Adoption of eP
H12	Effort expectancy	Adoption of eP
H13	Social influence	Adoption of eP
H14	Facilitating conditions	Adoption of eP
H15	Attitude	Adoption of eP
H16	Self efficacy	Adoption of eP

Table 2 lists eP usage activities by Malaysian suppliers and it is adapted from Teo, Lin & Lai (2009). They examined eP usage from the perspective of Singapore. Based on ASEAN spirit this study emulates eP usage activities developed by Teo et al. (2009). Regarding the impact of eP, this study emulates Teo & Lai (2009). They uncovered positive impact of eP adoption on the following perspective: (1) cost reduction (Hawking et al., 2004; Konicki, 2001; Minahan & Degan, 2001); (2) internal efficiency (Hawking et al., 2004; Konicki, 2001; Minahan & Degan, 2001); (3) managerial effective (De Lone & Mc Lean, 1992; Konicki,

2001; Minahan & Degan, 2001); and (4) coordination (Konicki, 2001; Soh, Mah, Gan, Chew & Reid, 1997).

Table 2. Types of eP usage activities by Malaysian suppliers.

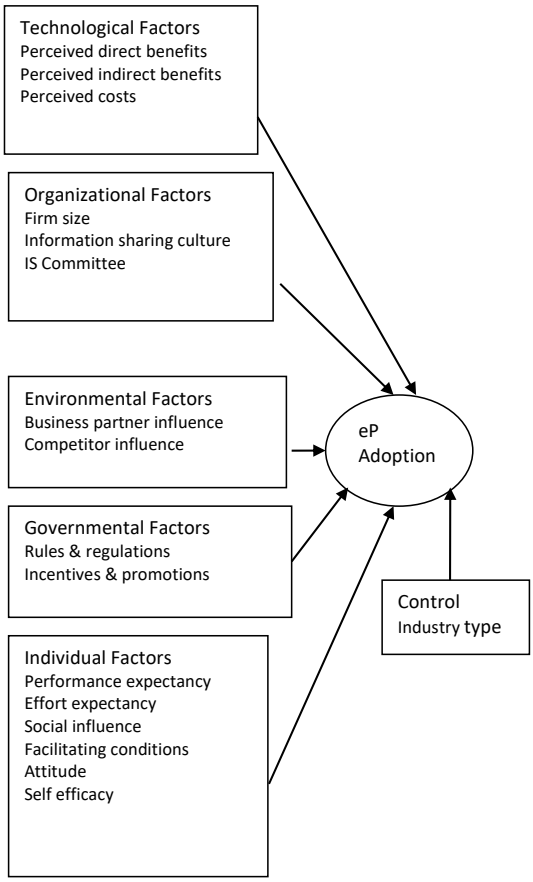
Types of eP activities conducted
1. Email correspondence between buyer and seller.
2. Sending Request for Proposal (RFP) / Request for Information (RFI) / Request for Quotation (RFQ) to trading partners.
3. Identify new suppliers and research into suppliers markets.
4. Gathering and distributing purchasing information both from and to internal and external parties.
5. Electronic order placement.
6. Price and availability checking
7. Tracking orders
8. Integration of procurement within the internal systems
9. Electronic payment
10. Creating and approving purchase requisites
11. Email in contract management
12. Electronic submission of tenders
13. Advertising tenders

(Source: Teo et al., 2009)

The prominent impact of eP is cost reduction (Hawking et al., 2004; Konicki, 2001; Minahan & Degan, 2001). The firms that source their supplies through can streamline and automate the procurement process and in turn reduce manpower costs, administrative and paperwork costs, operating and inventory costs. Using eP also enhances internal efficiency via the reduction in procurement cycle time, responsiveness to production and customer needs and mistake in the production capacity plan as well as less maverick spending. Being equipped with eP also enables an organization to enhance managerial effectiveness. This includes better decision making accuracy and speed, better resource usage, and higher visibility. Cross functional coordination is also improving since other functions can be connecting with purchasing function electronically. This in turn improves supply chain relationship management and trading, and business partner's coordination. In short, extensive usage of eP increases supplier's performance.

CONCLUSION

The aim of this paper is to addresses the factors influencing the adoption, the usage trend and impact of eP among Malaysian suppliers. To achieve this aim, a framework that consists of technological, organizational, environmental, governmental and individual factors (TOEGI) is proposed. The high level of adoption enables the achievement of Malaysia's eP mission and vision.



(Source: Framework developed for this study)

Figure 35. The proposed framework of eP adoption.

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A COMPARATIVE STUDY ON THE BEST E-BUSINESS SOLUTION FOR SMALL COMPANIES

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ABSTRACT. In Information and communication technology (ICT) era, it is important to determine the E-business solution for a company. Due to high entry cost of the electronic business (E-business) and time-consuming job, it is essential to study the best E-business solution prior to E-business setup. Currently, there are three different types of E-business solution which are Electronic commerce (E-commerce), Mobile commerce (M-commerce) and Television commerce (T-commerce). Comparative study on these three E-Business solutions are conducted based on three main components which are technological infrastructure, content, and services. The finding from the study found that M-commerce can be considered as the best option to E-business solution for a small company.

Keywords: E-Business, E-Commerce, M-Commerce, T-Commerce

INTRODUCTION

A company which plan to implement E-business should before hand compare and differentiate the existing business solutions so that the implementation will enhance their business activities. In order to expand business activity and to enable people to proceed with the commercial activities at anytime, anywhere, and any place, it is necessary for the company to identify the most potential E-business solution. However, there are barriers to the implementation among which is lack of awareness towards the E-business solution (Lamersdorf et al., 2004). The rapid growth of Information and Communication Technology (ICT) made the implementation of new Internet technologies complicated. Due to the costly price of Internet technologies to facilitate the implementation of E-business, most companies have low perception and consciousness towards these technologies; and this issue will cause a profit loss to the companies. E-commerce can be defined as execution of transactions over the interconnected networks between two or more participants (Kalakota & Robinson, 2003). Meanwhile, T-commerce uses broadband to enable the interactive power between Internet and traditional TV programming namely interactive TV technology (iTV). T-commerce also allows consumers to perform home shopping and this is known as Internet transferred commercial contents to medium of television (Jens, 2005).

With the fast growing of ICT, it brings the typical online retailing into a secure wireless transaction application using mobile phone as a middleware. The major aim of E-business is to expand the business activities over the Internet by achieving global sales and target a larger market group (Anthony, Ali, & Hanifa, 2006). In the United State (US) there are already 9.2 million mobile users making payment for goods or services through the mobile phone. To date, there are also about 49% mobile users are expected to use M-commerce in the future (Cellular-News, 2008). M-commerce activity uses the services of mobile phone and wireless

networks to perform the transaction and payment process. The innovation of the mobile devices can enhance business activities via M-commerce transactions. The cost effectiveness of M-commerce is one of the driven factors for a company to implement E-business in their business (Lamersdorf et al., 2004).

For this study, a thorough review of several articles and research papers published in various academic journals has been conducted. Comparative study on various research articles and academic publication has helped the researchers to identify the E-business solution to the existing or new company. In addition, discussion on the characteristics of M-commerce and the differences between M-commerce, T-commerce and E-commerce is also presented here. The thorough study will lead to the suggestion on the best option to the E-business solution which will be explained in the last section of this paper.

M-COMMERCE

M-commerce definition

E-commerce has become the prominent E-business solution before the appearance of M-commerce. In general, mobile commerce or M-commerce can be defined as the exploration of applications, services and transaction or purchasing activity via mobile devices (Anthony et al., 2006; Sadeh, 2005). According to Upkar (2008), M-commerce is an application that uses handheld mobile devices, wireless networks with added features such as secure, atomic transactions and mobile middleware. Meanwhile, Khosla et al. (2005) has defined M-commerce as an electronic commerce transaction that involves a payment and contract process via Internet with the aid of mobile device. Efficiency and quality of service of the business process can be enhanced by using M-commerce which have unique characteristics such as context awareness, personalization, transaction orientation and geographical constraint (Khosla et al., 2005). On the other hand, Taniar (2009) stated that adoption of M-commerce is decreasing due to several issues. There are seven main issues that have been identified which are (a) lack of effective business models in generating revenues (b) lack of security perception, (c) rapid changing in technology induces short of product lifecycle (d) non-convergence of standards (e) usability of devices (f) limitation of bandwidth and (g) cost.

Technology Road Map of M-commerce

According to Becker (2008), there are five generations in technology road map that representing the transmission bandwidth of each generation era in cell phone technology systems. Table 1 summarized the evolution of the mobile devices of the E-business application.

Table 17: Technology Road Map of M-commerce (Becker, 2008; Govil, 2008)

Generation	Technology Road Map
1.0G (1st.Generation)	❖ 1G system using analogue radio transmission in the cellular system and AMPS (Advance Mobile Phone Standard Services)
2.0G (2nd.Generation)	❖ Digital radio transmission, information digitized into binary coded data packets. ❖ Two main competing digitization schemes: Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA) ❖ Features include data encryption, short text messaging, and fax and data transmission
2.5G	❖ 2.5G systems upgraded with better data throughput called General Packet Radio Service (GPRS) enhancement from GSM ❖ 2.5 CDMA technology, IS-95B standard 64-128 kbps
2.7G	❖ Enhanced data rate for Global Evolution (EDGE) is an extension to GSM technology ❖ Transmission speeds: 384-553.6 kbps
3.0G (3rd. Generation)	❖ 3G systems enhance with wireless broadband connectivity ❖ Transmission speeds: 384 kbps – 2 Mbps ❖ 3G devices creating borderless mobile services
4.0G (4th Generation)	❖ 4G wireless combination of the 3G cellular networks and Wi-Fi network (combination of WiMAX and WiFi)

	❖ Transmission speeds: 100 Mbps – 1000Mbps
5.0G (5th Generation)	❖ Focus on user terminals mobile network with complete wireless communication ❖ Mobile devices over IP that support IPv6

The M-commerce value chain model

Porter (1985) defines value chain model as linkage and integration of series of activities that deliver, create and value products or services to customer by the enterprises. Porter also emphasized that it is important for enterprises to encompass the value chain in a broader value system which is industry value chain. M-commerce value chain can be categorized into eleven roles (Kuo & Yu, 2006). Figure 1, illustrated the categories and roles of M-commerce value chain (Kuo & Yu, 2006) and Table 2 shows eleven categories of M-commerce value chain and roles of each category.

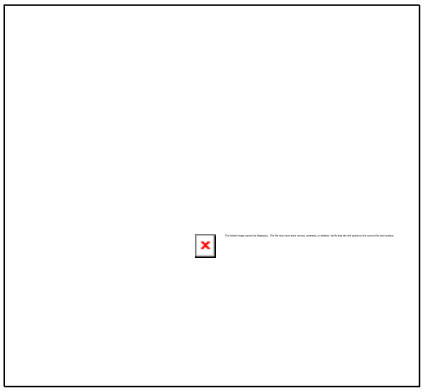

Figure 36: Category and Roles of M-commerce Value Chain (Kuo & Yu, 2006)

Table 18: M-commerce Value Chain Categories and Roles (Kuo & Yu, 2006; Olsson & Nilsson, 2002; Xu, Tjoa, Chaudhry, Wang, & Lu, 2008)

Category of M-commerce Value Chain	Roles of M-commerce Category
Technology platform vendors	To perform maintenance in backbone network, base stations, and the infrastructure. Also provides operating systems for Smartphone and micro-browsers
Infrastructure and mobile equipment vendors	To design and manufacture infrastructure to build devices that support WAP, GPRS, 3G, and so forth
Application platform vendors	To act as a middleware provider including wireless, application and also providing pre-build components.
Application developers	To convert Internet-based applications into the wireless environment and act as application software developer
Content developers	To provide, design, or produce various kinds of products or services
Content aggregators	To provide various functions which include aggregating, integrating, repackaging or distributing products or services
Mobile portal providers	To act the role of a "gate" to mobile Internet and provides search indexing engine
3G mobile network operators	To provide mobile communication networks

Mobile service providers	To provide two sections to consumers that include service based on wired Internet network and application services for mobile network
Mobile equipment retailers	To sell or be a distributor for all kinds of mobile equipments and network operators.
Customers	Customer mainly are end user or enterprise users

For this study, the eleven categories of M-Commerce value chain have been regroup into six categories namely vendors, developers, aggregators, service providers, retailer, and customer based on their types. Vendors consist of three types which are technology platform, infrastructure & mobile equipment, and application platform vendor. Developers consist of application and content developers. Meanwhile, content aggregators are those who provide various functions from integrating to distributing products or services. Service providers are mobile portal and mobile service provider. Mobile equipment retailers are those who provide all kinds of mobile equipment and network operators to end users. As for customers, there are the existing or potential end users of M-commerce.

There are three core processes within infrastructure and services (Barnes, 2002), which are Mobile Transport, Mobile Services & Delivery Support, and Mobile Interface & Applications. Mobile transport involves communications including network transportation, transmission, and voice and data switching. Mobile services and delivery support involves the infrastructure in connecting Internet, security, server platform, and payment systems. Finally, mobile interface and applications involve processes which integrate infrastructure and systems with users that include interface, navigation, and application or middleware development. Content consists of three main core processes which are Content Creation, Content Packaging, and Market Making (Barnes, 2002). Content creation focuses on creating digital material, for example audio, video and textual information. For content packaging, it combines package content by using software. As for market making it acts as primary roles in marketing and selling content, which includes the development of programme, delivery service and customer support. In this paper, the technological infrastructure and services provided are separate into the two different areas. Thus, there are three main component area dimensions to compare among three E-business solutions which are technological infrastructure, content and services.

COMPARISON OF VALUE CHAIN BETWEEN E-BUSINESS SOLUTIONS

Technological Infrastructure

Communication of computer over a well-established Internet that used Transmission Control Protocol/Internet Protocol (TCP/IP) and Domain Name System (DNS) has enabled billions of customers engaging in worldwide E-business. In 1989, the standard World Wide Web (WWW) has begun the commercial access to Internet and most of the E-commerce applications at this time are web-based (Shaw, Zhang, Yuan, & Archer, 2002; Wise & Sinclair, 2002). Internet and Web became a turning point in E-commerce and created a low E-commerce entry cost (Kalakota & Robinson, 2003). WWW on the Internet has enable firms to integrate and coordinate their information into the global network. Usage of web helped small business to be able to compete with multinational companies that use the same technology infrastructure. In addition, static terminal devices mainly come with certain technological features that are needed in E-commerce, for example personal computer (PCs) that has powerful processor, large data storage, big screen and complete input features. There are also minimal infrastructures that are need to be invested by customers who are involved in E-commerce such as a PC, a modem as well as an Internet account (Kalakota & Robinson, 2003). Some web sites are free to access but there are some company web site that will charge the users (e.g. subscription fees, member fees and so forth).

Prior to M-commerce implementation service, it is important to decide the location of management, real-time delivery, transactions support, security, and wireless network

reliability (Wise & Sinclair, 2002). In contrast to Internet, M-commerce services have a limited bandwidth as summarized in Table 1 (e.g. Bluetooth), mobility restrictions and slightly small screen (Shaw et al., 2002; Wise & Sinclair, 2002). The complexity of the system integration and application development is higher than the Internet due to lack of interoperability standards and business model. Even though M-commerce has its limitation, mobile devices are small in size and more portable (e.g. mobile phone and PDAs), has better voice data transmission, mobility and portability (Shaw et al., 2002).

T-commerce environment integrates wired computing and multimedia-based transmission medium to large targeted audiences. There are two delivery method in T-commerce services which are (a) trough cables, satellites or DSL to a television set-top box (STB – a device with audio-video decoding and broadband) and (b) through a pc (acts as receiver to decode) with broadband connections and display in digital TV formats (Simon, 2002). Differing from E-commerce and M-commerce, T-commerce required a high business entry cost. This is because the company needs to develop partnerships with broadcasters in order to build a new electronic channel. In terms of facilities, technology for television commerce can be costly compared to E-commerce and M-commerce. Users are required to pay for cable subscriptions (Wu & Hisa, 2004).

Content

Content can be described as the delivery of information, transactions or other products that occurred over the network (Wu & Hisa, 2004). Content that are delivered in E-commerce environment is the standard Hypertext Transfer Protocol (HTTP). The HTTP enables information-intensive to display the online product catalog and doing business activities. HyperText Markup Language (HTML) and Extensible Mark-up Language (XML) store and package the content in distribution centers (network server) before they are transfered to the client-server.

In M-commerce mobile environment, the content is a message-based content, which consists of textual, pictures, audio, and video. The major challenge in M-commerce is the transformation of the web site contents into mobile contents. The content of web page falls into format in the form of “business card” (vCard) in WML and this card help client to navigate within M-commerce environment. Thus, content creation in E-commerce is more compressed compared to web page (Wu & Hisa, 2004). Meanwhile, T-commerce environment is more likely have less information compared to E-commerce and M-commerce environment. T-commerce is not able to deliver huge interlinked information web site content over the Internet. It also stores and delivers web content in two ways, which are by uploading selected popular web site and downloading upon user request (Jens, 2005). Thus, T-commerce can only store selected and popular web site for client to display on the television. These can cause disparity to the other firms which are also doing an online business.

Services

Internet makes E-commerce worldwide and Web enables E-commerce deliver rich information to potential customers. In contrast to E-commerce and T-commerce, M-commerce applications rely on private wireless communication and mobile devices that are provided by the network operators in order to access to the Internet. Besides that, services that are delivered by both M-commerce and T-commerce are mostly sent to a specific region. M-commerce also delivers services to a small size mobile device and it can be anywhere and anytime. E-commerce can be categorized into business to business (B2B), business to customer (B2C), and customer to customer (C2C). Meanwhile, M-commerce environment are categorized into two types which are person to person (P2P) and person to system (P2S). For T-commerce, it only has one category which is B2C. Table 3 summarized the differences among E-commerce, M-commerce and T-commerce in terms of technology infrastructure, content and services.

CONCLUSION

A better understanding of the E-business solution will help new company or an existing small company to expand their business worldwide. This paper intends to show the added value of M-commerce compared to the E-commerce and T-commerce in E-business environment. As shown in Table 3, features of M-commerce such as technological infrastructure, content and services reveal its flexibility in term of service delivery compared to E-commerce and T-commerce. From the thorough literature survey, it suggests that a suitable E-business solution to be considered for small firm is M-commerce. However, despite the flexibility of M-commerce, there are issues that need to be aware of with M-commerce which are lack of standard business model and high business entry cost. For future work, more research can be done to identify M-commerce standard business model and how stakeholders can minimize the entry cost when they plan to use M-commerce as their E-business solution. Besides that, an extensive study also can be conducted to measure the effectiveness of M-commerce as the best E-business solution regardless the size of the firms.

Table 19: Differences of E-commerce, M-commerce and T-commerce (Holsapple & Sasidharan, 2009; Jens, 2005; Shaw et al., 2002; Simon, 2002; Wu & Hisa, 2004; Xu et al., 2008)

	E-commerce	M-commerce	T-commerce
Technological infrastructure			
Network Infrastructure	1. Wired networking 2. Data-oriented network 3. Internet channel 4. High and unlimited bandwidth 5. TCP/IP, HTML	1. Mobile/wireless networking 2. Voice-based network 3. Mobile phone network channel 4. Limited but low bandwidth 5. GPRS, PCS, TCMA, CDMA, WLAN, TCP/IP, Bluetooth, 3G and 4G	1. Television and Set-top box/wired networking 2. Television-based network 3. Internet channel/satellites 4. High and unlimited bandwidth 5. TCP/IP, DVB consortium
Communication Devices	1. Interface devices (personal computers) 2. Powerful CPU, large memory, and big screen 3. Full input model	1. Interface devices (mobile phones, PDAs) 2. Limited CPU, small memory, screen, and slow bearers 3. Limited input model	1. Interface devices (televisions) 2. Big screen and high resolution 3. Full input model
Business	1. Low business entry cost 2. Provide free or low cost Internet access to end user	1. High business entry cost 2. Required high mobile services charge to the end user.	1. Low business entry cost 2. Provide free or charge cost to the Internet access user
Content			
Content Creation	1. Hypermedia 2. Information-intensive 3. Transaction information	1. Voice and text 2. Message-based 3. Transaction and location information	1. Hypermedia 2. Information-intensive 3. Transaction information
Content Packaging	1. Hypertext (eg. HTML, XML) 2. Hyperlink navigation model	1. vCard (e.g. WML, HTML, XSL) 2. inter-card navigation mode	1. Teletext, eg. used APIs (Application Programming Interfaces) Navigation tools EPGs (electronic program guides) or iPGs (interactive program guides)
Services			
Services Range	1. Global 2. Delivery services from personal computer that are connected to Internet	1. Regional 2. Delivery services to person accompanied by a mobile device	1. Regional 2. Delivery services from set-up box that connect to the Internet and display to television
Information provided	1. Rich information 2. Less timing-critical	1. Simple and short messages 2. Time critical	1. Limited or selected web sites information

	3. Service to a fixed point	3. Service to a moving target	2. Less timing-critical 3. Service to a fixed point
Transaction	1. Complete and complex transactions 2. Digital payment 3. 3rd party payment system	1. Simple transactions 2. Digital payment or bill 3. Build-in carrier payment system	1. Simple transaction. 2. Digital payment or bill 3. 3rd party payment system
Services classification	1. B2C (business to consumer) 2. B2B (business to business) 3. C2C (customer to customer)	1. P2P (person to person) 2. P2S (person to system)	1. B2C (business to consumer)

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A STUDY ON METHODS FOR CREATING PERCEIVED CUSTOMER TRUST IN E-BUSINESS

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ABSTRACT. E-Business has spread widely over the years, and many companies have shifted their businesses to the internet, as this is the cheapest and easiest way to expand a business globally. However, due to the increasing number of instances of online fraud more and more customers are reluctant to be involved in online purchasing. This paper explores methods for creating perceived customer trust towards e-business. The first step is to understand what trust is and how trust can be formed in an individual towards a third party. In addition, the factors which affect the forming of trust among customers are examined. Although there are many factors which can affect the forming of trust among customers, this paper focuses on a few main factors: customer culture, personality and internet literacy; and website design, reputation and functionality. After defining the factors that affect online trust, we review methods for creating perceived online trust from the viewpoint of those factors. The results show that there are various methods of solving the problem which come from the factors affecting online trust. Thus, we conclude that all methods of creating perceived trust play a significant role in the success of e-commerce. However, more research is needed in this field to identify further methods that will assist e-business companies to gain customers' trust.

Keywords: trust, perceived customer trust, trust construct, trust factors

INTRODUCTION

Customer trust is vital for the success of e-business (Lumsden, 2009; Salam et al., 2005; Kumaraguru, Acquisti & Cranor, 2006). In e-business, customers perform transactions without face-to-face interaction and lack familiarity with the people behind the websites (Riegelsberger, Angela Sasse & McCarthy, 2003; Araujo & Araujo, 2003). In addition, customer privacy is also vulnerable to misuse because of the lack of control over the personal information which they provided in the e-business transaction process (Araujo & Araujo, 2003). Besides these issues, online fraud has increased over time, which threatens e-business online users and increases their uncertainty in online shopping (Kumaraguru, Acquisti & Cranor, 2006). Thus, it is difficult to perceive trust from customers in e-business. To ensure the success of e-business, it is very important to study the methods of creating perceived customers trust in e-business.

It is necessary first to understand the meaning of trust. Customer trust can be defined as the willingness and the intention of customers to have positive attitudes and beliefs towards the website and to undertake transactions on the web site (Salam et al., 2005). Hence, it is important to identify the methods by which sellers can create trust in their customers in e-

business. From the results of various studies on trust, we can classify trust into different categories. Several theories exist which explain trust from different perspectives. *Social Exchange Theory (SET*) states that individuals act in certain ways because they have the expectation that the value of output will be higher than the cost of input (Blau, 1964). *Expectation-Confirmation Theory (ECT)* states that individuals' expectations are compatible with the performance they perceive and thus affects their confidence to make a second transaction (Oliver, 1980). *Theory of Reasoned Action (TRA)* asserts that the actual behavior of an individual can be predicted through their beliefs and attitudes (Oliver, 1980; Fishbein & Ajzen, 1975). *Theory of Planned Behavior (TPB)* mentions several factors that affect individuals' behavioral intention, including their attitude towards the behavior, subjective norms, and perceived behavioral control (Ajzen, 1991). These theories of trust assist us in defining the methods for perceiving customers' trust.

Apart from the theory of trust, other factors play a significant role in obtaining and retaining customer trust in e-business. These include the customer's cultures, computer literacy, and personality, and the website's reputation, design and functionality (Riegelsberger, Angela Sasse & McCarthy, 2003; Araujo & Araujo, 2003; Li et al., 2009; Souza & Domelas, 2008; Lumsden & MacKay, 2006). By the analysis of both theories of trust and factors affecting customer trust, the most effective methods of creating perceived customer trust can be identified.

BACKGROUND STUDY

In this paper, researcher have done literature survey to obtain more information about the existing methods for creating perceived customer trust in e-business and have different thought regarding the problem based on previous researches. The literature survey starts with exploring academic papers and other valid resources which tackle the similar issues. Then, review of the literature was done in order to provide clear understanding towards the focus of the study. To carry out our study on the methods of creating customer trust in e-business, several concepts needed to be clarified and understood. First and foremost, the definition and the analysis of trust from different perspectives were studied. The role of trust in e-business was identified and the different types of customer trust in e-business were studied. Next, we examined customers' beliefs, attitude, behaviors and environment, all of which affect the trust of customers towards e-business. From this, we found that for customers to perceive trust, we must understand the characteristics of trust. This will enable us to figure out the requirements of customer trust and hence can yield a useful method of enhancing the e-business.

What is trust? Researchers have defined trust in various ways and from many different perspectives (Schultz, 2006). Different fields of study have different views on trust, such as psychology, social psychology, sociology, economy and so on. From the psychological view, trust is a general positive feeling of belief and expectation triggered in the personality of an individual by a third party (Grabner-Kräuter, Kaluscha & Fladnitzer, 2006). In the social psychological view, trust occurs when an individual has confidence in a third party, as shown by acting on their belief (Golbeck & Hendler, 2006). For the economic and sociological view, trust is gained by increasing the confidence of an individual in the third party through decreasing the anxiety and uncertainty in a transaction (Grabner-Kräuter, Kaluscha & Fladnitzer, 2006). Although there are different views of trust from different perspectives, each point of view should be taken into consideration while figuring out the methods of perceiving customer trust in e-business.

Several factors lead to the construction of trust. These construct factors are trusting beliefs, attitude towards trust, trusting intention, disposition of trust, system trust and situational decision to trust (Zhang & Zhang, 2005). Trusting beliefs are defined as degree of trustworthiness of an individual towards a third party based on their perception of the third party's characteristics (Salam et al., 2005; Schultz, 2006). Attitude towards trust is the

evaluation of trusting behavior and the belief of an individual in the outcomes of performing trust (Zhang & Zhang, 2005). Trusting intention is the willingness of an individual to rely on the third party without any control or influence over the trustee (Schultz, 2006). Disposition of trust is the measure of the degree to which an individual is willing to depend on others based on their past experience and socialization (Lumsden, 2009; Lumsden &MacKay, 2006). System trust is trust regarding the functioning of a system (Huang & Fox, 2006). System trust can be viewed in two different ways. Situational normality means belief in success when the predicted situation is normal and structural assurance means belief that the contextual structure can assure a good outcome (Zhang &Zhang, 2005). Last but not least is the situational decision of trust. Situational decision of trust means that the intention of trust is triggered by a particular situation but not by the attributes of the third party (Zhang & Zhang, 2005). All of the trust construct factors are keys to triggering the trust behavior. Figure 1 illustrates how basic construct trust is formed.

To put it in a nutshell, the studies of definition and constructs of trust show that there exist many dependencies for obtaining trust from an individual, including the personality of an individual, the culture which they perceive, the reputation of the third party, and so on. Those dependencies become the factors which play an effective role in the development of customer trust in e-business. Factors affecting customer trust are further discussed in the following section.

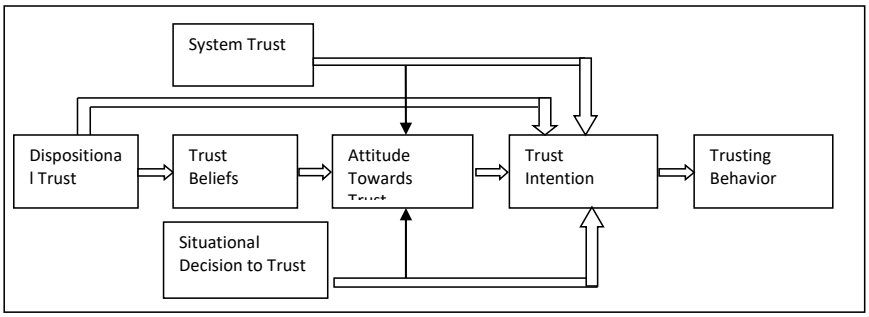

Figure 37: Basic Constructs of Trust (Zhang & Zhang, 2005)

FACTORS AFFECTING CUSTOMER TRUST

There are many factors which may affect customers' trust in an e-business and hence influence their online purchase decision-making. However, only few common factors will be discussed in this paper: customer culture, personality, and computer literacy, and webpage design, reputation and functionality. These factors are selected because they are related to the customers themselves and to the website which are important to the e-business environment.

Cultural values of the customer will affect their behavior and trust intention (Li et al., 2009). E-business serves global customers who come from different cultural backgrounds. Their cultural values will affect their dispositional trust (Lumsden &MacKay, 2006). Dispositional trust is a generalized expectation about the trustworthiness of others (Zhang & Zhang, 2005). Furthermore according to Li et al. (2009), the cultural dimensions of individualism/collectivism and time orientation have a significant effect on the trust intention of customers. Hence, people from different cultural backgrounds will respond differently to the same website.

Personality is the unique behavior displayed by an individual based on their emotions, thoughts and behavior patterns (Lumsden &MacKay, 2006). The personality of customers

will affect their trusting intention (Lumsden &MacKay, 2006). Trusting intention is the willingness of an individual to trust a third party (Zhang & Zhang, 2005). People who exhibit extroversion and openness to experience will have a higher degree of disposition of trust while neurotic and conscientious people tend to have lower disposition to trust (Lumsden & MacKay, 2006). Disposition of trust has a significant influence on a customer's intention to make an online purchase (Collin, 2006). Thus, customers who differ in personality will act differently in the e-business world.

Internet literacy is the degree of knowledge regarding the internet possessed by the customer. When customers have a higher degree of familiarity with the internet, they have a higher tendency to undergo the online purchasing process (Souza & Domelas, 2008). They experience a lower level of risk. A customer's risk perception will affect their attitude towards trust (Souza & Domelas, 2008). Attitude towards trust is the evaluation of trusting behavior and the belief of an individual in the outcomes of performing trust (Zhang & Zhang, 2005). So the customer's internet literacy influences their decision to make a purchase online.

Website design indirectly represents a particular company's image. Customers tend to infer the trustworthiness of vendors from their websites (Riegelsberger, Angela Sasse & McCarthy, 2003). E-business environments which take advantage of the 3D virtual space to demonstrate their products using human-like avatars will increase the trust of customers (Nassiri, 2008). Hence, websites which allow customers to better visualize their products and which can convey the information to customers in a simple yet attractive form will enhance the trust of customers towards the site.

Website reputation is very important in gaining trusting beliefs from customers. Trusting beliefs are the factors which let other people feel that one individual or organization is trustworthy (Zhang & Zhang, 2005). Benevolence, competency and predictability are the essential characteristics needed for a vendor to generate trusting beliefs (Salam et al., 2005). Benevolence refers to good deeds done by the company, competency is the honesty value a company possesses, and predictability is the degree to which a company has consistent and predictable sales actions (Salam et al., 2005). Thus, creating and maintaining a good company image of the e-business is very important.

Website functionality refers to the technology used in the site. Technology is one of the factors affecting customer trust (Zhang & Zhang, 2005). Technology used to perform the functionality of the website, such as fast connection, ease of use, security control, and so on, can raise the customer's system trust and intention to use the website by creating a high level of trust in the usefulness of the website (Li et al., 2009; Zhang &Zhang, 2005). System trust is defined as an individual's belief in future success based on the proper structure of an organization (Zhang & Zhang, 2005). So, website functionality is also one of the important elements which can affect customer trust.

From the various studies, we conclude that the factors which affect customer trust can be divided into two categories, internal and external. Internal factors are those arising from the customer himself; for example, customer culture, personality and computer literacy. External factors are factors of the e-business environment, such as webpage design, reputation of the website and website functionality.

METHODS OF PERCEIVING ONLINE TRUST

Currently, there exist numerous methods which are used in websites to perceive customers' trust. However, there is still a need to analyze and determine the methods of perceiving customer trust in e-business from various angles.

For cultural factors, people who have different cultural backgrounds will perceive the usefulness of a website differently (Li et al., 2009). Most e-business sites tend to be designed

with localized elements and style (Li et al., 2009). Hence, to create customer trust websites should be designed according to the cultural values possessed by the target market of the site. For instance, a site may want to provide alternative channels of communication between customers and vendor by using multiple languages if the target market is made up of global customers (Lumsden, 2009).

Personality of customers is a factor which is difficult to fit into a suitable method of generating perceived trust because different personality customers may perceive the type of trust trigger differently (Lumsden & MacKay, 2006). As an example, a customer who is more extroverted and open to experience will be more concerned with the website's privacy measures, security and feedback but not with the logo or design (Lumsden & MacKay, 2006). Thus, a website should be developed according to the general personality of its customers. General elements such as privacy policy, feedback, security, website design and so on should be included in an e-business website.

For customers lacking internet literacy, they are less familiar with internet technology and perceive a higher risk compared to those having good internet literacy (Souza & Domelas, 2008). To trigger trust among the low-level internet literacy customers, the first step is to reduce their feeling of risk towards e-business by, for example, including clearly stated privacy policies and vendor information in the site (Lumsden, 2009). The website should be simple and easy to navigate by having a simple purchasing process so that users will not confuse and lost in the middle while surfing the site (Lumsden, 2009).

Websites design is the main element by which users gain their first impression of an e-business company. Customers will infer the trustworthiness of the vendor through the design of the website (Riegelsberger, Angela Sasse & McCarthy, 2003). To trigger trust in the customer, an e-business site should have a professional design with an attractive layout and design, use color in high contrast and create a comfortable view (Lumsden, 2009). The graphic design should be at a professional level, and an appropriate amount of animation should be used in the site to avoid irritating customers while still attracting them (Lumsden, 2009). A good design can give customers confidence towards the particular e-business site and create a trusting intention towards the site.

Website reputation refers to having a good image of the e-business. To create a good impression in customers of an e-business site, branding of products and the e-business logo play a significant role as they are key elements in the success of an e-business site (Lumsden, 2009). Hence, to create perceived trust in a customer, an e-business site should have brand name and logo which represent the company and can easily be recognized. Customer testimonials and feedback are also one of the trust triggers for customers (Lumsden, 2009). Thus, testimonials and feedback from customers should be included in the website.

Last but not least, good website functionality is essential in gaining customer trust. Trust triggers in the area of website functionality include having third party security seals and up-to-date technology and security measures (Lumsden, 2009). Online fraud is one of the risks faced by customers when purchasing online (Kumaraguru, Acquisti & Cranor, 2006). Thus, the website's security system is an essential element for customers to feel trust towards an e-business. Methods of causing customers to perceive trust in e-business go beyond what we have mentioned previously. To optimize the performance of a website in gaining customer trust, an e-business should analyze the background of their customers and apply various methods of creating perceived trust in the website.

DISCUSSION

Our study on the definition of trust and the basic formation of trust found that there is no standard definition for trust. Researchers define trust from various perspectives and hence have different definitions (Araujo & Aroujo, 2003). There are also several construct factor of

trust (Zhang & Zhang , 2005). Most of the papers emphasized on the importance of disposition of trust from customers in enabling the success of e-business (Lumsden, 2009; Lumsden & MacKay, 2006; Zhang & Zhang, 2005). However, other construct factors also have a significant role in forming trust behavior.

The formation of trust relies on internal factors which arise from the customer's own self or external factors which arise from the environment provided to the customers. There are many factors which can affect customer trust; there is no standard measurement by which to determine the most effective method of causing customers to perceive trust in an e-business. However, in order for a business to implement the best method for creating perceived online trust, we must first understand the basic formation of trust (Zhang & Zhang, 2005). Although it is impossible for us to change the internal factors -- that is, the customer's own personality and culture-- we can change external factors like the environment. If the methods of creating perceived trust which are applied to the websites for our target market result in better performance of the website, then that method can be considered the effective method for that particular website.

All in all, from our point of view, different websites may need different methods to cause customers to perceive trust, since the target markets differ from one to the other. However, prior to determining the most effective methods, we need to analyze the preferences of the target market and study their characteristics and types of trust. Based on our study, we identified the most important factor for creating perceived online trust from customer view which are cultural, personality, Internet literacy, Website design, reputation and functionality. Table 1 summarizes the factors affecting online trust and methods to create perceived online trust.

Table 20. Summarization of Factors and Methods for Creating Perceived Online Trust

Factors	Methods
Cultural (Li et al., 2009)	➢ Design the website with localized elements and style ➢ Design website according to cultural values possessed by target market ➢ Provide alternative channels of communication between customers and vendor by using multiple languages
Personality (Lumsden & Mackay, 2006)	➢ Develop website according to the general personality of target customers ➢ Include elements such as privacy policy, feedback, security
Internet Literacy (Souza & Domelas, 2008; Lumsden, 2009)	➢ Clearly stated policies and vendor information in the site ➢ Simple and easy navigation of website ➢ Simple process for purchasing
Website Design (Riegelsberger, Angela Sasse & McCarthy, 2003; Lumsden, 2009)	➢ Professional design with attractive layout and design ➢ Use color in high contrast and create comfortable view ➢ Professional graphic design with appropriate amount of animation
Website Reputation (Lumsden, 2009)	➢ Create branding of products in the site ➢ Have business logo in website ➢ Include testimonials and feedback from customers
Website Functionality (Li et al., 2009; Lumsden, 2009)	➢ Have third party security seals ➢ Ensure up-to-date technology and security measures

Bonclusion and future work

Customer trust is very important in determining the success of e-business. In this paper, the methods of creating perceived customer trust in e-business were investigated and different factors which affect customers trust were examined. By examining the factors which affect customer trust one can better identify the effectiveness of the methods used. However, only few factors which affect customer trust are included in this paper. Much more research is

needed in this field to identify other methods which are not discussed in this paper. In addition, the factors which affect customer trust may vary from time to time as the threats and risks in internet commerce are increasing along with the rise in the amount of attacks on business websites, so research on the methods of creating perceived trust should be carried on in the future.

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ESTABLISHING POTENTIAL AREA OF RESEARCH IN E-WASTE MANAGEMENT IN MALAYSIA

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ABSTRACT. This article aims to provide an overview on derived waste from electronic devices or e-waste management. It started off with an explanation of what is e-waste and e-waste management. Then, an elaboration of the source, component, lifecycle, economic impact and threat of e-waste is presented and served as a driving factors and motivation for proper management of e-waste. Based on these factors, some areas of research which is beneficial to the improvement of e-waste management are identified.

Keywords: IT waste, green IT, electronic waste governance

INTRODUCTION

The Moore's law postulated that the microchip's computing power doubles every 24 months. This entails to reduction in size, increase in power, and lowering (or at least the same) in price of the computing and IT apparatus (Laudon 2010). It further affects the attitude of the users: increase in acquisition, usage, and waste of the equipment. Recognizing the significance of IT to the world today, the direct and indirect impact of its use, either good or bad, must be carefully managed. This research is mainly interested in the waste (or e-waste or IT waste) aspect of this use. That is when the IT equipments are no longer in use. This paper provides an overview of what is e-waste management, the motivation for proper e-waste management, research project and initiative related to e-waste, and recommendation for research area pertaining to e-waste in Malaysia.

WHAT IS E-WASTE MANAGEMENT?

The terminology e-waste refers to all types of disposable electric and electronic apparatus or parts. Currently, computers (such as PCs, laptops, notebook, and servers) are on the top of the list due to the substances that are hard to decompose and are highly toxic, used in fabricating computer parts. These waste material needs to be managed. E-waste management which is the relatively new concept refers to managing of the waste. These include collect, transfer, process (such as break-down of material) and, recycle parts (Perry, 2006). Most common practise in this management aims at the 3R: Reuse, Reduce, and Recycle (UNEP, 2010). Besides these processes, e-waste management is also concerned with governing policies and regulation (Kojima, 2008).

The aim of the general waste management is such that it would cause least damage to the earth and the environment and have some positive economic returns. Waste management includes technique in which waste materials are recycled: it is health conscious in the sense

that it also finds ways to ensure minimum damages to the natural balance of this planet (including its inhabitants) caused by toxic substance (Tatum and Harris, 2010).

THE IMPORTANCE OF PROPER E-WASTE MANAGEMENT

The research has identified two major factors that drive the importance of proper e-waste management. In short they are environment and economy. The environment factor can be seen from two aspects: The first is to ensure minimum damage to the earth and second is to ensure the toxic chemical from the waste does not harm people's health. The economic value is derived from the decrease in cost from reduced waste removal, disposal and landfill space. Income could also be derived from price of recycle materials.

Economic Perspective

The economics of better waste management would result in decreased landfill space, decrease in removal and disposal cost, price paid for recycled materials (Kinnaman and Fullerton, 1999). E-waste from devices such as computers and mobile phone can be broken into many valuable parts or substance and can be reused such as wires and cables, aluminium, copper, glass, and plastics (Kets 2011)

Research initiative, especially initiated by the green movement and renewable energy are dedicated at finding ways to make use of waste to produce energy. An example is by capturing the biogas formed by the waste disposal and generates the green energy which can be used in many areas which uses electricity or fossil fuel (UNEP, 2011)

Most electronic or electrical appliances are typically made of many parts that are reusable. However, recycling of these parts may incur a higher cost compared to new ones which results in a recycled product being more expensive. Hence it makes more economic sense for a consumer to purchase a brand new device. According to the Base Action network, (due to the cost in recycling,) more than 80% of the e-waste derived by US and Canada which was supposedly sent for recycling was in fact shipped to other countries (Goodwin, 2011).

Environment perspective

Not only does it threaten the environment, the human health is also highly at stake. The amount of e-waste generated worldwide is increasing by around 40 million tons each year (UNEP, 2010). Much of this is waste comes from the heavy use of the computer - A computer will usually become obsolete in 3 year or less (Wisconsin Dept. of Natural Resources, 2006). The table below listed more electronic device and its life expectancy.

Table 1: Life expectancy of Electronic Devices

Source: National Safety Council US

	Range of Primary and Secondary Use(Reuse) Life Expectancy(in years)
Video Products	
Direct View Color TV	13 to 15
Projection TV	13 to 15
LCD Color TV	13 to 15
Videocassette Players	7 to 10
VCR Decks	7 to 10
Camcorders	7 to 10
Laserdisc Players	7 to 10
Audio Products	
Rack Audio System	3 to 15
Compact Audio System	3 to 15
Portable CD	3 to 15

Portable Headset Audio	3 to 15
Total CD Players	3 to 15
Home Radios	3 to 15
Information Products	
Cordless/Corded Telephones	3 to 6
Wireless Telephones	2 to 4
Telephone Answering Machine	3 to 6
Fax Machine	3 to 6
Personal Word Processors	3 to 6
Personal Computers	3 to 6
Computer Printers	3 to 5
Computer Monitors	6 to 7
Modern/Fax Modems	3 to 6

Toxic Components of a typical PC. Many of the parts in a computer and other electronic devices contain toxic substance. For example, a desktop computer contains monitor, central processing unit and accessories is build using different types of metal such as lead, mercury, antimony, silver, chromium, zinc, tin, copper, iron, aluminium, nickel, cobalt, and lithium and plastics. This type of metal contains toxic materials which can cause problem to kidney, cardiovascular and central nervous system. Figure 2 shows the source of toxic substance in a typical desktop computer.

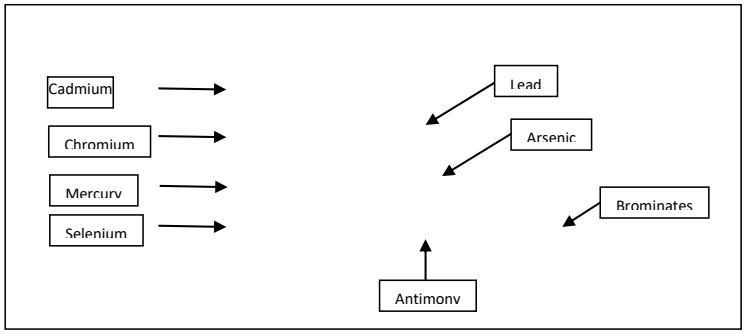

Figure 3: Toxic material in a desktop computer

Effect on Health. The chemical toxin from the electronic waste, if not contained, may infiltrate and contaminate our ecosystem: air, food, and water system (Cairns, 2005). Hence, the aim of appropriate e-waste management from the health perspective is to minimize the impacts of the unsafe disposal of electronic products on public health and the environment (UNEP, 2010). Table 2 below presents a list of problem causes by the toxic.

Table 2: Toxic chemical in e-waste and their effect on Human Health

No	Substance	Effects on Human Health
1	Arsenic	Lung and skin cancer
2	Brominates	Hormonal problems
3	Cadmium	Long damage and eventual death
4	Chromium	Carcinogenic when it's entered lungs via
5	Lead	Anorexia, muscular pain, headache and other
6	Mercury	Damages to the brain, kidney and fetus
7	Polychlorate biphenyls	Harm to the endocrine system
8	PBDE	Harm to the endocrine system
9	Chlorine Fluorine	No effects
10	PVC	In low levels no harm

11	Barium	Gastrointestinal disorder and muscular weakness
12	Beryllium	Respiratory inflammation known as the Beryllium
13	Cr+6	Cold, nose bleeding, ulcer and damage to sinuses
14	Lithium	Damages to the central nervous system
15	Nickel	Lung cancer and sinusitis
16	Antimony	In low levels no harm
17	Selenium	Selenosis, hair loss, neurological problems
18	Zinc	Corrosive to skin and lungs

REGULATING E-WASTE MANAGEMENT

The research has found that governments throughout the world recognize the seriousness of e-waste implication. This is evidence in the many Acts, Regulations, and Policies. The United Nation, under United Nation Environment Programme, UNEP has a very strong presence all over the world with a strong interest in Asia and Africa. Sample of the governing mandates are presented in Table 3 below.

Table 3: Examples of mandate from all over the world

Europe's directive on waste from electrical and electronic Equipment	The directive aimed at reducing the amount of waste from electrical and electronic equipment that ends up in landfill. This goal is to be achieved by changes throughout the EEE product cycle including improved product design to ease dismantling, recycling and reuse and, more significantly, provision of national WEEE collection points and processing systems. (The European Parliament and the Council of the European Union, 2003)
Malaysian Solid Waste and Public Cleansing Management Act 2007	Management of solid waste is put under Federal Government's jurisdiction, allocates responsibilities to newly established agencies, redefines the roles of local authorities, and aims to improve the collection, recycling and disposal of solid waste throughout the peninsular of Malaysia (UNDP Malaysia 2008)
Philippines Republic Act 9003 – Ecological Solid Waste Management Act 2000	The Act involves systematic administration of activities which provides for: segregation at source, segregated transformation, storage, transfer, processing, treatment, and disposable solid waste, and all other waste management activities does not harm the environment (Kojima and Rebullida, 200x)
The UK Waste Management Licensing Regulations 1994	The regulation addressed measures relating to the prevention, reduction and elimination of pollution of water and the prevention, reduction and elimination of pollution caused by waste (UK Government, 1994)
Washington Statute	Manufacturers have responsibility for both collecting and recycling of their products (Perry, 2006)

POTENTIAL RESEARCH ON E-WASTE MANAGEMENT IN MALAYSIA

One of the key thrust of Vision 2020 is to pursuing "an environmentally sustainable development to reinforce long-term growth which presents a challenge to established policies and practices in the rapidly expanding area of solid waste management" (UNDP Malaysia, 2008). However, based on review of existing literature, Malaysia still lagged behind in the governance and research efforts specific to E-Waste and IT-Waste. Therefore, the following areas should be given emphasis to remedy the lag:

Governance of e Waste. An important aspect in e-waste management is the ability to ensure that "appropriate e-waste management" actually happens. A governing mechanism which include monitoring, control, compliance auditing, and continuous improvement of the waste-management method must be in place and enforced.

Replication of successful research. A web search on the current or recent research on e-waste management reveals high interest in the e-waste subject (Chun S and Murakami-Suzuki R, 2008; Chen, Yenming and Wu, Tien-Hua 2010; Li Jian and Zhang S, 2010). Extensive

researches are found to be in all parts of the world. United Nation Environment Programme, UNEP has been active in conducting research on e-waste. It launched a landmark report, 'Recycling - from E-Waste to Resources', in February 2010. Other strong research groups are found in Japan, China, and Europe. However, there not many information on the Internet pertaining to e-waste research found to be conducted by Malaysian researchers (Noraida Yusof, 2011).

Based on the recent and present researches world-wide, our research team has proposed that similar the researches are performed in Malaysia. Such are:

Economics of E-Waste Management; E-Waste Recycling System; and *Effective E-Waste Management* – These topics can be based on many angles: state, institution such as universities, public, corporations, and collaborative. It may take the form of frameworks or model;

Data Sanitization technique - From the perspective of Information and Data confidentiality, a research is proposed on *Data Sanitization technique*. When an IT device is no longer in use, it may still contain data that can be restored. Measure must be taken to ensure that the supposedly retiring devices no longer contain or able to restore confidential and sensitive company data.

CONCLUSION

The economic, environmental and health impact brought by e-waste must be taken seriously. With the phenomenal increase in the waste, solutions must be found at a very fast rate. Malaysia, are still wanting in the research of e-waste management: its understanding in the economics of waste management methods, effective techniques pertaining to it's handling as well as effective governance to oversee the effective and efficient execution of the management method. It is proposed that research activities in the identified research area above is carried out appropriately and rigorous.

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E-CATALOG: BUSINESS PROCESS RE-ENGINEERING OF DIRECT SELLING PRODUCT CATALOG DISTRIBUTION PROCESS

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Abstract. The traditional printed paper based product catalog is restricted to customers and places, which is difficult to handle in addition to time and cost of printing, storage area and shipping. Thus, this study attempts to present results of a business process re-engineering of a direct selling catalog distribution that is able to eliminate such physical limitations and enable the distribution business process to become more efficient. Incorporating e-catalog as an outcome of the business process re-engineering shows that the business process can be simplified from 32 activities to 13 activities. With this approach the percentage of process efficiency rate for business process selected has been increased dramatically from 20% up to 86% and also reduced the waiting rate from 55% to 7%. In order to rate the usefulness of the e-catalog solution, 30 respondents from avon dealers were selected to test the e-catalog prototype. The final result indicated that business process re-engineering has the capability to simplify a fairly complex manual and paper-based processes, resulting in a better, more efficient e-catalog distribution system.

Keywords: BPR, efficiency, e-catalog

INTRODUCTION

The significant growth of the internet usage for advertising and selling of products has become dramatic in recent years, particularly with the proliferation of broadband technology. According to ITU (2010) which is a leading agency for information and technology issues reported that about 64.4% from 26,160,256 of the Malaysian population are using the internet. In fact, the number of internet subscribers expected to reach 10 million in the next five years (Telekom Malaysia, 2007). Considering this volume of data, today many people make use of the internet in working, learning and sales on line with greater speed and accuracy regardless of time and distance.

In 2008 internet sales for the United Kingdom increased by 51% relatively from 2007 to 2008 (Statistical Bulletin, 2009). This number indicated that users preferred to buy and sell online rather than traditional retail shopping. Technically, online business is associated with 4 components, which are product catalog, Shopping Cart, Transaction Security and Processing order. Combination of these elements can provide a true shopping experience to the customer (Greenberg, 2001).

With the influx of businesses conducted online taking advantage of the internet technology, the use of e-catalog rather than printed version product catalog has become a

viable alternative. The potential to reach a larger market based on online catalog which is more dynamic, flexible and consumer responsive has been identified by researchers (Vijayasarathy & Jones, 2000). Other researchers such as Kotler (2000) and Muldoon (1996) also predicted that online catalog will become more popular than traditional print catalog due to quicker access, price comparison and faster searching capability.

Although the internet offers many potential benefits, direct selling companies such as Avon (M) still distribute this traditional print catalog among their dealers and Avon Beauty Boutique nationwide through manual distribution process. Basically, Avon (M) used printed version product catalog in order to sell their products. With the rapidly high cost distribution and printing, (Rosman Abu Bakar, personal communication, November 2, 2010) identified approximately RM800,000 monthly was needed to spend on printing and distribution process. This triggered the interest to further examine what is the most suitable application to be applied in order to solve this issues and how Business Process Reengineering technique can improve efficiency and effectiveness of the company performance.

BACKGROUND OF THE STUDY

Avon (M) Sdn. Bhd. was established since 1978 in Malaysia. Today Avon(M) has empowered many women across the Peninsular, including Sabah and Sarawak by providing them with earning opportunities and making their dreams come true. Avon representatives are supported by their zone manager, training, credit facilities and 179 Avon Beauty Boutiques around Malaysia. The location of Avon (M) headquarters is based in Petaling Jaya, Selangor.

This company has their own vision which is to be the company that best understands and satisfies the products, services and self-fulfillment needs of women globally. Avon(M) has multiple missions in their organization which, among others are listed as follows:

i. To become the world's most trusted beauty company
ii. To create lifelong customer relationship
iii. To achieve economic independency
iv. To become the largest woman's foundation
v. To create exceptional opportunities for professional growth
vi. To be a socially responsible, ethical company that is watched and emulated as a model of success

Avon (M) developed their own website which is limited to basic information about company profile, account numbers for dealers and short news about current programs. Although Avon (M) has their own web site, the company used manual process to distribute their product catalog to all dealers and Avon Beauty Boutique around Malaysia.

For the purpose of this study, the process selected for reengineering is the product catalog distribution process. The complete existing process is presented in a flowchart as illustrated in Figure 1. The description of the existing and reengineering processes for the product catalog distribution is presented in the next sections.

Figure 1. Flowchart of product catalog distribution process

DESCRIPTION OF EXISTING PROCESS

The existing business process for the product catalog distribution process can be summarized as follows:

i. The process begin with Art Director produce a draft of the catalog.
ii. The Art Director presents draft to Marketing Manager and Senior Art Director in order to get the approval. If the draft is not approve then it will get back to Art Director for amendment, if the draft is approved, finalized the work design details and proceed to printing process.
iii. The Marketing Manager will check whether the printing process is successful. If the printing is not successful then the process will end. If the printing process is successful then the ready print catalog will be delivered to HQ and Data Pos.
iv. From HQ, the bundle of print product catalog will be dispatched to Avon Beauty Boutique nationwide.
v. From Data Pos, the print product catalog will be mailed to all active dealers.
vi. Avon Beauty Boutique and active dealers receive the product catalog and the process ends.

Based on the analysis of the existing business process, there are seven main activities involved. These are:

i. Produce draft product catalog
ii. Request for printing product catalog
iii. Update record for top sellers and active/ inactive dealers
iv. Deliver ready print product catalog
v. Data Pos receive ready print product catalog
vi. Active dealer receive Product catalog
vii. Avon Beauty Boutique receive Product catalog

From the main activities, there are sub-activities that should be completed which takes time to complete for every stage. People (actors) involved in the work process are as follows:

i.	Marketing Manager	vii.	Supervisor
ii.	Marketing Assistant Manager	viii.	Warehouse Assistance

iii.	Senior Art Director	ix.	Account Maintenance Officer
iv.	Art Director	x.	Sales Representatives
v.	Copywriter	xi.	Dealers
vi.	Supply Chain Manager	xii.	Data Pos

The total time taken for the whole work processes to complete was 46186 minutes. This can be shown in the following calculation to identify the value for process efficiency rate and waiting rate:

Calculation of existing process

Process Efficiency Rate = **Total VAT/TOTAL * 100**
= 9193 / 46186 * 100
= 19.90%
= 20% (approximately)

Waiting Rate **= Total WT/TOTAL * 100**
= 25550 / 46186 * 100
= 55.3%
= 55% (approximately)

Based on the calculation of existing process, the percentage of Process Efficiency Rate is 20% whereas the Waiting Rate is 55%. Clearly the existing process is inefficient and wastes a lot of time as more than half of the time for the process to complete is to wait for the subsequent activity in the process. The BPR technique was used to identify the time consuming activities and introduce ICT to automate the business process.

A Pareto chart was used to determine and compare significant time-consuming activities that are potential for re-engineering. Basically, this is a bar graph that shows all the activities involved and sorted in descending time order. The longest time taken for each activity will be arranged at the left most position whereas those activities with the shortest time will be shifted to the right-most position. According to Pareto principle, a 20/80 percent rule was applied to identify the 20% significant activities that contribute to 80% of the time to accomplish the selected business process. The 20% activities generated by the Pareto chart identified the following activities: Keep the print catalog, Receive the bundle of new print catalog, Coordinate the printing job and Distribute print product catalog that consumed the most time.

DESCRIPTION OF RE-ENGINEERING PROCESS

The idea in this re-engineering process is to make use of Avon (M) website to allow every dealer, whether active or not, to view the e-catalog online. This can be done by introducing a new re-engineer process using the e-catalog as an online application. With this application the activities in the work process can be reduced and at the same time it will help to increase the process efficiency rate of the work process.

After the e-catalog is received from the Marketing Assistance Manager, the Copywriter will upload the e-catalog to Avon (M) web site. Then, dealers, Avon Beauty Boutique and customers can access the Avon (M) web site and click on ‘E-catalog’.

Based on the analysis of the online of the work process schedule, there are three main activities involved. These are:

i. Produce draft product catalog
ii. Receive e-catalog
iii. View e-catalog

From the main activities, there are sub-activities that should be completed which takes time to complete for every stage. The people involved in the work process are: the Marketing Manager, the Marketing Assistant Manager, Senior Art Director, Art Director, Copywriter, Sales Representatives, Dealers, and Customer.

For the re-engineered process, the total time taken for the whole work processes to complete was 9281 minutes. This can be shown in the following calculation to identify the value of process efficiency rate and waiting rate for the new work process:

Calculation of re-engineering process

Process Efficiency Rate	**= Total VAT/TOTAL * 100**
	= 7946 / 9281 * 100
	= 85.62%
	= 86% (approximately)
Waiting Rate	**= Total WT/TOTAL * 100**
	= 667 / 9281 * 100
	= 7.19%
	= 7% (approximately)

The results show that product catalog distribution process through online application help to increase the efficiency rate from 20% to 86%. It also shows that the number of waiting time was reduced from 55% to 7%. Therefore, it can be concluded that with the proposed e-catalog incorporating in Business Process Re-engineering technique in this study can contribute to increase in process efficiency and provide significant saving in time.

DISCUSSIONS

According to the original work process mapping, 32 activities were needed to accomplish all seven main activities as discussed earlier. From the current analysis, the total time to complete the whole process is 46186 minutes. With the BPR technique the 32 activities can now be reduced to merely 13 activities, a reduction of almost 60% less activities. The use of e-catalog allows all dealers to view the catalog information and latest updates on products within an instance. For the organization, the cost for delivery and printing process can be eliminated. The total time taken to complete the process is reduced to 9281 minutes compared to 46186 minutes previously. This indicates that the process after BPR is more efficient compared to existing process where the efficiency rate is up to 86%. Another impact is the waiting time can now be dramatically reduced from 55% to 7%.

CONCLUSION

In conclusion, adopting the BPR approach could be considered practical, reliable and useful for managers, employees, dealers and customers, in helping organizations to increase their business performance. The significant result of the business process efficiency shows that the product catalog distribution process can be simplified by implementing e-catalog using the BPR approach. There is no more delays, everyone can receive e-catalog at the appropriate time and also organization can ultimately reduced the cost for delivery and printing. Finally, in return, all users involved in this process will be able to achieve satisfaction.

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BEHAVIOR OF TRANSFORMATIONAL LEADER, ORGANIZATION CULTURE, AND SUBORDINATE'S WORKING BEHAVIOR TOWARD WORKING PERFORMACE OF SMALL AND MEDIUM ENTERPRISES: RECONCEPTUALIZATION AND MODELING

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ABSTRACT. The low working performance of small and medium enterprises can not be separated from behavior of transformational leader and organization culture which can form subordinate's working behavior. These factors are very important to be concerned, especially for an entrepreneur who lives with full of uncertainty and continually speculation. Based on the mentioned things, the research is conducted with a purpose to form measurement model of organization's working performance through behavior of transformational leader and organization culture in forming behavior of subordinate's duty on knitting industry in the Binong Jati kinitting center, Bandung. The method used is *descriptive survey* and *explanatory survey,* with 120 researched samples from 412 knitting entrepreneurs with simple randomized sample method. The analysis method was structural equation model (SEM) analysis method using LISREL software. The important finding of this research result shows that behavior of transformational leader is classified in fair category, while their organization culture is classified in low category. Furthermore, behavior of subordinate's duty is classified in fair category, while organization working performance is still classified in low category. The analysis result proves that transformational leader and organization culture can form behavior of subordinate's duty which finally can form organization working performance.

Keywords: Behavior of Transformational Leader, Organization Culture, Working Behavior of Subordinate, Company's Working Performance

1.1 BACKGROUND OF RESEARCH

The role of small and medium enterprises in Indonesia is admitted very important in the national economy, especialy in the improvement of employment opportunities, equal distribution of income, rural economic development, and the increasing of non oil export. It should be admitted that the emerging and development of an economic business is not only caused by the existence of a policy or government's supervisory program. The main determinant of the emerging and development of an economic business is related to economics, social, cultural and historical factors which afterward bring influences to the business working performance.

The economic and social factors can be classified in two sides: demand and supply side. Factors in the demand side is average of income and taste of community's consumption,

structur, space, and served market charcateristic. While, factors in supply side are labbor supply both of quality and quantity, *managerial skill,* information, technology, quantity and quality of raw material, ethos, and working disciplines, and other aspects related to *entrepreneurship.* The government's policy only makes the influence of each factor become bigger or smaller. The difference of consumption taste and pattern in the community for the similar goods is also determine the size of industrial market.

The decreasing or increasing of small and medium enterprises globally in indonesia, and bandung region especially, indicates the lack of goverment's allignments in addressing economy that is based on small medium enterprises industrial. This is caused deep apprehensive. The more higher competition level is between small medium enterprises, the more it's create positive challenge for small medium enterprises to improve their quality.

The organization continuance depends on owned resources and choosen strategy in empowering its internal resources to respond threaten and external opportunities (barney in campbell, 1997:26). The ability to gain opportunity and winning competition need to be supported by organization culture that able to direct organization strategy, mission, and vision. Moreover, organization culture is convinced become one of the factors that forms and directs behavior of organization management. According to kotler dan heskett (2008), the most of organization culture researcher agrees about the existence of an organization culture impact to its long-term working performance. The organization culture is one of manager behavior determinant in organization, besides of structur, planning system, and other formal policies: leadership, and competitive environment. Therefore, organization culture has an impact toward organization effectivity and efficiency that become real result because of the existence of certain working behavior that is showed by organization members. Conceptually, organization culture has been related with the leadership and subordinate behavior. In the other side, organization culture….

Small and medium enterprises as an organization needs innovation of organizational management. This far, small medium enterprises is considered as the most flexible organization in operational running. This is means small medium enterprises has a high organization innovation. Small medium enterprises that has high innovation management will be able to compete by raising of new things that is not owned by other enterprises. With this ability, the enterprises can gain bigger selling portion and finally influencing the working performance of the enterprises. According to neely et.al (2001:114) that "organization that conducts continue organization innovation will survive in the competition"

II. Relationship Modeling of behavior of transformational leader, organization culture, working behavior of subordinate, and company's working performance

Transformational Leadership

Theory of transformational leadership, for the first time was said by Bernard M. Bass, that is built above earliaer ideas that was said by Burns (Yulk, 1994: Pawar and Eastman, 1997). Burns (in Pawar dan Eastman, 1997), defines transformational leadership as a process to reach collective goal, united mutually beneficial motives that is owned by the leader and his/her sub ordinate in order to reach desired changes. While Greenberg and Baron (2000), defines transformational leadership as a leadership behavior by which a leader using his/her charisma to transforms and revitalize organization. According to Yulk (1994), the original formation of transformational leadership theory which was said by Bernard M. Bass

is covering three main components: charisma, intellectual stimulation, and attention that is individual oriented. Charisma is defined as a process in which a leader influences their followers by raising strong emotion and identification to him/her. Intelectual simulation is a process where main role of a leader is to improve the awareness of their followers to the problems around them and influence the followers to views those problems from a new point of view. Individual oriented attention including give the support to encourage and share the experiences about self development to their followers.

So, transformational leadership theory is characterized with a condition where the leaders motivate their followers by:

1. Make them realize about the importance of a working result;
2. Promoting them to put the importance of group or organization (team) above the personal importance;
3. Activating their need at the higher level.

Organization Culture

Organization culture has been conceptualized into several construct on the organizational researchgs. One of them is Schein model (Budiharjo,2003) that is defined culture as : *a pattern of basic assumptions – invented, discovered, or developed by a given group as its learns to cope with its problems of external aaptions and internal integration – that has worked well enough to be considered valid and, therefore, to be taught to be members as the correct way to perceive, think, and feel in relation to those problems.* Schein (Hatch , 1993) is assumed that culture exists simultaneously in three level : In the surface is artifacts, below the artifacts is values, and inside is basic assumptions. Artifacts, is the outermost element of organization culture that has concrete and visible characterization. The part of artifacts are : material object, building design, language technology, myth story, ritual, heroes, and symbol. Values is a basic element of organization that directs to behavior, that is related to morale, ethics because its has role to determine what should be done by organization members. This element is also related to the faith that is adopted together by organization member. Basic assumptions is the deepest part that is underlie value, attitude, and faith of the organization members that have 5 main dimension : relations between human and nature, characteristic of the truth, natural characteristic of human being, natural characteristic of human's activities, natural characteristic of relations between human being. If an organization has basic assumption that trust as a foundation of relation between human beings, so value consequence that is adopted by organization members is honest norm, and desired norms are honest, transparency, and trust norm (Budiharjo, 2003).

This model is further developed by Hatch (1993), become The Dinamys Model of organization culture. Two basic changes that is conducted by Hatch (1993) are: first, by adding new element, and second the fourt of those elements makes become centralized so the relations between several organization culture elements become focal. Afterward, Hofstede (2004) defines organization culture as: *the collective programming of the mind which distinguishes of members of one organization from another.* Culture in Hofstede's view almost similar with two previous mentioned models that is consisted of four main elements: *symbols, heroes, ritual,* and *values.*

Organization culture is formed through long process, where the role of leader very strong in the process. The norms and basic assumptions that is owned by the leader have a big role in an organization forming. The norms, values, and basic assumptions that is owned by a leader will influence leadership behavior and leadership style that is implemented by him/her.

Behavior that is showed by the leader will directly form organization strategic policies. The policy is one of the elements that directs to where an organization will be aimed.

Working satisfaction

In working, social, and family life, someone will be involved with emotional feeling, both of negative and positive. Positive emotional side that is felt by subordinate has been conceptualized into several construct by the researcher. The most get attention construct is working satisfaction. Working satisfaction is one of the subordinate's behavior fom that is defined as something pleasure or positive emotional vision of working assessment or someone's working experience (Locke, dalam Vandenbrg dan Lance, [1992]). Someone's working satisfaction is determined by differentiation between all things that are wished with all things that are felt from a job or all thngs that is actually accepted.

According to Witt dan Nyee (1992), the most part of research based on two basic assumption. First, working assumption is an potential determinant to predict presence level, rotation, working performance, and extra role behavior. Second, that the main antecedents of subordinate's working attitude can be influenced by ability that is owned by company's management. The empirical proves presents the conclution that personal working satisfaction influences organizational commitment in a positive way. (Clugston, 2000; Levy and William, 1998; Lum et al., 1998; Russ and McNelly, 1995; Vanderberg andLance, 1992), absence (golberg dan Waldman, 2000), living satisfaction (Judge dan Watanabe, 1993), motivation, (Igalens dan Roussel, 1998), and rotation desire (Clugston, 2000; Golberg and Waldman, 2000; Russ and McNelly, 1995).

Personal working satisfaction is determined by differentiation between all things that are wished with all things that are felt from a job or all thngs that is actually accepted. Working satisfaction is found become intervening variable in relations between environment and personal characteristic with organizational commitment (Lum et al.,1998), and is believed as one of the main determinant of subordinate's rotation in organization (Good et al., 1996).

Personal working satisfaction tends to influence her/his commitment level toward organization where he/she works. But, there are difference of conclution that resulted by the researchers about the influence of working satisfaction toward organizational components that is presented by Allen and Meyer (1990). Clugston (2000) concludes that working satisfaction influences effective, continue, and normative commitment in a positive way. But Hackett et al. (1994) found that working satisfaction influences continue commitment in a normative way and its related to effective and normative commitment in a positive way.

Working Motivation

Working motivation is defined as a process in which personal working performance is energized, directed, and survived in a work and organization living (Steer and Proter, in leonard et al. [2003]). The empirical researchs about this, more focus on working motivation resources (Leonard et al. 20093. Personal working performance can be sourced from individual itself (internal motivation) and can be sourced from outside factors (external motivation). The role of culture to maintain and form sub ordinate' s working motivation is very strong. The strong culture, generally, able to raise enthusiasm and motivation of the members to gain the organization's goal through duty and job accomplishment in a better way.

Organizational commitment

According to Meyer et al. (1993), organizational commitment is defined as how far the involvement of someone in an organization and the strength to identify something of an organization. The researches which use organizational commitment as one of the variable can be grouped in two perspectives:, the first is unidimensional research and second is the researches which make the organizational commitment to construct the multidimensional one.

Commitment as construct the dimensional one, divide organizational commitment into three commitment forms, which are: affective organizational commitment (AOC), Continuance organizational commitment (COC), and normative Organizational commitment (NOC) (meyer et al., 1998). Affective component refer to how far someone has emotional bond, identify him/herself, and feel involve inside an organization. Continuance refer to commitment which is based on the cost arising as he/she leaves the organization. Normative refer to the moral obligation which is felt by the subordinates to stay inside the organization (Dunham et al., 1994). Furthermore, Shore et al., (1995) explain that an subordinate who has high affective commitment will stay inside the organization because they want to, in the other hand, subordinate with high continuance commitment will stay inside the organization because they need it, and the subordinate who has high normative commitment will stay inside the organization because they feel morally and based on their trust that they have to stay.

Work satisfaction which is felt by someone tends to influence the level of the commitment to the organization where he/she have worked for. But, there are still different conclusions which are made by the researchers about the work satisfaction influence to the organizational commitment components which are presented by Allen and Meyer (1990). Clugston (200) found that work satisfaction influence the affective commitment, continuance and normative in positive way. But, Hackett et al (1994) found that subordinate work satisfaction influence the continuance commitment negatively and influence the affective and normative positively.

Organizational Citizenship Behavior

Subordinate behavior in the workplace can be grouped into two kind:behavior related to official workings (in-role-behavior) and behavior outside the official working (extra-role behavior). Extra-role behavior is very important to the effectivity of organization, which affect performance in long-term, directly affect the continuity of the organization, especially in the business environment which are volatile these days. Organ define OCB as individual behavior which is free (discretionary), indirectly, and explicitly get a reward from the formal reward system, and overall encourage the effectivity of the organizational functions. It is sree and voluntary, because that behavior is required by the role requirement or position description, which clearly required based on contract with the organization, not as a choice (Podsakoff, et all (2000))

Company Performance

In the development prespective, UKM can be classified into 4 (four) groups:

1. *Livelihood Activities*, is UKM which is used as working chance to get a living, commonly known as informal sector. For example: cadger.
2. *Micro Enterprise*, is UKM which has craftsmen identity but doesn't have entrepreneurship identity.

3. *Small Dynamic Enterprise*, is UKM which has entrepreneurship soul and can accept sub-contract job and export.
4. *Fast Moving Enterprise*, is UKM which has entrepreneurship soul and will transform into Bih Bussiness. Or Usaha Besar (UB)

The definition of operational aspect performance as described by Karst and Rosenzweig (2002, 507), covers all the organization purposes. For low level managers, performance is a target which helps all of the mission's accomplishment. For every organization unit, the management working is to achieve the performance which is measured by the relevant criterias. For the company, economy performance is measured with sales value, marketshare, profit, return of investment and active growth. Besides that, the targets like product quality or customer satisfaction is one of the manager focuses. The working of a manger covers the company social responsibility for issues like consumer protection, education, health, and positive actions in environment preservation. They also show that manager performance and every unit is determined by the status in the organization, working coverage and authority.

The compatibility between *effort* and direct boss view about *rule perception*, by matemathic model of working performance according to Lawler & Porter is:

P = E x A x R

with: P = *Performance,* E = *Effort,* A = *Ability,* R = *Rule Perception*.

The above understanding indicates about the importance of working performance measurement for organization as a key factor to ensure that organization implementation and strategy is working. The description above is meaned that unproper working performance measurements is an obstacle for organization development because working performace measurements has an important role to improve quality and productivity in organization, provide visibility in monitoring working performace level of each subordinate. Small Medium Enterprises that has high innovation performance will always create suitable product or service with the change of need and costumer's interest. This thing will bring an impact to the increasing of consumer's demand, finally will improve company's market share. As presented by Yamin (in Ross et.al , 2007:879) in a research at a manufacture company in Australia that obtain result there are a relations between innovation of duty behavior with the company's working performace

Based on the description of relation between above variable, can be drawn model expectation on the below diagram.

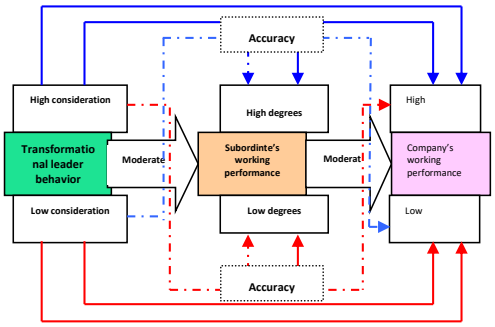
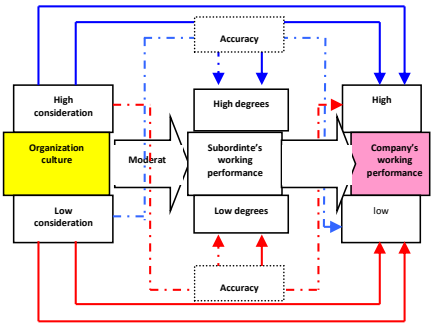


Diagram 2.1. Model Expectation of Transformational Behavior Leader toward Subordinate's Working Behavior and Company's Working Performance

Afterward the writter also expecting organization culture effect, Subordinate's Working Behavior and Company's Working Performance can be seen on Diagram 2.2.



Digram 2.2 Model Expectation of Organization Culture toward Subordinate's Working Behavior and Company's Working Performance

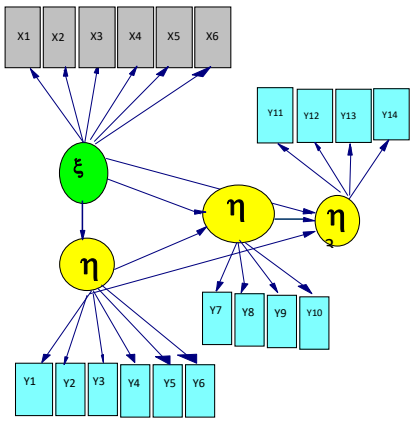
Based on the description of the above literature, can be describe research hypothesis as follows :

(1) The behavior of transformational leader behavior toward organization culture
(2) The behavior of transformational leader behavior and organization culture influences sub ordinate's working behavior
(3) The behavior of transformational leader behavior and organization culture influences company's working performance
(4) sub ordinate's working behavior influences company's working performance
(5) The behavior of transformational leader behavior and organization culture influences sub ordinate's working behavior

III. RESEARCH METHOD

The types of this research is an descriptive survey and *explanation research*. Sample in the research are 120 enterpreneurs from 412 enterpreneurs/knitting industry in Bandung City, generally certralized in Binong Jati, Batununggal Regency, while others are spreaded around of Bandung City as analisys unit based on sampling iterative.

Beside quantitatively analized, data of this research also analized by using *Structural Equation Mode-SEMI*). SEM is an technique that analized indicator variable, fix variable, and measurement error (Joreskog & Sorbom, 1996). SEM is used to analize relations between one fix variable with others that is known as (*structural equation*) that together involves measurement error. Besides of that, this equation structure model can be used to analize (*reciprocal relationship*. Data processing in this research is using LISREL program (Linier Structural Relationship) that is an statistical program package for *Structural Equation Model* (SEM). Afterward on the diagram 3.1 is a model of relation structur between variable.



Picture 3.1 Relationship structure of Transformational Leader Behavior, Organizatioanl culture, Subordinate Working Behavior, and Company Performance

Legend:
ξ = Transformational Leader Behavior
η1 = Organizational Culture
η2 = Subordinate Working Behavior
η3 = Company Performance

IV. FINDING

Descriptive Analysis Result

1) Transformational Leader Behavior which include Inspirational Motivation, Intelectual Stimulation, Individul Attention, Ideal Influence, Foster the group goal acceptance, and charisma of the knitting entrepreneur in Bandung in categorized as FAIR.
2) Organizatioanl Culture which include Process vs Result, Subordinate vs Job, Parochial vs Professional, Open vs Closed, Loos vs Tight, and Normative vs Pragmative is still LOW.
3) Subordinate Working Behavior which includes: Work Satisfaction, Motivation, Organizational Commitment, and OCB is categoraized as FAIR.
4) Company performance which includes: Profitability Performance, Liquidity, Solvability, and Acyivity in average is FAIR, but for Solvability and Activity performance is LOW.

Hypothesis Test Result

1) Analysis result proves that (a) Transformational Leader Behavior (ξ) affect positively to the organizational Culture (η1), with influence of 0.4388; (b) Transformational Leader Behavior (ξ) and Organizational Culture affect positively to the Subordinate Working Behavior. From both variables, the biggest one which affect Subordinate Working Behavior is Transformational Leader Behavior, which is 0.414, and Culture which is

0.3152.;(c) Transformational Leader Behavior (ξ), Organizational Culture (η1), and Subordinate Working Behavior have significant positive influence to Company Performance. From the three variables, the biggest one which affect Company Performance is Subordinate Working Behavior which is 0.4157.Total influence of the three variables is 58.37%. The rest 41.63% is influenced by other variables outside these three observed variables. This can be interpreted that the company performance for Knitting industry in Bandung can be achieved with the consideration to accommodate transformational leader behavior, organizational culture, and subordinate working behavior so work innovation can be created and directly affect the company performance.

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LEARNING PROTOTYPE AS A TOOL TO PROMOTE SUSTAINABILITY AWARENESS

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ABSTRACT. Introducing information and communication technology applications as learning tool is a novel way to increase awareness and to promote appreciation of sustainability among the young generation, for instance, students at the tertiary level. In this study, the sustainability awareness program is contextualized in a paddy farm that practices sustainable paddy farming, which is designed as a learning prototype. Hence, the main objective of this paper is to discuss the use of a persuasive learning program prototype as a tool to promote sustainable practices in organic paddy farming. The real-life practices of sustainable paddy farming have been adapted in the design of the prototype. For the purpose of evaluation, a lab experiment is conducted at the Computer Laboratory of the Engineering Department, University Putra Malaysia. The respondents consist of students from the Biology, Engineering and Agriculture programs. These students are selected randomly to answer the usefulness of the prototype. The findings of this study indicate that the prototype is beneficial in creating sustainability awareness among the students. For future applications, the learning prototype for the sustainability awareness program can be extended to other sustainability related issues.

Keywords: sustainability awareness, learning prototype, sustainable agriculture, paddy farming practices

INTRODUCTION

Sustainability is now becoming both an important concept and practice for social, economic and environmental governance (Goodland 1995; Ismail, 2006; Kajikawa, *et al*., 2007). Sustainability in agriculture refers to farmer's ability to maintain sustainable yield while preserving natural environment, promoting social development, creating economic opportunities and being a commercially good competitor in the fast changing environment (Ismail, 2006). Furthermore, sustainable agriculture encompasses both the aspects of production and preserving environment. It means that sustainable agriculture integrates three main goals: environmental health; economic profitability; and social and economic equity. These goals have been defined by a variety of philosophies, policies and practices, and the vision or perceptions of farmers and consumers. The focus of sustainable agriculture in this paper is how information and communication technology (ICT) as an innovation helps to promote and provide exposure for sustainable agriculture in paddy farming activity.

Multimedia and virtual reality(VR) have the advantage of being a persuasive technology. Fogg (2003) had coined a word 'captology' which refers to the understanding of motivation and persuasion obtained from the application of computers and consumer devices. The

objective is to change behavior and attitude in predictable ways. The potential of multimedia and VR technology for supporting education is widely recognized. Many researchers found that virtual reality offers many benefits that can support learning such as revealed by Pereira (2006), Kuo *et al*. (2004, 2007); Ha and Woo (2006); Salam *et al* (2010) and Buntod *et al.* (2010) in their work. Among the benefits stipulated include the acquisition of meaningful learning, as well as easy and better understanding of the learning contents.

Creating awareness in sustainable agriculture

The public awareness of sustainable agriculture in Malaysia is considered to be rather low (Berita Harian, 2010). According to the National Green Technology Policy Malaysia, effective promotion and public awareness are two of the main factors that would affect the success of sustainable development through the Green Technology agenda. This is particularly significant as such adoption requires a change of mindset of the public through various approaches which includes the effective dissemination of education and information to increase public awareness of sustainable agriculture and on ways to conserve the environment. Mustapha and Mohd Jani (1995) also argue that awareness among Malaysian people on environmental pollution and resources can help Malaysia to develop a sustainable agriculture. In addition, by conducting more intensive monitoring and investigation on agricultural practices, this would enable Malaysia to achieve sustainability (Murad *et al*, 2008). As a solution, introducing the use of virtual technology through learning as a tool to promote sustainability awareness in paddy farming practices in order to increase public awareness is among promising alternatives available.

METHODOLOGY

The research involves several phases (see Figure 1 and Figure 2). At the initial phase, it involves the understanding the problem domain: the practices of paddy farming in Malaysia. The real practice of present sustainable paddy farming practices in Malaysia will be adapted in the design of the education prototype courseware, using the multimedia and virtual reality software.

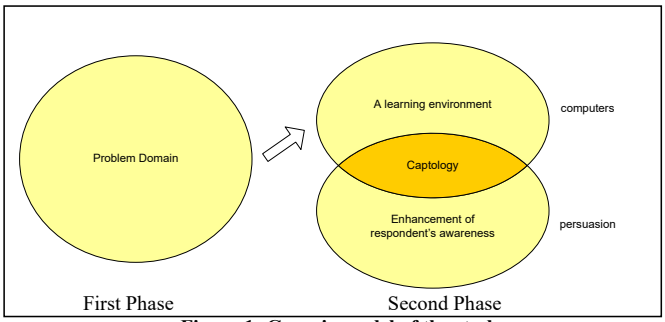

Figure 1: Generic model of the study

First Phase

In the first phase, this research employs a qualitative research design which uses the observation and interview approaches. The respondents are farmers, researchers and agricultural officers. The location for this case study includes the paddy farming areas in Sabak Bernam, Kahang, Tunjung and the Muda Agricultural Development Authority (MADA). The reason for selecting the Kahang Organic Rice and Tunjung locations are because both these locations fully adopt sustainable practices in organic paddy farming.

Sabak Bernam was selected because it has the most productive paddy fields and MADA has the largest size of paddy planted areas (hectares) in Malaysia. As the paddy farming practice in the Sabak Bernam and MADA areas in Malaysia is under the jurisdiction of the Agricultural Department of Malaysia, the same technique or practice is used in all the paddy fields in this area. The interviews were conducted with agricultural officers because they are in strategic positions in the top management and represent all the farmers involved with activities related to paddy farming in the chosen areas or locations of this research study. These officers were the officers from MADA at several department (Accountant, Section of Planning and Information Technology, Department of Statistics, at Section of Paddy Industry, Department of Dissemination and Monitoring, the officer at Section of Planning and Information Technology), the officer at Sabak Bernam Agricultural Department and the organic paddy field researcher and lecturer from the National University of Malaysia (*Universiti Kebangsaan Malaysia*- UKM).

The documentation required for this study was acquired from pamphlets, brochures, annual reports, department collections, books and journals collected. The observations were done from 28 June 2008 until 12 November 2009. In addition, visits to the Paddy Museum in Kedah and in-depth interviews were conducted with three farmers to get further information to reinforce the data.

The interviews were also conducted with the Salor Project Supervisor and leader of the paddy field workers, and an expert in SRI-Organic farming from Indonesia. In the Kahang Organic Rice location, the interviews were conducted with the managing director, his assistant and leader of workers.

The main questions asked during the interviews were related to the following issues:

i. The steps employed in paddy farming practices
ii. The fertilizers used
iii. The use of materials/items to control pests, diseases and weeds
iv. The use of ICT application in the paddy fields

Some of respondents allowed the interviews to be recorded by videotape. However, all the interviews were noted by the researcher in her notebook. During the observations and field work, the phone was also used to obtain clarity of information from the respondents.

The results indicated that there were several similarities and differences in the practice of paddy farming in these four selected locations in Malaysia. To summarize, paddy farming practices in Sabak Bernam and MADA can be categorized as those who employ conventional practices in paddy farming, whereas, the practices in other places can be categorized as those who employ sustainable practices (Othman & Muhammad, 2009; Othman *et al*, 2010). The organic paddy practices are used in the design of the prototype courseware.

The second phase

The second stage is the design and development of a persuasive learning environment. In this research, the learning outcome of a persuasive environment is to persuade society to enhance its sustainable awareness in paddy farming practices. The captology in Figure 1 and Figure 2 focuses on attitude and behavior change resulting from human-computer interaction. There are three persuasive principles that have been applied in this study. They are the principle of cause and effect, the principles of praise and the principle of social learning (Othman & Muhammad, 2011).

The methodologies used for the prototype design and development of this study is adapted from the model for design and development created by Alessi and Trollip (2001) and the development process of a non-immersive VR desktop (Kalawsky, 2001). In this simulated learning environment, the experience at four selected location paddy farming practices was

shown in video clip, image and virtual environment. Using this technique, users can view several real practices of paddy farming. In addition, the narrative of paddy practices games provides entertainment in understanding of the real practices of paddy farming.

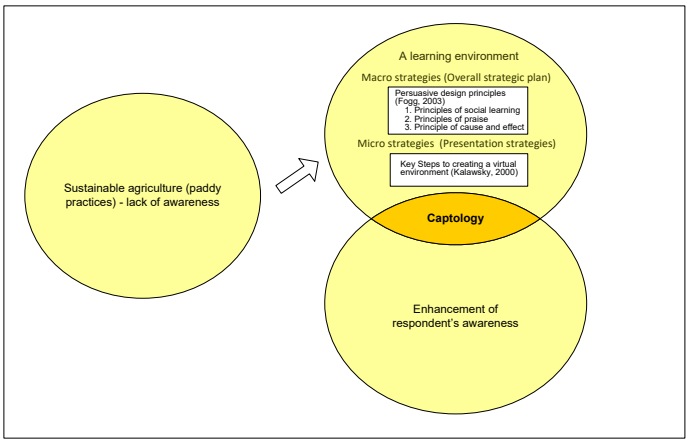

Figure 2: Specific model of the study

Lab experiment procedure

A laboratory experiment was conducted at the Computer Laboratory of the Engineering Department, University Putra Malaysia (UPM) on the 8th of April 2010. A total of 50 respondents were selected randomly to answer the usability and awareness (knowledge and understanding) questionnaire. The respondents consisted of students from the Biology, Engineering and Agriculture Departments, and the Faculty of Engineering of UPM. UPM, was previously known as the School of Agriculture where the main focus of this school to produce agriculture professional in Malaysia.

Before carrying out the study, a letter for seeking permission to use students as test subjects was sent to the dean of the respective faculty. Subsequently, this research began with notification to the respondents by letter and telephone call.

The respondents were gathered at the Computer Laboratory of Biological and Agricultural Engineering, of which then, a test was conducted, as according to the agreed date. The test session began with a brief description of the research goals, tasks and procedures that should be done as well as the protection of confidentiality of information on personal information of the respondents involved. In addition, the respondents were also given the opportunity to ask questions regarding the research. Following this briefing, a declaration form was distributed to respondents.

After obtaining the subjects consent, the respondents were asked to answer the questions in Part 1 and Part 2. Then, the respondents were asked to use the prototype. The period of time that was allocated for the use of prototype was not stated to ensure that the attention of the respondents was focused and satisfactory. After the participants finished playing the learning environment prototype, they then responded to a questionnaire on the learning experience obtained from learning prototype. The questionnaire contained questions on the respondents' feelings and perception on computer usage. During throughout this test phase, the session was recorded by using video cameras.

RESULTS

In the pilot test conducted, expert reviews were carried out to assess the usability of the contents of the program to evaluate the content, the flow of the material, the user interface and the usability of the prototype. Two experts were identified for the purpose of this study; namely a subject matter expert and a user interface expert. The subject matter expert's responsibility was to review the accuracy, significance and comprehensiveness of the content. Specifically, the content of the prototype deals with sustainable paddy practices. In the evaluation of the content, an expert reviewer from UKM was chosen. Following this, three sessions of interviews and discussions were conducted.

The responsibility of the user interface expert is to examine the interface of the prototype and judge its compliance with recognized usability principles (the heuristics). Two user interface experts from University Utara Malaysia were selected for this phase (ongoing evaluation design process).

In short, the usability results revealed that the learning prototype has the potential to be a learning tool, particularly to be used in promoting awareness on sustainable farming issues and enhancing the level of sustainability awareness. At the beginning of the survey, it was found that 32% of the respondents were not aware of organic practices as being part and parcel of sustainable agriculture. However, after the respondents had used this prototype, 90% of them agreed that organic practices are a part of sustainable agriculture. The results also indicated that 94% of the respondents agreed that this system provided more understanding in organic paddy farming practices. 96% of the respondents also stated the prototype had been successful in creating awareness among the respondents. On the other hand, for the descriptive user interface satisfaction analysis, the lab experiment results shown at table 1 reveal that the highest item stands at a mean of 4.35 and the lowest mean is overall reaction system.

Table 1: Mean of User Interface Satisfaction

Dimension	Mean (Scale 5)
Overall Reaction to the Software	4.15
Screen	4.35
Terminology and Sytem Information	4.30
Learning	4.25
System capabilites	4.21

CONCLUSION

In brief, ICT has become the medium to generate and disseminate sustainable agricultural knowledge for environmental, social and economic sustainability. Sustainable agriculture has an important role to play in improving the quality of human lives and environment. Hence, technology should be used to facilitate sustainable practices in farming activities. Moreover, from the study, it has been proven that by using ICT tools in the learning environment prototype, it can be used to educate and promote sustainability practices to the public. However, other factors such as interactive and cooperation between farmers; government bodies, research institutions; and policy-makers are important factors in achieving sustainability in agriculture (Murad *et al*, 2008; Sharghi *et al*, 2010). For future study, it is recommended that more research regarding the use of ICT in promoting sustainability awareness to explore sustainability issues in other areas to be carried out.

ACKNOWLEDGMENTS

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TREND OF SERVICE ORIENTED ARCHITECTURE (SOA) ADOPTION ON HETEROGENEOUS INFORMATION SYSTEMS IN UNIVERSITIES' ENVIRONMENT

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ABSTRACT. The purpose of this paper is to discuss the trend of adopting Service Oriented Architecture (SOA) concept in information systems (IS) at universities' environment. Recently, SOA has been tremendously adopted in many organizations for their benefits in IS management. Characteristics of SOA such as loose coupling and service based make heterogeneous systems easily integrated. However, the adoption of SOA into IS development for universities especially in Malaysia is still not very encouraging. Many aspects need to be further explored in relation to the issues and motivation of SOA adoption, especially in the aspect of system integration. At the initial stage, the current trend of web services should be well understood. This paper will discuss the reviews on previous and current studies of adopting SOA in universities' systems environment. The findings show the trend of SOA adoption on heterogeneous IS in universities' environment. A study has been initiated at Universiti Utara Malaysia to explore the potential of the SOA current trend in improving system integration between heterogeneous IS; Learning Management System and Student Information System. The study intends to use different technologies in constructing SOA based system with apply the so-called web services that will act as the major technology in solving problems of the system integration.

Keywords: Service Oriented Architecture, web services, loose coupling, heterogeneous, information systems

INTRODUCTION

In universities' environment, information technology (IT) and information systems (IS) have played important roles in supporting universities' operations. Universities normally use different IS that have been developed using different programming language and database, managed by different department as well as operated on various platform. This situation creates difficulties when there are needs to integrate different systems in large distributed systems. This is because by nature all large systems are heterogeneous and complex. According to Spencer (2007), many student information systems used in academic institutions are inflexible, complex, less functional, and do not meet current needs. These phenomena contribute to data redundancy in different databases, which consequently create technical challenges and cost increment for systems maintenance. Then, as for users, the situation has eventually created frustration in using the systems.

The challenges above are similarly encountered in most universities especially in Malaysia. As IS that are related to students, courses, classes, healthcare, and teaching and learning need to be effectively managed especially in providing students with different IS

services at all levels of operations; a new paradigm in IS development should be considered to enable and support system integration. In dealing with this, a study needs to be conducted to help finding a solution in a way to increase efficiency of IS operations at universities' environment especially in Malaysia. This paper presents some reviews that relate to SOA adoption in several universities' environment. The findings of the reviews have created an effort to conduct a study on using SOA adoption for systems integration among the heterogeneous IS in a university.

HETEROGENEOUS SYSTEMS IN UNIVERSITIES' ENVIRONMENT

The functions and operations in universities are supported with various IS. The IS mostly operated in different platform, programming language and type of database. Furthermore, usually in a university, the IS will provide services to different entities such as colleges, library and departments which are always updating data from the main system such as student information systems. Figure 1 depicts a typical scenario of the current situation for communication systems among different IS in a university at Malaysia. There are student information system; undergraduate system or Academic and Student Information System (ASIS) and postgraduate system or Graduate Academic Information System (GAIS), Library System, University Health System, Alumni System, Teaching and Learning System; E-Learning System, and College System. These systems are isolated, decentralized and heterogeneous; running on different databases, applications, servers, operating systems (OS) and programming or script languages.

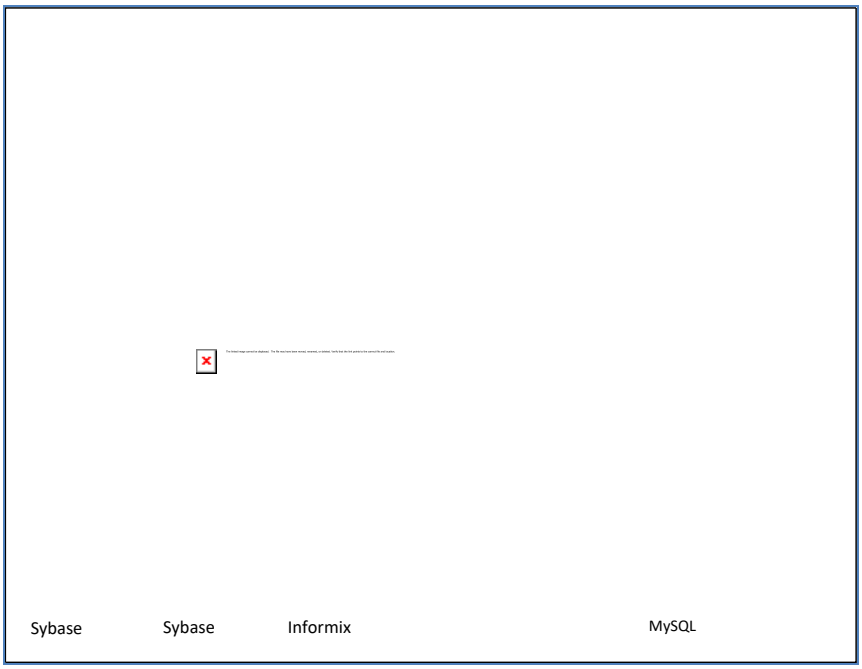

Figure 38. Current Scenario of the Systems Communication in a University

The heterogeneous systems provide several challenges to users, especially the issue of system integration. Without the integration capability among the heterogeneous IS, the users

are required to repeat some tasks like to enter the same data several times in each different system, which is called silo tasks. For instance, in the university, new student has to fill in a form of student personal information during admission registration. This information will be manually inserted into admission module of ASIS by a person in charge there. This similar case also had occurred at the library system where the student's data again must be manually selected by system analyst there from the main systems such as e-University System, ASIS and GAIS to active the access library functions such as borrowing books from the library. This is because the library system uses Informix database and PHP language while ASIS works based on Sybase database with JSP language, which is possible to integrate both of them. These silo tasks should be reduced when the main student information system can be integrate efficiently across the heterogeneous IS. The main problem here is the systems involved used different programming languages, databases as well as OS that hard to exchange the data each other and making silo tasks.

THE CONCEPT OF SERVICE ORIENTED ARCHITECTURE

Service Oriented Architecture (SOA) is a system design approach for enabling interaction across heterogeneous information systems. An information system developed based on SOA concept will provide a loosely coupled suited with services that can be used within multiple separate IS from several business domains. Loose coupling, on the other hand, is the best characteristic for reducing system dependencies. Besides, SOA characteristics of loose coupling enable high interoperability (Josuttis, 2007) that can also make a real time data updating. This attribute of interoperability is very important in solving the systems integration problem especially for the heterogeneous systems. There are many integration solutions were proposed and have been used (Nikayin, 2009) but some improvements are still needed for more efficiency.

In SOA environment, IS operates with a collection of services. Term of service in SOA means the self contain business functionality and to bridge the business and IT gap. According to Papazoglou & Georgakopoulos (2003), services are self-describing, open components that sustain rapid and low-cost composition of distributed applications, while architecture is a combination of models that describes a structure of subsystem's components, which is defined by the combination of those models. Bass, Clements & Kazman (2003) defines architecture as the structures of the system, which comprises of components, the externally visible properties of those components and the relationships among them. Therefore, architecture of a system could be defined as a model that describes the structure of a software system in terms of computational components, the relationships among components, and the constraints for assembling the components.

SOA also brings a different definition to different people and organizations (Gabhart & Bhattacharya, 2008). In this study, based on the problem of system architecture that was not connected to each other, SOA is considered as an approach to design architectural system for large distributed systems (Bhakti & Azween, 2009). It is recommended that the concept of SOA should be adopted into IS development in universities' environment. It will help reducing silo tasks, technical issues of system integration and maintenance cost in the university's management and operations.

TREND OF SOA ADOPTION IN UNIVERSITIES' SYSTEMS ENVIRONMENT

The previous studies (Pasatcha & Sunat, 2008; Mok & Fong, 2008) have shown that many education institutions have applied SOA concept into IS development and integration, such as at the University of Wisconsin at Madison, Embry-Riddle Aeronautical University, and Cornell University. Most of the projects used Web Services (WS) technology, SOAP, XML, and as well as Java programming language to develop interface agent of SOA (Mok & Fong,

2008) to centralize their systems. WS technology is widely used as a middleware in implementing SOA concept for heterogeneous IS among in the education institutions to support interoperability (Mohd Hasan & Al-Kharusi, 2009) and loosely coupled. This is to ensure flexibility to integrate with different IS environment and any changes in one component will not affect other components in the system. These systems of SOA based show that implementing SOA with WS technology becomes a trend in SOA adoption in IS development including at education institutions.

The three universities above had been succeeded in implementing the SOA concept into their IS environment (Eduventures, 2006). The University of Wisconsin at Madison has accomplished eliminating data redundancy, getting the information needed on real time, and improved their security for only official data they were authorized to receive. At Embry-Riddle Aeronautical University, the adoption of SOA had contributed to a robust, highly agile, & scalable enterprise resource planning (ERP) system that could provide its globally dispersed staff and students on real time, web-accessible services & improving the speed and accuracy of its business process. These efforts had saved cost and time in completing a process for the university. For the case of the Cornell University which earlier had a problem in integrating their different IS and silo applications, had improved the integration process and allowed users to view enterprise data dynamically across silos as well as to access componentized applications as needed.

In Malaysia, a small number of studies have been conducted on SOA adoption with WS technology into IS in universities' environment (Alkhanak & Salimah, 2009; Fang Fang & Chien Sing, 2009). The legacy systems are decentralized and separated and therefore, it is worth to take an effort to integrate them. A study was conducted at a public university in Malaysia, where SOA concept was applied into a postgraduate student department (PGD) system, developed with several modules of applications. The study produced SOA web services framework with a prototype, being developed and evaluated. The result shows an increase level of students' satisfaction in using the systems services.

The traditional system of educational services cannot support IS architectural flexibility due to their isolated and complicated designs but every day the demand for modularized and personalized educational services is growing. By providing IS architecture based on SOA, it can allow scalable environment where any modification of the system services can make and grow easily without interrupting the core architecture so its maintainability of the educational services is easier than before (Pasatcha & Sunat, 2008). The most important here is this model based on SOA concept could help the educational sector to develop their IS with cost efficiently and dependable services. The advantages of SOA concept was agreed by Erl (2008) who viewed SOA as a way to loosely coupling software components or the services from different legacy systems to empower business agility and facilitate the reusability of software assets.

POTENTIAL SOA ADOPTION

Based on the discussions presented earlier, various characteristics of SOA such as loosely coupling and services based can be supported by WS technology. The trend of SOA adoption studied is normally related to three quality attributes of interoperability, flexibility and modularity, which are currently the main concern for wide acceptance and adoption of SOA based systems in IS development. These studies of the SOA adoption trend could be a guideline for universities' IS development and integration. Motivated by this trend, a study has been initiated to identify the best way for implementing SOA based systems in Universiti Utara Malaysia (UUM). The intention was driven by the needs to solve system integration issues existed among the heterogeneous IS at the university. These systems include ASIS, and Learning Zone System (LZS), as the learning management system that were developed using different programming languages, databases and platforms, thus, creates challenges in

performing smart system integration. For instance, the ASIS was developed using Sybase database and Java Script Programming (JSP) whereas the LZS is Hypertext Preprocessor (PHP) language and MySQL database oriented. Both of the systems are related to each other in a sense that data provided in ASIS is used by LZS. Due to the different technologies, users face challenges in updating the data from ASIS to LZS. Through SOA, which provides the opportunities for creating a web service to handle the request and provision of services such as data updating, it is expected that the adoption of SOA could help to improve and solve the related system integration problem. In the first stage of this study, an interview with systems' developer there had been conducted to further analyze the current situation and issues of the two systems. Continuing from that, the study will propose the SOA framework for UUM case and proceed with a prototype development to explore the potential adoption. Different tools and standard technologies that support SOA functionality will be applied towards determining the suitable solution for implementation. Figure 2 shows the SOA framework for UUM case with the focus of ASIS and LZS as the pilot project to integrate services of the heterogeneous systems on real time.

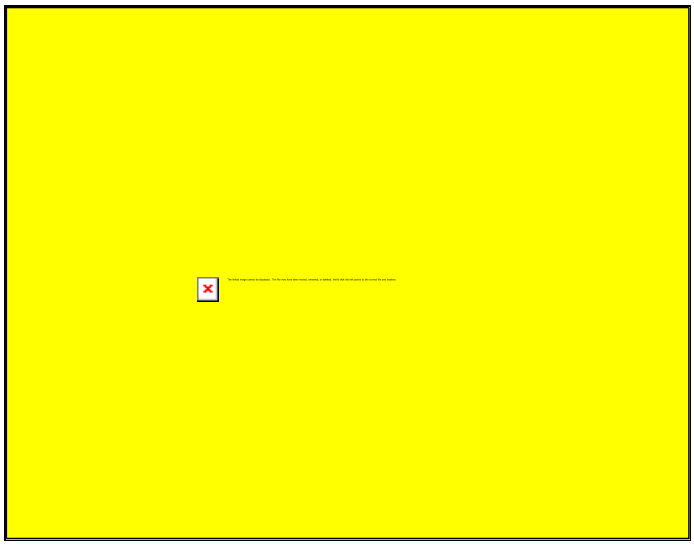

Figure 2. SOA Framework for Pilot Project of UUM Case

The next stage includes the review of the prototype by the selected experts and the evaluation of the prototype by the system's users. It is the research's expectation that the findings, in future will take the advantages of SOA benefits in solving issues of system integration in the university's information systems as well as in other institutions.

CONCLUSION

Many parties have realized the advantages of SOA adoption. However, to have a successful SOA implementation, a careful study and a good strategic plan is important and need to be considered for IS development because with inappropriate planning, SOA implementation will become costly and complicated to achieve successful. SOA implementation rightly claimed to reduce silo tasks, maintenance cost and time in receiving information with the latest update as well as increase performance. With these advantages, it

could indirectly increase operational efficiency for the IS management. An effort to apply the concept of SOA in solving system integration issues in UUM is expected to give more benefits to the university to effectively and efficiently manage its IS as well as to provide some insights to other institutions in searching for solution to system integration among heterogeneous systems.

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ICT KNOWLEDGE TRANSFER TRAINING PROGRAM AT MALAYSIAN UNIVERSITIES

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ABSTRACT. This paper addresses the employability issues namely the gap between graduates' foundation knowledge and skills in technical subjects and the needs of the industries through knowledge transfer training program. Infosys Campus Connect Program is adapted to enhance graduates' technical and problem-solving skills tailored towards industry requirements. Participants are expected to be able to integrate substantive and syntactic knowledge to obtain discipline knowledge. At the end of the program, the participants of the program are expected to be industry-ready or work-ready.

Keywords: employability issues, knowledge transfer

INTRODUCTION

The Malaysian Ministry of Higher Education (MOHE) has put together two blueprints which outline how MOHE aims to transform the state of higher education named: National Higher Education Strategic Plan (NHESP) and the National Higher Education Action Plan 2007 – 2010 (NHEAP). The National Higher Education Strategic Plan outlines seven strategic thrusts to re-energize the national higher education. One of the seven thrust areas is strengthening institutions of higher education to enhance graduate employability.

In order to execute the thrusts, the NHEAP was formulated to provide appropriate focus on the initiatives as well as to enhance quality in higher education (National Higher Education Action Plan 2007 – 2010, 2007). Malaysia aspires to produce competent graduates to fulfill national and international manpower needs with 75% of graduates employed in their relevant fields within six months of their graduation. However, the current model of higher education here does not sufficiently address the needs of the industries.

With businesses going global there is intense global competition for talent around the world which Malaysia is currently not in the position to supply. This need is not supported by the curriculum at universities where technology innovation is moving faster than the enhancements in the curriculum which means that the universities are not in tandem with the current technology. In most of the Malaysian universities, the curriculum is reviewed after more than 2 years (Frost & Sullivan, 2009). As it will take time for the universities to adjust to the current needs, the government looked at other possibilities to enhance the graduates' employability.

Rozana, (2009) reported that there is no issue of job openings for graduates in the ICT sector but the issue is whether the graduates have the right skills for the industry.

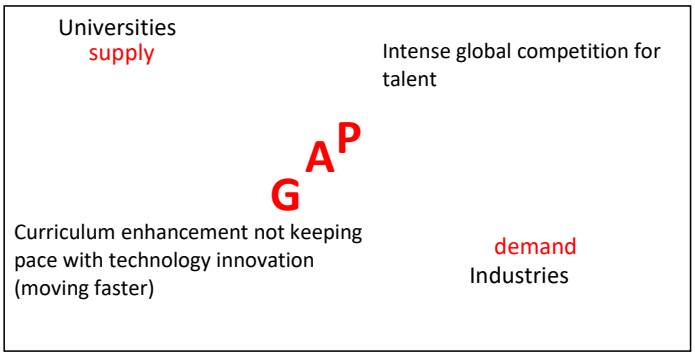

Figure 39. Supply and Demand Gap
(Source: MSC Malaysia Frost & Sullivan Supply and Demand Study 2009)

Gazali (2009) presented several issues regarding graduate employability where industries claimed that local graduates lack employability competencies such as basic functional competencies, confidence, communication skills and language proficiency. Another issue was that 90 percent of university lecturers do not have industry experience to enable them to share actual experiences and real industry cases with their students.

As one of many initiatives to realize the NHEAP, the Malaysian government has signed an understanding with the Indian government to enhance employability and industry readiness of our local graduates. The Indian government responded with the knowledge transfer program known as Campus Connect Program (CCP) from Infosys Technologies Limited. The main objectives are to increase the quantity and quality of the ICT talent pool in Malaysia. The same program is currently successfully implemented in India in over 300 colleges and the number is on the increase.

LITERATURE REVIEW

Argote & Ingram (2000) define knowledge transfer as "the process through which one unit (e.g., group, department, or division) is affected by the experience of another". This transfer may be executed if there are social interactions of two types of knowledge: tacit and explicit knowledge. Tacit knowledge is basically in the human brain and cannot be easily expressed while explicit knowledge can be documented and transferred. In the universities, students develop tacit knowledge in their domains of study from various sources such as from the lectures, lecturers' experiences, practical skills and internship programs. However, domain knowledge can only be developed if they have substantive and syntactic knowledge.

Substantive knowledge refers to knowledge of the global structures or principles of conceptual organization of a discipline (Shulman, 1987). It includes knowledge of facts, concepts, and principles within a content area and knowledge of the relationships between these. Students should build this knowledge gained from content subjects they have learned. The problem at universities is that students do not have the substantive knowledge as they are not able to blend the knowledge from subjects they have learned. This is one of our problems in the universities (Sulaiman, 2010).

Syntactic knowledge includes knowledge of the historical and philosophical scholarship on the nature of knowledge in a discipline (Shulman, 1987). It refers to knowledge of the principles of inquiry and values inherent to computer science and of the methods with which new ideas are added and deficient ones are replaced by those who produce knowledge in the field. Students should build this knowledge through research methodology and project development (e.g. final year project), alas students at times cannot relate between research methodology and project.

In implementing the Infosys program, students are found to be able to integrate or blend the knowledge together as it is designed to create a conducive and "related" learning environment for the students so that each new module will be related to the previous module. The order in which the modules is implemented plays an important role in ensuring students can easily absorb the knowledge and skills and apply it in projects. In the university environment each module is "an island" where a subject is taught in a semester of 14 weeks and usually has no "connection" with other subjects in that semester. By the time a student learns another subject in the following semester, the subjects taught in the previous semester will have been forgotten. They will find it difficult to "connect and relate" knowledge and skills from previous subjects to the current subjects being learned.

Students who participated in the program are treated as office workers. They have to "clock-in" at 8:30 a.m. in the morning and "clock-out" at 5:00 p.m. Attendance is taken in the morning, lunchtime and in the evening. Absenteeism without a valid reason is not tolerated. Notes, lab guides and case study booklets for each modules are available for the participants to refer and use only during "office" hours. The documents cannot be taken out of the "office". This policy forces the participants to focus their attention towards the "work" at hand. Apart from the technical skills, participants are exposed to the soft skills during their project developments where they can display their leadership skills, teamwork skills, communication skills, ethical and moral values. During the project presentations, they will display their presentation and communication skills which are important skills in the industry.

METHODOLOGY

The Malaysian government formed a technical committee to coordinate the implementation of the CCP in Malaysia. The committee members comprise of technical experts from various local universities, MOHE and MDEC. The ministry also appoints lecturers who have attended the FEP to be the Single Point of Contact (SPOC) at each university to coordinate the FP rollouts at their own universities. Communications with Infosys is through a SPOC for Malaysia from MDEC.

The technical committee agreed that the CCP should be carried out starting with the conclave or workshop to discuss the needs and actions for the academia-industry collaboration as well as the importance of networking among academia. The workshop is followed by the Faculty Enablement Program (FEP) where the academia is introduced to the teaching methodology that Infosys uses and prepares them to roll-out or implement the Foundation Program (FP) in their own colleges. The FP aligns technical competency to a student's individual needs. Participants are exposed to real-life case studies and insights into application of technology. The facilitators are themselves practitioners and thus are able to share their industry experiences with the participants.

FINDINGS

The FP for students is carried out in two approaches: national level rollouts and local university rollouts. There are 400 participants in the national rollouts and 339 participants in the local rollouts. The national level rollouts are shown in Table 1 and the local university rollouts are in Table 2 below.

Table 1. FP National Rollout

Year	Location	No. of Participants
2007	Infosys Global Education Center, Mysore	100
2008	Infosys Global Education Center, Mysore	100
2009	Universiti Teknikal Malaysia Melaka	100
2010	Universiti Malaysia Sarawak	100
	Total	**400**

Table 2. FP Local Rollout at Universities

Year	University	No. of Students
2007	Universiti Teknikal Malaysia Melaka	47
2008	Universiti Teknikal Malaysia Melaka	129
	Universiti Teknologi MARA	22
	Universiti Tun Hussein Onn	8
2009	Universiti Teknikal Malaysia Melaka	27
	Universiti Malaysia Sarawak	5
2010	Universiti Teknikal Malaysia Melaka	18
	Universiti Sains Islam Malaysia	22
	Universiti Pendidikan Sultan Idris	18
	Universiti Teknologi MARA	43
	Total	**339**

The FEP for the academia was done in two batches involving public and private universities. Table 3 shows the details of the FEP.

Table 3. FEP Implementation

Year	Location	No. of Participants
2007	Universiti Teknologi Petronas, Perak	70
2010	A'Famosa Resort, Melaka	38
	Total	**103**

Feedback forms designed by Infosys are used to get information on the appropriateness of the course content, projects, class environment, and team assignment from participants at the end of each module to enable the technical committee to evaluate the effectiveness of the module implementation. Using a Likert scale of 5, 739 participants were asked to fill out questionnaires on course content, projects, class environment and team assignment. One of the feedbacks from participants in Batch 3 conducted by UTeM for the programming fundamentals module is in Table 4.

Table 4. Feedbacks for Programming Fundamentals module

Criteria	Average (/5)
Course Content	4.58
Projects	4.58
Class environment	4.67
Team Assignment	4.17
Average	**4.55**

The MDEC conducted surveys to find out the employability status of the participants and collected feedbacks from the participants, lecturers and industries. In terms of employability, from Batch 1, 75 percent of participants are gainfully employed within two months after returning back to Malaysia while 25 percent furthered their studies. For Batch 2, where 73 students and 27 lecturers attended, 76 percent of the students are employed. Information from Batch 3 and 4 is currently being collected through the myinfosysalumni.org portal and through phone interviews.

From the academia, a lecturer at Universiti Islam Sains Malaysia embeds the FP tool, Raptor, in her programming classes. She found that the students were more enthusiastic to learn flowcharting algorithms with the tool. It helps them understand the logical system flows and thus they can design better systems.

UTeM introduced a subject in 2008 designed from one of the 9 modules in the FP. The Analysis of Algorithm module was transformed into a 14-week syllabus for the second year degree students. The module is currently taught at the degree and masters levels of the ICT programs. A total of 180 students have attended the course up till 2010.

From the participants' perspective, Johanna Hanny Johny Anwar from Batch 1, now working with Infosys Technologies Limited, Singapore, has this to say: "Everything was so hands-on. In university, we received excellent theoretical knowledge but the Infosys educators were very experienced and they used real scenarios in their lessons."

CONCLUSION

The transfer of knowledge through the CCP of Infosys has helped our graduates to easily get jobs as the name "Infosys" is already well-known in India and around the world due to its commitment to quality training. The CCP can either be implemented as a 'polishing up' class for final year students, as one of the elective courses or embedded in the taught courses. Infosys offers this program as part of its corporate social responsibility to the community and to the world through its many international offices around the world.

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CRITICAL FACTORS OF HOSPITALS PERCEPTION ON CRM SYSTEM: INNOVATION, ORGANIZATIONAL AND ENVIRONMENTAL PERSPECTIVES

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ABSTRACT. This paper highlights on a study aimed to identify the factors that may influence on the perception of the benefits of Customer Relationship management (CRM) system and the direction of this influence in the private hospitals in Malaysia. Three factors (innovation, organizational, and organizational factors) were identified as influencing on the perception of the benefits of CRM system. A quantitative research approach is deployed in this study and a questionnaire is used as the data collection tool. Private hospitals in the northern part of Malaysia are selected using area sampling method and the convenience sampling where the managements of the hospitals become the target respondents. The pilot study indicated for an acceptable level of reliability of the questionnaire constructs where the values of Cronbach's Alpha for all the constructs were greater than 0.6. For the survey, the research questionnaire will be distributed to the sample of the study and each respondent will be given a month to complete the questionnaire. The collected data will be analyzed using SPSS 18 and Structural Equation Modeling (SEM) using AMOS. The results of the survey are expected to help the decision makers of the hospitals to better plan for the adoption and implementation of CRM systems. In addition, it will benefit the vendors of CRM systems toward better understanding of the needs of hospitals to be able to expand their market in the healthcare industry.

Keywords; Customer Relationship Management (CRM), perception, critical factors

INTRODUCTION

Customer Relationship Management (CRM) systems promise of several benefits to hospitals such improving customer satisfaction and loyalty and increasing competitiveness and revenues. Naidu et al. (1999) articulated that hospitals could make relationships with their customers or collaborate with other partners such as the suppliers, other hospitals, or specialized healthcare providers to improve their service delivery to customers. Hospitals as the major healthcare units are highly depending on direct contact with the customers. Therefore, they have to adopt the CRM as an information system innovation to gain benefit from the CRM capabilities in managing their relationship with the customers. On the other hand, there is a lack of CRM systems adoption in the hospitals. For example, Raisinghani (2005) reported that there was no hospital in Germany adopted CRM system until 2005. In addition, only 41% hospitals in Taiwan adopt the CRM systems and 59% do not (Hung et al., 2010). The perception of CRM by organizations is still vague and unclear (Plakoyiannaki,

2005). In addition, there is an indication for a lack of studies of the CRM perception of organizational members (Reinartz et al., 2004). However, the organizational efficient adoption and implementation of CRM initiatives could be enabled by the understanding of how organizations' members perceive CRM (Plakoyiannaki, 2005). Obviously, a review of the literature reveals a lack of studies discussing the perceptions of organizational members of CRM (Reinartz et al., 2004). Additionally, the perceived benefits of CRM influence the CRM strategy adoption significantly (Ko et al., 2008). According to Rogers (2003) the perception of an innovation benefits precedes the decision of adopting this innovation. In addition, the perception of CRM benefits has been found to be significantly influencing the organizational decision of CRM adoption (Ko et al., 2008). It is also claimed that CRM as a technology innovation will be adopted by organization only after they realize its benefits.

Based on the early observation, the situations in the private hospitals in Malaysia are as the following; some hospitals do not know about CRM systems; other hospitals just have the orientation to be customer-centric; some have customer service department; some hospitals have software for managing customer feedbacks; and other hospitals enable their customers to do activities such as making appointments for treatment or medical tests and checkups, viewing the tests results, and even complaining of the services through the hospital's website (Rababah et al., 2010). Moreover, Rababah et al. (2010b) have conducted a study to identify the perception of the benefits of CRM system in the private hospitals in Malaysia. They found that there is limited understanding of CRM concept and low perception of the benefits associated with the implementation of CRM systems in the private hospitals in Malaysia. In addition, the results of the study revealed that no private hospital in the northern part of Malaysia has adopted a CRM system and only two hospitals have a future plan for the adoption of CRM system.

This paper presents a discussion about a study that aims to identify the main critical factors that may influence on the perception of the benefits of CRM systems. In addition, this study will empirically investigate the influence of these factors on the perception of the benefits of CRM systems in the private hospitals in Malaysia. The organization of the rest of the paper is as the following; defining CRM and CRM system; describing the roles and benefits of CRM systems to hospitals; identifying the antecedents of CRM system perception in hospitals; proposing the research model and hypotheses; and presenting the research method. The last section discusses the conclusions and recommendations of the paper.

CRM AND CRM SYSTEM DEFINITIONS

CRM has been defined as a business philosophy, a business strategy, and a business technology as it means different things for different people (Buttle, 2004). However, a wider definition of CRM that combine the previous three views is provided by Rababah et al. (2010a) defined CRM as "the building of a customer-oriented culture by which a strategy is created for acquiring, enhancing the profitability of, and retaining customers, that is enabled by an IT application; for achieving mutual benefits for both the organization and the customers". Lun et al. (2008) stated that "CRM is the philosophy, policy and coordinating strategy mediated by a set of information technologies, which focuses on creating two way communications with customers so that firms have an intimate knowledge of their needs, wants, and buying patterns". These information technologies which are CRM system is defined by Bibiano and Pastor (2006) as "an enterprise information system that includes all business processes in sales, marketing, and after-sale service that involve the customer". CRM system may consist of three modules; operational CRM, analytical CRM and, collaborative CRM (Lun et al., 2008). The next section addresses the different roles of CRM systems in hospitals.

CUSTOMER RELATIONSHIP MANAGEMENT (CRM) IN HOSPITALS

There are many deficiencies in the relationship between healthcare providers and their customers such as the long waiting time by patients till receiving the treatment whether at the inpatient clinics or at the admission office and the forgetting of the appointments by patients (Chao et al., 2007). CRM could be referred to as patient relationship management and it is not a popular concept among chief executives officers (CEOs) of hospitals (Young, 2007). On the other hand, there are many expected benefits from the implementation of CRM systems in the healthcare organizations such as (1) optimizing revenues and improving patient health, relationships, and loyalty (Ginger & Nancy, 2004), (2) could deliver greater Return on Investments (ROI) and it seems to be the perfect solution for the major problems at the healthcare industry (Rebecca, 2007), (3) an essential cost-effective approach to maintain long-term customer relationships (Kohli et al., 2001), (4) increasing the transparency of cost and resource allocation within the hospital (Raisinghani, 2005), (5) the mapping of the documentation during the patients' treatment is one of the major cost reduction areas that the CRM systems have handled effectively in the hospitals (Raisinghani, 2005), and (6) reducing the costs associated with the no-shows or cancelled appointments (Young, 2007). After explaining the different roles of CRM in hospitals, the following section reviews and indentifies the different factors of the perception and adoption of CRM systems.

ANTECEDENTS OF CRM SYSTEM PERCEPTION IN HOSPITALS

There are complex reasons or issues for the introduction of a new IS in an organization such as economical considerations and technology (Lehane & Huf, 2005). Moreover, Fitzgerald et al. (2002) indicated for the need to consider the technical and organizational factors to increase the IS adoption in healthcare industry. Furthermore, CRM adoption is strongly related to organizational and environmental contexts in which the introduction of CRM into organizations is closely relevant to internal organization culture and structure and also requires considering the possible competitive impact from the external environment (Wu & Wu, 2005). Therefore, this study will focus on three factors; innovation, organizational, and environmental factors that are related to the CRM system adoption.

The innovation factor includes the innovation characteristics where it is the CRM system in this study. The focus of this study will be on six characteristics of the CRM system. The relative advantage, complexity, compatibility, trialability, and observability of the CRM system as supported by DOI theory by Rogers (2003) and the Model of (IS) Innovation by Kwon and Zmud (1987). Moreover, this study will focus on another determinant of CRM adoption in the healthcare which is the security as supported by Rebecca (2007) as she indicated for the customer data confidentiality concerns and as supported by Paddison (2004) as she indicated for the privacy concerns. For the organizational factor, among the causes or reasons of CRM initiatives' failure are; the lack of leadership and top management involvement in the CRM project (Caldeira et al., 2008; Kale, 2004), cultural problems (Caldeira et al., 2008; Trembly, 2007), and not managing organizational change properly (Caldeira et al., 2008; Kale, 2004). There is a lack of business knowledge and skills of managers and executives at the healthcare industry in terms of the full utilization of automation and technology (Fok et al., 2003). The organizational factor is supported by the model of IS innovation by Kwon and Zmud (1987). The focus of this study will be on five of the organizational characteristics including top management support, knowledge management capabilities, IS experience, organizational readiness, and innovation of senior executives. For the environmental factor, Kohli et al. (2001) pointed out that because of reasons such as limited competition and the lack of pain in forcing a change, healthcare organizations have been very slow in adopting IT. In addition, the environmental factor is supported by the model of IS innovation adoption of Kwon and Zmud (1987) and this model includes competitor pressure, customer satisfaction, and marketing approach variables. The focus of

this study will be on two variables including the competitor pressure and the external IS support.

This study will relate the perception of the benefits of CRM system to three factors; innovation, organizational, and environmental factors. The following section describes the research methodology.

RESEARCH MODEL AND HYPOTHESES

As more people especially high income people have high interests in getting medication and services from private hospitals, these hospitals need to increase the quality of the services to their customers. They are looking forward to improve to relationship with customer. However, based on the researchers' early observation, there is no record show that hospital (general and private hospital) in the northern part of Malaysia has adopted a CRM system. Since perception can influence the adoption of a new technology, it is important to investigate the perception of these private hospitals towards adopting CRM systems.

The focus of this paper is therefore to discuss on the critical factors related to study on the persuasion (perception) of CRM systems as prior stage before the decision of adoption. The study was based on the Innovation Diffusion Theory (IDT), which has been widely used in the literature to investigate the adoption of innovations at different kinds of businesses (Rogers, 2003). The model highlights the adoption process as consists of five stages: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, (5) confirmation. Kwon and Zmud (1987) have suggested that the combination of IDT with market research will be highly necessary and useful for studying IT effectively. They have added into Rogers's model with environmental and task factors. It was found that this model could provide an understanding for the adoption of IS innovations in organizations in a generic sense (Wu & Wu, 2005).

Figure 1 illustrates the research model in relation with the study. Three hypotheses are proposed; H1: The innovation factor will positively influence the perception of the CRM system's benefits; H2: The organizational factor will positively influence the perception of the CRM system's benefits; H3: The environmental factor will positively influence the perception of the CRM system's benefits.

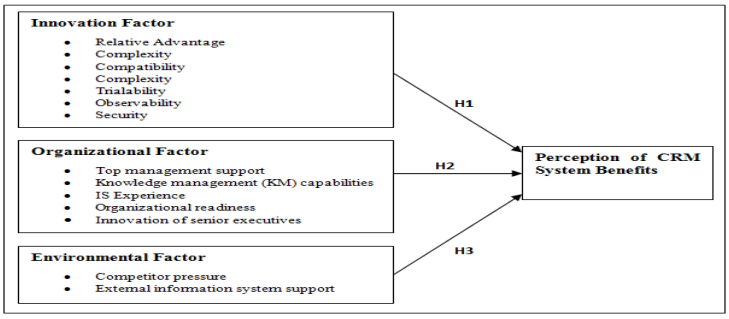

Figure 1. Research Model

RESEARCH METHOD

A quantitative approach was utilized in the study and a survey was used to collect the data. The target population of this study is the Malaysian private sector hospitals' top management and senior management including general managers, marketing managers, IT managers, HR managers and other managers. The private hospital in this study is defined as any hospital in Malaysia that is owned or managed by individuals or groups for the purpose of profit.

The area sampling method is used to determine the sample of the study. Three geographical areas are selected; Kedah, Penang, and Perak and the hospitals to be selected are the member hospitals in the Association of Private Hospitals of Malaysia (APHM). In total, there are 112 private hospitals registered as members in the APHM of Malaysia (APHM, 2010). There are 26 hospitals located in the three states; Kedah 4 hospitals, Perak 9 hospitals, and Penang 13 hospitals. Convenience sampling method was adopted to define the research sample.

Questionnaire was designed to collect the data. The questionnaire developed in this study consists of five sections. The first section was regarding the general information of the respondents including their job title, experience, education, sex, and age. Section two consisted of 15 items developed from multiple resources for the first time to measure the perception of the benefits of CRM systems. Section three was to measure the innovation factor by 38 items. The items for relative advantage (9 items), complexity (8 items), compatibility (4 items), trialability (7 items), and observability (7 items) were adapted from (Moore & Benbasat, 1991). Security was measured by three items adapted from (Kevin et al., 2006). Section four was to measure the organizational factor by 25 items where the top management support was measured by 4 items adapted from (Premkumar & Roberts, 1999), knowledge management capabilities were measured by 6 items adapted from (Croteau & Li, 2003), IS experience was measured by 3 items adapted from (James, 1999), organizational readiness was measured by 9 items adapted from (Iacovou et al., 1995; Croteau & Li, 2003), and innovation of senior executives was measured by 3 items adapted from (Thong & Yap, 1995). Section five was to measure the environmental factor by 9 items, where competitor pressure was measured by 4 items adapted from (Premkumar & Roberts, 1999; Premkumar & Ramamurthy, 1995) and external information system support was measured by 5 items adapted from (Premkumar & Roberts, 1999).

A pilot study was conducted to identify the reliability of the questionnaire. The pilot study shows an acceptable level of reliability where the values of Cronbach's Alpha for all the constructs were greater than 0.6.

FUTURE WORK

The pilot study gave an indication for the three factors; innovation, organizational, and environmental as potential factors influencing the perception of the benefits of CRM systems. Proceeding the pilot study, questionnaire will be refined before distributing to the study sample. Data will be collected to test the proposed hypotheses. Each person in the sample (General Managers, IT Managers, Marketing Managers, HR Managers, and Other Managers) will be given a month to complete the questionnaire. The researcher will collect the questionnaires at the end of the month. A Statistical Package for Social Science (SPSS) V18 and Structural Equation Modeling (SEM) using Amos V18 will be used to analyze the collected data. Based on the results of the survey, a set of recommendations and guidelines will be suggested for both the hospitals' decision makers and the vendors of CRM systems regarding the adoption of CRM systems.

CONCLUSION

This paper discusses about a study that emphasizes on the lack of the perception of the benefits of CRM systems in the private hospitals in Malaysia. In line with that, three factors were identified as potential factors that may influence on the perception of the benefits of CRM system in the private hospitals in Malaysia. By adapting a quantitative research methodology and using a questionnaire, the influence of these factors will be investigated. Using area sampling and convenience sampling, the study will be conducted on the northern part of Malaysia and the target population is the management. For the pilot test of the research instrument, the results of the reliability test show an acceptable level of the reliability for all

the constructs. The questionnaire will be distributed to and retrieved from the study sample personally by the researcher and each person will be given a month to complete the questionnaire. The collected data will be analyzed using SPSS .18 and SEM using AMOS .18 to examine the research hypotheses. The results are expected to provide a great help for the decision makers in the healthcare industry regarding the successful adoption and implementation of CRM systems. In addition, it may have implications on the vendors of CRM systems and provide them with an indication toward expanding their investments in the healthcare industry as challenging and promising market.

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REDEFINE ENTREPRENEURSHIP IN THE CONTACT OF HIGHER LEARNING INSTITUTION

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Abstract. This paper addresses the issue for the searching of generic definition of entrepreneurship that can applied in the contact of higher learning institutions especially in Malaysia. To address that issue, this paper explores the historical perspective as well as various economic models of entrepreneurship such as the Schumpeter Model. The outcome of the qualitative analysis, this paper suggests that a dynamic and programmatic approach which is a progressive in nature be taken as the process of developing enterprising culture. As such, the participants of this type of program are given guidance and support at the appropriate levels in the organizational entrepreneurship life cycle. For the purpose of redefinition, some underlying principles need to be adopted as guiding the direction toward the long journey to the destination.

Keywords: entrepreneurship, higher learning

1. INTRODUCTION

Entrepreneurship is the most powerful economic force known to mankind. There has been a great deal of attention paid to the subject of entrepreneurship over the past few years, stemming primarily from the discovery by economic analysts that small firms contribute considerably to economic growth and vitality. The entrepreneurial revolution that captured our imagination during the last decade has now permeated every aspect of business and social thinking and planning. The process of transforming creative ideas continues to be our major challenge. Successful entrepreneurship requires more than merely luck and money.

The concept of entrepreneurship has a wide range of meanings and definitions. On the one extreme an entrepreneur is a person of very high aptitude, who pioneers change, possessing characteristics found in only a very small fraction of the population. On the other extreme of definitions, anyone who wants to work for himself or herself is considered to be an entrepreneur. The word entrepreneur originates from the French word, entreprendre, which means "to undertake." In a business context, it means to start a business. The Merriam-Webster Dictionary presents the definition of an entrepreneur as one who organizes, manages, and assumes the risks of a business or enterprise.

Peter Kilby(2003), once compared entrepreneurship to the imaginary animal, the Heffa-lump: It is a large and important animal which has been hunted by many individuals using various ingenious trapping devices. All who claim to have caught sight of him report that he is enormous, but they disagree on his particularities. Not having explored his current habitat with sufficient care, some hunters have used as bait their own favourite dishes and have then tried to persuade people that what they caught was a Heffalump. However, very few are

convinced, and the search goes on (Kilby, Hunting the Heffalump: Entrepre-neurship and Economic Development)

Yet, despite all of the discussion and attention paid to this issue, fundamental questions remain unanswered in a generalize form: What is entrepreneurship?

2. WHAT IS ENTREPRENEURSHIP? FROM HISTORICAL PERSPECTIVES

Many definitions of entrepreneurship can be found in the literature describing business processes. The earliest definition of entrepreneurship, dating from the eighteenth century, used it as an economic term describing the process of bearing the risk of buying at certain prices and selling at uncertain prices. Other, later commentators broadened the definition to include the concept of bringing together the factors of production. This definition led others to question whether there was any unique entrepreneurial function or whether it was simply a form of management. Early this century, the concept of innovation was added to the definition of entrepreneurship. This innovation could be process innovation, market innovation, product innovation, factor innovation, and even organizational innovation. Later definitions described entrepreneurship as involving the creation of new enterprises and that the entrepreneur is the founder. Many kinds of organizations now exist to support would-be entrepreneurs, including specialized government agencies, business incubators, science parks, and some NGOs. In more recent times, the term entrepreneurship has been extended to include elements not related necessarily to business formation activity such as conceptualizations of entrepreneurship as a specific mindset resulting in entrepreneurial initiatives e.g. in the form of social entrepreneurship, political entrepreneurship, or knowledge entrepreneurship have emerged.

Considerable effort has also gone into trying to understand the psychological and sociological wellsprings of entrepreneurship. These studies have noted some common characteristics among entrepreneurs with respect to need for achievement, perceived locus of control, orientation toward intuitive rather than sensate thinking, and risk-taking propensity. In addition, many have commented upon the common, but not universal, thread of childhood deprivation, minority group membership and early adolescent economic experiences.

At first glance then, we may have the beginnings of a definition of entrepreneurship. However, detailed study of both the literature and actual examples of entrepreneurship tend to make a definition more difficult, if not impossible.

3. SCHUMPETER'S VIEW OF ENTREPRENEURSHIP

Austrian economist Joseph Schumpeter's (1942),definition of entrepreneurship placed an emphasis on innovation, such as:

- new products
- new production methods
- new source of supply
- new markets
- new forms of organization

Wealth is created when such innovation results in new demand. From this viewpoint, one can define the function of the entrepreneur as one of combining various input factors in an innovative manner to generate value to the customer with the hope that this value will exceed the cost of the input factors, thus generating superior returns that result in the creation of wealth.

4. THE NEED FOR REDEFINITION OF ENTREPRENEURSHIP IN THE CONTACT OF HIGHER LEARNING INSTITUTION

A dynamic and not static definition for the term entrepreneurship needs to be specifically adopted for the implementation all activities and programs. This approach in definition need to be taken as the process of developing enterprising culture is a progressive in nature. As such, it is a more programmatic approach that allows participants in the program be given guidance and support at the appropriate levels in the organizational entrepreneurship life cycle.

5. THE UNDERLYING PRINCIPLES BEHIND THE REDEFINITION

For the purpose of redefinition, some underlying principles need to be adopted as guiding the direction toward the long journey to the destination. Below are some of those underlying principles. By no means are these principles exhausted.

i. The nature of Higher Learning Institution as a living system of an entrepreneurial organization
ii. The fundamental functions of the university as a learning, teaching, research and consultancy, and provider of community services institution.
iii. The dynamic nature and growth phases of the organization life cycle
iv. The vision and mission of the university in championing human capitalThe consideration of creating enterprising students and staffs
v. The universality of the concept of entrepreneurship of not only for profit organization but also for nonprofit organization
vi. The inclusion of social entrepreneurship in the contact
vii. The need for nurturing of enterprising students with entrepreneurial characteristics regardless of what profession they will venture after graduation
viii. The need to serve the small and medium enterprises
ix. Taking into consideration that entrepreneurship is a process.

6. SUGGESTED ALTERNATIVES DEFINITIONS OF ENTREPRENEURSHIP IN THE CONTACT OF HIGHER LEARNING INSTITUTION

Below are some suggested alternatives definitions of entrepreneurship for discussion and thought and probably will lead to unique definition in the contact of Higher Learning Institution.

I. Entrepreneurship is a capacity building and willingness to undertake conception, organization, and management of productive venture with all attendant risks, while seeking profit or non profit with consideration of creating enterprising culture and society, social well being, economic and social impact for global prosperity as reward. The entrepreneurial spirit is characterized by innovative, creative, risk taking, and essential components of organization's ability to succeed in an even changing, challenging, dynamic, and more competitive global environment.

II. Entrepreneurship is the dynamic process of creating incremental wealth. This wealth is created by individuals who assume the major risks in terms of equity, time, and/or career commitment of providing value for some product or service. The product or service itself may or may not be new or unique but value must somehow

be infused by the entrepreneur by securing and allocating the necessary skills and resources.

III. Entrepreneurship is a dynamic process of vision, change, and creation. It requires an application of energy and passion towards the creation and implementation of new ideas and creative solutions. Essential ingredients include the willingness to take calculated risks- in terms of time, equity, or career; the ability to formulate an effective venture team; the creative skill to marshal needed resources; the fundamental skills of building a solid business plan; and, finally, the vision to recognize opportunity where others see chaos, contradiction, and confusion(Kuratko and Hodgett, 2009)).

7. CONCLUDING REMARKS

The concepts, historical perspectives, and the underlying principles, the dynamic of the organization life cycle and the environment, the conceptualization and the practicality of entrepreneurship will provide thought of developing a unique definition of entrepreneurship for the Higher Learning Institution. This is one the many alternatives to position HIL on the perceptual map among higher learning institutions around the globe as unique and different. Hopefully this short paper will lead toward that direction.

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IMPACTS OF WIRELESS TECHNOLOGY AMONG BUSINESSES IN THE NORTHERN STATES OF PENINSULAR MALAYSIA: URBAN VERSUS RURAL

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ABSTRACT. The applications and use of the wireless technology have potential to improve the Malaysian quality of life by providing them the opportunities to grow in business. This paper looks at the impact of wireless technology in selected urban and rural areas in the northern states of Peninsular Malaysia namely Penang, Kedah and Perlis. Findings from the study are presented in two parts: firstly, the general review of the wireless technology in terms of its access, applications and technology; secondly, the impact of wireless technology in terms of productivity and business. The findings show that wireless technology usage, application and services do benefit both the urban and rural folks in enhancing their economic well-being.

Keywords: wireless technology, urban area, rural area

INTRODUCTION

Malaysia aspires to become a fully developed country by 2020. The transformation from agriculture-based economy to service-based economy put Information and Communication Technology (ICT) in a very special agenda in Malaysian development program. The Government believes that the achievement of the vision can be accelerated by the capability of Malaysians to transform them into information society. This includes not only the urban people but also the rural folks. As a proof, the Government of Malaysia has launched several initiatives to spur the take up rate of ICT, including via wireless technology, among her citizens. Among the initiatives in supporting the rural ICT development are the establishments of various types of telecentres such as Community Broadband Centres (CBC) and Community Broadband Library (CBL) with the purpose to provide collective Internet access to local communities (Datuk Halim, 2009). The ultimate aim, among others is to increase local communities' socio-economic standards through the creation of business opportunities via the centres' activities. This has been proven by Zulkhairi et al. (2009) in their study that telecentres can serve as means to improve one's standard of living, and also as platforms for the cottage industries to promote local produce. Furthermore, it is expected that by 2015 broadband infrastructure will generate economic activities. Such efforts receive supports from telecommunication companies such as Telekom Malaysia Bhd., Celcom (M) Berhad, Packet One Networks (M) Sdn. Bhd., Redtone-CNX Broadband Sdn. Bhd., Danawa Resources Sdn. Bhd. and many others (MyConvergence, 2009).

In order to support and strategize the implementation of ICT at the state level, state governments were taking various initiatives to spur the development of ICT. The state government of Perlis has declared that the whole state of Perlis as a knowledge state (NST, 2008). There is a potential for wider ICT growth to support the vision of the state.

Accordingly, the Perlis state government has undertaken a RM500 million project to implement high speed broadband access for businesses and schools. The project, which is expected to complete by 2013, aims at providing the community with e-government applications and would give broadband access at minimal monthly fees for businesses. Under the first phase, the state's 92 primary and secondary schools involving 48,000 students would be equipped with this service within six months and enjoy free broadband access (NST, 2008). Similarly, in Penang, the Penang K-ICT Council was established headed by the Chief Minister to promote the development of an intelligent island code name PENANG i-LAND 2010 with special emphasis on wireless infrastructure. A program called the Penang Free WiFi, the bigger part of Wireless@Penang initiative, was launched to provide free connectivity to major public places, commercial areas, campuses and housing estates. The target was within three years, 75% of major areas in the island and the mainland are expected to have wireless access (Penang next to get WiMax, 2008). Similar effort has been undertaken in the state of Kedah. The state government is committed to making Kulim High Tech area an extension of the MSC corridor for the northern region. This commitment is important not only for economic reasons but also to pull in the big ICT companies to help the state in promoting ICT especially wireless technology to their people.

Wireless technologies and applications can have great impact on organizations as they change the traditional business processes (Hsieh, 2007; Scornavacca et al., 2006). In fact, mobile business is viewed as an alternative way of conducting business in the future (Li et al., 2008). Mobile business is only possible with the availability of wireless technology, infra- and info-structures. Zaini et al. (2009) indicates that wireless technology helps to boost the players' business reputation and image as technology savvy. Furthermore, it is also mentioned that wireless technology facilitates home-based entrepreneurs in promoting their products and services. This is identical to the findings of Nor Shariza and Oyefolahan (2009). These findings should be valuable for small scale industries' players not only for those that reside in the rural areas but also the underserved groups in the urban areas. On the other hand, the study conducted by Norizan et al. (2010) on the impact of wireless technology on Malaysian highlights that there is a significant difference in means between the urban and rural areas including in business. As such, it deems necessary to investigate this incongruence further. Hence, this paper presents the findings in due respects but focuses only on the rural and urban areas in the Northern States of Peninsular Malaysia.

METHODS

This research was conducted in two stages. During the first stage, a survey was conducted to examine the usage and impacts of wireless technologies among the users in the Northern Zone of Peninsular Malaysia based on quantitative research technique. Three states are categorized within this zone namely Kedah, Penang, and Perlis. In total, ten locations were surveyed. The locations selected were four in Kedah (two urban, and two rural) and four in Penang (two urban, and two rural), and two in Perlis (one urban, and one rural). A set of questionnaire was developed that comprised of, apart from the users' profiles, items related to the applications and services, and impacts of wireless technology. The impacts were assessed in view of its usage in business using five-point Likert scale. Of 400 questionnaires distributed, 390 were returned, and this represents 97.5% response rate. The distribution of urban (53.1%) and rural (46.9%) respondents is depicted in Table 1.

In the second stage, to gauge the implications of wireless technology in business, structured interviews were conducted. Among the questions asked were related to the respondents' choice of technology used and their opinion on the usage of the mentioned technology, the positive and negative values gained from the usage, and the benefits acquired in terms of business advancement.

Table 1: Locations and Questionnaire Received

State	Urban	Received	Rural	Received
Kedah	Alor Setar	38	Jitra	39
	Sg. Petani	51	Pendang	40
Perlis	Kangar	35	Spg. Empat	40
Penang	George Town	39	Permatang Pauh	37
	Butterworth	44	Balik Pulau	27
Total		207		183

PROFILES OF RESPONDENTS

A total of 390 responded to the survey representing the Northern region of which 207 is from the urban area and the remaining 183 is from the rural area. Of the total males respondents, urban males constitute 57.9% whereas, its rural counterpart make-up 42.1%. On the other hand, from the total female respondents, urban females represent 48.5% and rural females represent 51.5%.

In terms of marital status, most of the respondents are married (53.6%). This is consistent across both urban and rural areas (51.7% and 55.7% respectively). It is interesting to note that more than 50.0% of the respondents are aged between 19 to 35 years old. This provides a good indication that the technology is widely acceptable by the young users both in the urban and the rural. Furthermore, in the rural, almost 30.0% of the respondents are aged between 36 and 50 years old, and this making up slightly more than 80.0% of the users from the rural area is those between 19 and 50 years old compared to its urban counterpart which is 76.3%. Accordingly, the level of qualifications of the respondents supports this fact as most of them are youngsters. Male respondents dominate both in number and percentage in the urban (53.1%) as compared to its rural counterpart (43.7%), and majority of them are the Malays (correspondingly 92.3% and 91.8%).

Pertaining to the occupational information, in the urban, 37.2% of the respondents work with the government and 26.6% work in private sectors. They are mainly in the Clerical and Support Staff category (18.4%) as well as professionals (13.5%). Similarly, in the rural, 43.7% of the respondents serve in the government sector, and mainly they are educators. Quite a significant number of the rural respondents are students (26.2%). It is interesting to note that there is also small number of users that work in the Agricultural sectors.

WIRELESS TECHNOLOGY APPLICATION AND SERVICES

Table 2 lists a number of wireless technology services subscribed. The data shows that all types of services are subscribed by both urban and rural respondents. Multimedia messaging is ranked as the most subscribed service by the urban and rural respondents, 64 and 36 respectively, either free of charge or paid. Similar pattern is revealed for ring tones and graphics downloads, video calls and Wireless broadband. These services are mostly paid services. This phenomenon indicates that, despite their economic situation, there are people in rural area who are willing to pay for such services which are mainly entertainment. This could due to the fact that wireless technology is cheaper compared to normal wired installation (Zaini et al., 2009). Details on the types of the services subscribed by the respondents in both the urban and the rural, either free or paid are depicted in Table 2.

Table 2. Services Subscribed by Areas

	Urban (n=207)			Rural (n=183)		
Services Subscribed	**Free (%)**	**Paid (%)**	**Total**	**Free (%)**	**Paid (%)**	**Total**
Cordless telephone	6 (2.9)	-	6	-	1 (0.5)	1

Wireless Home Phone (CDMA/GSM)	1 (0.5)	1 (0.5)	2	-	3 (1.6)	3
Wireless broadband	5 (2.4)	14 (6.8)	19	4 (2.2)	11 (6.0)	15
Video Phone Call (3G)	6 (2.9)	28 (13.5)	34	2 (1.1)	12 (6.6)	14
Video streaming	4 (1.9)	1 (0.5)	5	-	4 (2.2)	4
Ring tones & graphics downloads	18 (8.7)	33 (15.9)	51	7 (3.8)	19 (10.4)	26
Multimedia Messaging (MMS/EMS)	16 (7.7)	48 (23.2)	64	4 (2.2)	32 (17.5)	36

IMPACT OF WIRELESS TECHNOLOGY IN BUSINESS

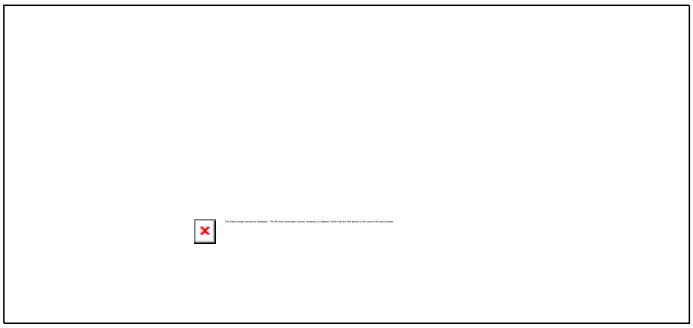

Figure 1. Range of Profit Acquired (n = 46)

The use of wireless technology has influenced business accomplishments from three aspects namely, productivity, profit, and demand. Of the total number of respondents, 57 of them are business respondents. Out of the 57 business' respondents, 75.5% mentioned that the increments in their production rates range from 41.0% to 100.0%. The increased in profit, based on 46 responses, varies in percentages as shown in Figure 1, and the highest ranges between 61.0% to 80.0%.

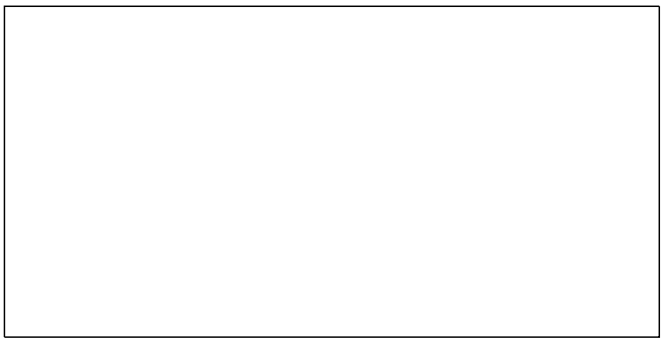

Figure 2. Range of Increase in Demand (n=27)

Similarly, in terms of the demand of the respondents' products or services, slightly more than 51.0% of the 27 respondents indicate that the increments vary between 61.0% to 100.0% as depicted in Figure 2. The huge increment in the demand is believed to be caused by the opportunity that wireless technology offers such as in assisting them to promote their products via advertising on the Internet and mobile phone applications. Viewing wireless technology as a facility that allows access to various information resources, majority of the respondents

believe that their knowledge in business can be enhanced through participating in online discussions (blog/forum), creating business networking/circle, and providing channel for customers' feedbacks.

In addition, most respondents agree that wireless technology helps them in promoting product (25.5%), increasing business knowledge (22.6%), and business network (14.6%). To rank the reasons of the business respondents' choice of using wireless technology in their business, the assessment was done by assigning weight for the listed items namely the reasons to use wireless technology in business (as in Table 3). Score for each item is calculated by multiplying the frequency with the rank assigned by the respondents. The scores are then being summed across all the responses in the sample. The score is computed across all the eight items in the list. The lowest total sum indicates the highest priority. The results of the computation based on 143 business' respondents are shown in Table 3.

Table 6. Reason of Usage*

Reasons	Weighted sum
Fast and speedy communication	403
Broad coverage	434
Access of latest information	471
Quality coverage	565
Low cost	569
High mobility	605
Trendy	643
Increase social network	651

*Out of 143 respondents

From the table, the highest ranked item was fast and speedy communication with the score of 403. This is followed by broad coverage (434), and access of latest information (471). The least is increase social network (651). The following findings are extracted in the effort to probe further on the business impact of wireless technology on the urban's and rural's folks. When the respondents were asked on the kind of wireless devices used within the business context and their opinions on technology used, an urban respondent that involves in advertising business indicates that he used fax machine, telephone, and computer. These devices allow him to get in touch with his clients and consultants even at overseas, and do Internet banking. Furthermore, the technology does improve his reputation and allow him to generate better idea for his business. The technology also helps him to conduct his business more effectively. Other respondents mention that they could now advertise their home produced products and services which allow them to gain more income even from home. Similarly, a rural respondent, who is also involved in stock trading activities, uses a telephone and computer to check his account, stocks, as well as manages his small company's inventory. Another entrepreneur, a contractor, states that the technology allows him to be contacted at any time. This is very vital for him as the nature of his work of getting job or a business contract (and thus income) usually is done through successful tendering exercises.

CONCLUSION

In general, the findings of this study suggest that wireless technology do give positive and negative nuances. In the positive sense, the technology helps the users to easily and effectively conduct businesses and communicate with others, get access to various information resources including on businesses, stakeholders, as well business expansion opportunities, and ultimately generate better revenue. On the contrary, it is also believed that the technology provide the users with opportunities to venture into undesirable endeavors that are often observed among youngsters such as viewing, disseminating as well as trading undesirable materials, and promulgating rumors in blogs. However, the use of wireless technology would lead to better quality of life, both economically and socially, if its

advantages are well conquered. In summary, this exploratory study shows the significant impact of wireless technology towards businesses. The creative industry can take the opportunity to create more and better multimedia products and services, whilst businesses can use the wireless infrastructure to expand their product promotions. One important factor found in this study is the demand for fast and speedy communication services. Wireless technology should not only be accessible to reach a wider coverage, but equally important is the high speed broadband that is required both in the urban and rural areas. Efforts should be made to extent high speed coverage even to small towns and rural areas for Malaysia to be well in place to become a fully-developed country. Perhaps Bridging the Digital Divide should no longer be measured in terms of the "have's and have not's" accessibility to the Internet among urban and rural communities, but should now be measured in terms of the "high speed broadband" gap between the urban and rural areas.

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EFFECTS OF NETWORKING, ENVIRONMENT AND INNOVATION ADOPTION ON SUCCESSFUL ENTREPRENEURS IN CENTRAL JAVA, INDONESIA

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ABSTRACT. This paper aims to test models of networking, environment, and innovation adoption on successful entrepreneurs in Central Java, Indonesia. The study was dependent on a survey conducted on 260 subjects using a random sampling technique. Structural Equation Model (SEM) was used to analyze the data. The results showed that networking and environment have a significant effect on innovation adoption. Consequently, innovation adoption significantly affects the success of entrepreneurs. Based on the finding, implications to practice are offered.

Keywords: networking, environment, innovation adoption, successful entrepreneurs

INTRODUCTION

The economic crisis happening in Indonesia gives worthy consideration for the government to reflect a more serious thought on the existence and the importance of Small-Medium Enterprises (SMEs). In the era of economic crisis there were many Large Enterprises (LEs) facing bankruptcy and some of them have to liquidate their firms. However, SMEs have resilience and able to protect themselves from the recession because of their innovativeness and dynamism to recover during the early years of the economic crisis. Furthermore, SMEs have a flexibility of using high value-added production technique to counter the problem of unemployment during the economic crisis (Yoon, 2002). The important role of the SMEs does not just occur in countries like Indonesia and the Philippines, but in Europe as well. Cassell, Nadin, Gray & Clegg (2002) stated that, the presence of the SMEs continuously increased significantly and had an important role in the European economy whether in local or national economy.

LITERATURE REVIEW

The success of an entrepreneurs and their ability in managing their SMEs to grow and sustain, depends on its market leading position, number of employees, and unique organizational culture (Choueke & Armstrong, 2000). Success is also determined by entrepreneur capability in doing innovation process through learning. However, Holt (1992) and Staw (1991) were in different opinion that the entrepreneur success was due to his or her inheritance since birth. Meanwhile, a study by Dana (2001) proved that an entrepreneur was not born to be successful, but successful through his/her presence in different education and training provided directly or indirectly in government or private institutions.

Another factor affecting the success of an entrepreneur was networking. It implies networking as a creation and uses of personal friendship for certain aims that are beneficial to the group or to the organization. In addition, networking is a group of relationship built for promoting the work or institutional development or cluster (Berley, 1985; Aldrich & Zimmer, 1986). Networking may be conducted in different contexts as in job, social life, and many life situations. In enterprise, networking is studied excessively for the role of supporting the entrepreneur success (Lechner, Dowling & Welpe, 2005). For them, maintaining networking is strongly needed to develop their enterprises.

Meanwhile, studies by Ibrahim & Goodwin (1986) and Cynthia Benzing, Hung Manh Chu & Orhan Kara (2009) stated that another factor was business environment that became one of the important factors determining entrepreneur success. Further research done by Yusuf, (1995) and Huck & Mc. Ewen (1991) concluded that environmental condition was one of the determinant factors very crucial to influence entrepreneur success.

Success is not only determined by the result of environment and networking, but also determined by entrepreneurs' capability in conducting innovation in which the products are acceptable by consumers (Charles & Sawyer, 2004). The entrepreneurs having creativity and critical ability always owned specific ways and uniqueness to defend and to advance their companies (Littunen, 2000). Innovation means that the entrepreneur should have the ability to create new technique or strategy including innovative products in facing changing situations particularly dealing with consumer behavior. At the initial steps for the company operation, the important traits that should be owned by the entrepreneur are innovative character, desire and bravery to act. Tibbits, (1979), Bird, (1989), and Riyanti (2003) explained that innovation played a major role in the success of small enterprises. The entrepreneurs should continuously seek for new ways or changes in order to run their enterprises.

There are five hypotheses in this study:

H_1: Networking has significant positive effect towards innovation-adoption behavior.
H_2: Environment has significant positive effect towards innovation-adoption behavior.
H_3: Networking has significant positive effect towards entrepreneur success.
H_4: Environment has significant positive effect towards entrepreneur success.
H5: The innovation-adoption has significant positive effect towards entrepreneur success.

METHODOLOGY

This research was designed as an ex-post facto and a correlation trying to see the relationship among construct variables as a determinant for entrepreneur success. The theoretical construct comprising variables as networking, environment and innovation-adoption behavior and entrepreneur success. The target population of this study was 4,524 SME entrepreneurs involved in the food and beverage sector in Banyumas, Central Java, Indonesia. Samples taken were conducted by using a random sampling technique. A total of 300 questionnaires were distributed representing more than 7 percent of the estimated population size. Of these 260 questionnaires were returned, indicating an 86.6 percent response rate. Structural Equation Modeling (SEM) was used to analyze the data. A confirmatory factor analysis was performed to assess the reliability and validity of the measurement model before we tested the structural model.

ANALYSIS AND DISCUSSION

A confirmatory factor analysis is used to know whether the indicators applied are able to explain the variables formed. The confirmatory result can be seen from tests of construct reliability and variance extracted (VE) as following. The CFA results on networking = 0.96, environment = 0.95, the innovation-adoption = 0.96, and the successful entrepreneurs = 0.95. These CFA values are greater than the standardized value, namely 0.70, so it can be concluded that latent constructs used in this research are really reliable. The VE results on

networking = 0.77, environment = 0.75, the innovation-adoption = 0.79, and the successful entrepreneur = 0.76. These VE values are greater than the standardized value, namely 0.50. So it can be concluded that latent constructs used in this research are really reliable.

According to Hair *et al.* (2010), the SEM was if particularly estimated by using maximum likelihood estimation, should require to be furnished the normality assumption. Statistical value that could be used to test the normality was by comparing the z-value with the critical value of ± 2.58, at the probability level of 0.01. In this research all data used have fulfilled the normality assumption, because the CR value for skew and kurtotis are all smaller than ± 2.58. This implies that all data fulfill the normality assumption at the α level = 0.01.

By using the foundation that observations having the z-score of ≥ 3.00 will be categorized as outliers. It is known that these data used are free from univariate outliers, for there is no variable having the z-score ≥ 3.00. Evaluations to multivariate outliers could be seen from the mahalanobis distance for every variable namely to show the distance of a variable of means for all variables in a multidimensional space (Norusis, 1998; Tabacnick & Fidell, 2001).

Calculations on the mahalanobis distance are based on the *Chi-Square* values in the χ^2 distribution table (26; 0.001 = 54.052). Therefore, data with the mahalanobis distance > 54.052 are assumed multivariate outliers. In this research, there are no multivariate outliers

To see whether both multicollinearity and singularity are present in a variable combination, so it is necessary to observe the value of the determinant of sample covariance matrix. In this research, the determinant value is 0.00000619 and this number is > 0, then this data in the research can be used. So, it can be concluded that multicollinearity and singularity are absent; therefore data in this research is properly used.

Table 2 show the overall fit for the measurement model. The χ^2 was 311.665. In addition, The NFI, TLI, CFI, and RMSEA values indicated a good fit and exceed the common acceptance levels as suggested by Hair et al. (1998)

Table 2. Fit Indices for the measurement model

Goodness of fit Index	*Cut-off Value*	Model result	Notes
χ^2- *Chi-Square*	Expected to be small	311.665	χ^2 value with the DF = 293 is 333.922, so calculated χ^2 < table χ^2 (311.665<333.922) (Good category)
Probability	≥ 0.05	0.117	Good
CMIN/DF	≤ 2.00	1.064	Good
GFI	≥ 0.90	0.917	Good
AGFI	≥ 0.90	0.900	Good
NFI	≥ 0.80	0.958	Good
TLI	≥ 0.95	0.997	Good
CFI	≥ 0.95	0.997	Good
RMSEA	≤ 0.08	0.016	Good

Table 3 shows the coefficient regression values for each of the Hypotheses 1 to 5.

The effect of networking on the innovation-adoption behavior gives $\beta = 0.48$ with $p < 0.05$. The hypothesis that stated that networking has a positive and significant effect on innovation adoption is supported. This study supported the prior findings by Barnir & Smith (2002) and Florin, Lubatkin & Schulze (2003) which stated that through networking, entrepreneurs adopted innovation to defend their enterprises from competitors.

As expected, the result of this study supported Hypothesis 2 that environment ($\beta = 0.43$, $p < 0.05$) has a significant positive effect on the innovation adoption. This study supported the

prior findings by Ibrahim & Goodwin (1986) and Cynthia Benzing, Hung Manh Chu & Orhan Kara (2009) stated that another factor was business environment that became one of the important factors determining entrepreneur innovative

Hypothesis 3 was supported in this study. networking ($\beta = 0.33$, $p < 0.05$) has a significant positive effect on the success of the entrepreneur. This study was consistent with other studies in (Lechner, Dowling, Welpe; 2005) another factor that also determines enterprise success is networking that is partially numerously studied in its role to support entrepreneur success. Networking became an important part when used to open access to opportunity and chance, to collect numerous resources required to build a new enterprise and a new legitimate (Berley, 1985; Aldrich & Zimmer, 1986; Johannison, 1988; and Dubini & Aldrich, 1991).

As expected,environment ($\beta = 0.35$, $p < 0.05$) was found to have a significant positive effect on successful entrepreneur. The effect of environment on the successful entrepreneur gives him/her open access for opportunity and chance to collect many resources required to build his/her enterprise. This study was also supported by Garnsey (1998), which stated that between personality and environmental factors, environmental factor was proven to have more significant contribution than the personality to the success of an entrepreneur. O'Gorman (2001) in his research result stated that entity of an enterprise success was depended on the entrepreneur in determining a strategy and a structure of organization when facing with the external environment, including market condition, competitor. The environment would always change from time to time.

Hypothesis 5, as expected showed innovation adoption behavior ($\beta = 0.24$, $p < 0.05$) was found to have a significant positive effect on successful entrepreneur. This finding was consistent with other studies in innovation behavior field (Tibbits, 1979; Bird, 1989; Riyanti, 2003).

Finally, that innovation adoption is intervening between the networking and the environment against entrepreneur success. This study is supported by Charles & Sawyer, (2004).

Table 3. Regression coefficient values

Variable	β	*p*
Networking → Innovation-adoption	0.48	0.000
Environment→ Innovation-adoption	0.43	0.000
Networking→ Entrepreneur Succes	0.33	0.000
Environment→ Entrepreneur Succes	0.35	0.000
Innovation-adoption → Entrepreneur Succes	0.24	0.002

$p < 0.05$

CONCLUSION AND RECOMMENDATIONS

This study found the Goodness of fit for the structural equation modeling (SEM) among networking, environment, innovation-adoption behavior and the successful entrepreneur.

This study also found that networking has a strong effect on the innovation adoption. Networking of the entrepreneurs needs to be strengthened so that entrepreneurs will derive opportunity to do innovation. This study also found that the innovation adoption has a dominant influence on the success of the entrepreneur. The food and beverage SMEs in Central Java required more enhancement to do networking in order for their innovation adoption to be increased. So, this will affect the development of their enterprises. The entrepreneurs could increases and widen their networking by increasing using the internal or external networking. Networking extension can be done to widen the market and increasing the frequency of connection with other stakeholders. These efforts will make SMEs chosed more alternative innovation that can quicken the success of their enterprises. To be more robust in the findings it is suggested that this study needs to be tested on different industries such as services and agriculture.

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