Architecture of Knowledge Management System in Mobile Computing Environment

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ABSTRACT

Collaborative knowledge management (KM) system for organizational learning, addressing the needs of the individual within a purposeful context should be improved in term of organizational responsiveness, innovation, competency and efficiency. Mobile devices, such as Personal Digital Assistants (PDAs), evolve rapidly and addition to the capabilities of these devices, new mobile communication technologies, such as Wireless LAN, enable 'anytime' and 'anywhere' access to information infrastructures and integrate the devices as the front ends of mobile information systems. In Implementing the KM system in mobile computing, there are many frameworks but lack of implementation in bioinformatics domain. Therefore, this research is an attempt to develop a framework for mobile knowledge management in bioinformatics domain especially in herbs plantation and formulate this concept in order to deliver the best information to the users, organizations in term of collaboration environment.

Keywords

KMS, mKM, Bioinformatic

1.0 INTRODUCTION

Recently, the issues of "knowledge management" and "mobility" have received much attention in the Computer Support Co-operative Work (CSCW) literature. The interest in these issues is often motivated by the fact that work in many organizations is "knowledge intensive" and "mobile." These issues have been explored separately. However, so far few researchers have explored the topic of knowledge management in mobile work domains [Fagrell H., Forsberg K. and Sanneblad J. (2000)].

KM system (KMS) is a system that needs to be developed to manage knowledge effectively. There are many perspectives for describing the KMS. Among them is from the technical perspective, proposed by Meso and Smith (2000). It consists of three components; technology, function and knowledge. Knowledge taxonomy for KM system consists of knowledge acquisition, storage, dissemination and application.

Mobile devices, such as PDAs, evolve rapidly from digital assistants primarily serving as calendars and address books to hosts of more complex functionality. In addition to the capabilities of these devices themselves, new mobile communication technologies, such as UMTS or WLAN, enable 'anytime' and 'anywhere' access to information infrastructures and integrate the devices as the front ends of mobile information systems. [Grimm M., Tazari M. and Balfanz D, 2002]

A mobile computing environment allowing a collection of individual's to work together on a task for a common objective of business. It occurs when all the individuals have computers connected to a network that allows them to send e-mail to one another, share data files, and schedule meetings. Mobile computing environment is part of a concept that appeared has many years, called Computer Supported Cooperative Work (CSCW) [Duffy, J., (1996)]. The main applications for this environment could be categories in term of E-mail, e-meeting, video conferencing, document management system, workflow, groupware and knowledge management system. Meanwhile, the KM is a system that managing the gathering, organizing, refining, analyzing, and disseminating of

knowledge in all of its forms within an organization [Storck. J. and Hill, P., (2000); Klasson, Kirk, (1999)]. The advanced KM systems will need to address issues such as agent technology, encryption, pattern recognition, biologic models, replication, personalization, localization, collaborative filtering, natural language, object-oriented structures, and other methods of electronic information management [Lueg, C., (2001)].

Mobile Knowledge Management (mKM) systems try to incorporate the technical progresses in the field of Mobile Computing, such as mobile networks and personal devices, into IT-solutions supporting Knowledge Management in organizations. [C. L. Spiteri, and J. C. Borg, (2006)].

There is a need for an organization to find out the best framework to meet their requirement and goals. For this reason, this research will find what the best framework for mobile knowledge management system.

Bioinformatics is a field that deals with research, development or application of computational tools and approaches for expanding the use of biological, medical, behavioral or health data, including those to acquire, store, organize, analyze, or visualize such data. (Haas, 2001).

Bioinformatics knowledge management system is a system that managing the gathering, organizing, refining, analyzing and disseminating of biological knowledge within the CoP especially biologist. In order to extract relevant biological knowledge from experimental data, it is crucial not only to analyze the experimental data, but also to cross-reference and correlate these large volumes of data with information available in external biological databases accessible online (Adak,2002). Bioinformatics is a relatively new interdisciplinary area that combines concepts and techniques from molecular biology, computer science, statistics, biochemistry, artificial intelligence, database systems, and others (Morrow, 2004). Bioinformatics is an emerging research area which is characterized by computational challenges and which can therefore benefit substantially from strong computer science collaborations (Jones, 2000).
In Implementing the KM system in mobile computing, there are lots of frameworks but it was found that there is lack of framework in bioinformatics domain. Therefore, this research is attempted to develop a framework for mobile knowledge management to be applied in bioinformatics domain and formulate these concepts in order to deliver the best information to the users, organizations as well as for the nation in term of collaboration environment.

2.0 RESEARCH METHODOLOGY

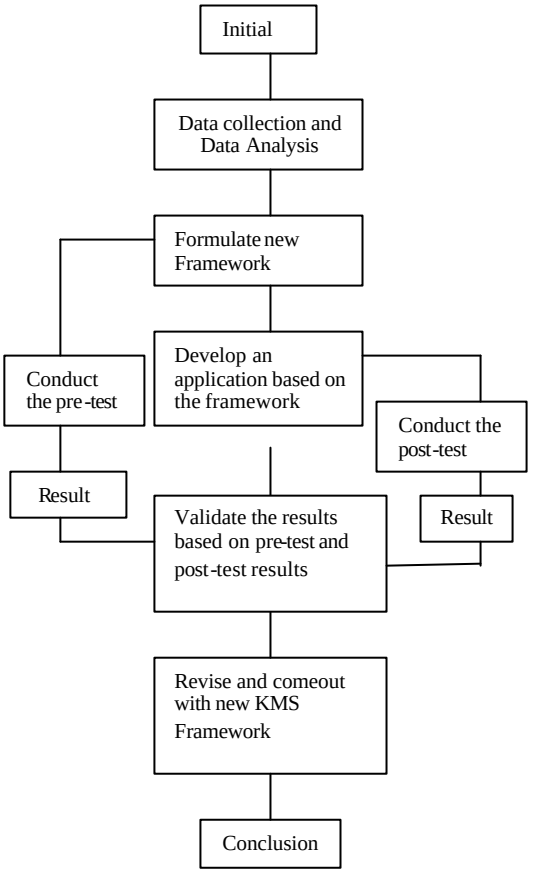

Figure 1: Research Operation Flowchart

Figure 1 shows the research operational flowchart in order to come out with the framework. The initial phase is to determine the research problems and the objectives of the research. Then the data is collected from the review of related research and being analyze. From review of the previous research, we formulate the new framework and conducted pre-test survey.

System is build based on the framework and then the system will be tested by user to get their feedback. Then we validate result from the post-test and pre-test and the framework is revised

iteratively until the best framework for herbs domain is produced

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3.0 DATA COLLECTION

Before we proceed with the actual development of CKMS, we need to clarify and understand few things in order to collect correct data to ensure this system may perform exactly based on the user's requirement. Therefore, we had planned some activity, which explained as follows:

3.1 Identify theCoP

The CoP is very important as they may act as the main actor which use and contribute the knowledge in order to ensure the successfulness of the system development. Our main CoP may involve with two groups from different areas and experiences, which includes the biologists, researchers, computer scientists and farmers. The CoP may have relations between them, as the purpose of developing this system is to build a system, which may facilitate knowledge sharing in collaborative environment. These CoP role as they can own knowledge beneficial from the knowledge activities including acquiring, storing, disseminating and applying to their works of areas as well as to facilitate the knowledge sharing. The considerations of the CoP that may involve in this system development are based on these questions:

- Who are the potential users that may use this system?
- What is the role of users that might helps the consideration of being as the respondent?
- Who are the people that may contribute the source and information about herbs plantation knowledge?

Table 1: The role of respondent (CoP)

Respondent (CoP)	Role
Biologist	Biologists are the people who do the experiment and have the raw data of herbs plantation knowledge that may helps us to identify the varieties oh herbs plantation that exists in Malaysia today.
Computer Scientist	Computer scientist are the people who have been or currently involved in KMS development which may helps us to validate and develop a KMS model and framework to ensure our system may perform successfully.
Researcher	The researchers may involve people from the bioinformatics area, computer science area or both. The researcher's role is basically same as the role of biologists and computer scientists which may also used this system in their works of areas.
Farmer	The farmers are the people who work directly in planting which may used the system to pass, deliver or contribute any knowledge for the knowledge repositories purpose.

3.2 Questionnaires

The other way of collecting data is passing a questionnaire form to the CoP as shown in the Table 1. The CoP that already identified are the most potential CoP that may use and contribute the knowledge to the system. These people may also become as the target users that will collaborate among the others to ensure the successful of this KMBioPlant system.

The questionnaire has divided into seven sections. The sections and the purpose of sections are explained as follows:

- Section A: Demographic Information
  This section is used to have CoP's information including job position and description in order to clarify the group of CoP either the biologists, computer scientists , researchers or farmers.

- Section B: KM and Bioinformatics Concepts
  This section is used to clarify how far the understanding of general knowledge management and bioinformatics among the CoP.

- Section C: KM in Bioinformatics Environment
  This section is seeking the CoP from the CoP either they have been used or experienced in any KMS in Bioinformatics application, system, portal or website before and rate the usability of those existing application.

- Section D: KM Infrastructure, KM Framework and KM Content Organization
  This section is to gather information about infrastructure, framework and content organization in order to develop our own KMBioPlant System.

- Section E: KM in Bioinformatics Usability
  This section lets the CoP to give ideas and identify what are the expectations that they want from the KMBioPlant system.

- Section F: Mobile Issues
  This section's objectives are to know how potential user usually works collaboratively with colleagues and to answer few questions regarding mobile usage

- Section G: mKm & Functionality expectations
  This section is to test user's knowledge about mKm and their expectations on mKm system functionalities.

3.2.1 Questionnaires analysis

This questionnaire has been answered by 14 respondents. Our main focus is section F and section G. From the analysis from the section F and G, we come out with conclusion as follows:

Conclusion Section F

- People usually work collaboratively to share info, news and schedule by using email and meeting as a medium
- However, mobile plays an important role too and SMS is the most popular function in it
- People agrees if there exist a system that uses SMS or MMS to send and receive latest information regarding their interest/work
- Types of files that usually they want to share are document files, text files, pdf files and image files.

Conclusion Section G

- Only 2 people have known about mKm system through friends, news, internet and conferences
- They agrees that mKm is important in knowledge sharing, knowledge storing and knowledge searching
- Lots of people agrees that mKm should bring benefits such as to access info anytime, anywhere, shortens learning process, helps in decision making and many more.

4.0 TAKING THE MOBILE CAPABILITIES TO TASK OF KMS IMPLEMENTATION IN BIOINFORMATIC

From the reviewed of previous research and the result of pre-test, we come up with the system implementation model as depicted in figure 2.

The PDA's strengths are flexible data handling, portability, and ease of use. Flexibility in data use is advantageous because tasks can be matched to the ideal data access format (e.g., information for the periodic table of elements can be accessed via a graphical interface instead of a text-formatted database). The portability of PDAs is an equally important attribute, because it increases the availability of the material contained within the PDA. The PDA's ease of use is aided greatly by a consistent look and feel of applications.

Profiled notification requires organizing and tagging content, so that it can be easily aligned with user's profile. Once the content is organized and the individual is profiled, the user is instantly notified, either through e-mail or a message sent to a mobile phone, when relevant content is available. If the device has the capabilities, user can download the content immediately.

Our model requires tools to communicate between server and the user such as Transmission Control Protocol (TCP)/Internet Protocol (IP), Global System for Mobile Communication (GSM) and Point-to-Point Protocol (PPP), General Packet Radio Service (GPRS) Short Message Services (SMS), Multimedia Message Services (MMS), Wireless Markup Language (WML), Wireless Application Protocol (WAP).

In our model, communication from client using mobile devices to server is done with TCP/IP The client use GSM and PPP to communicate in wireless mode. The clients are connected to a GSM phone with cable or infrared (IrDA 1.0). Today, the bandwidth for GSM is 9600 bits per second and the time to get online is about 20 seconds.

In our system, if users have information or latest news regarding herbs plantation, they can send the data to our server through emails if they have WAP or GPRS connection, or else, they can send SMS and MMS if they are in offline mode. SMS and MMS is a part of GSM and it will be send to the SMS gateway. SMS gateway acted as an intermediary between the GSM modem and our server. Once the data arrived, our system will process it and save to the KM database. User can operate our system from a web browser that requires HTML and is most appealing with an information rich format, or from a Wireless Application Protocol (WAP) browser, which due to tiny screens requires the minimum of information, formatted in WML.

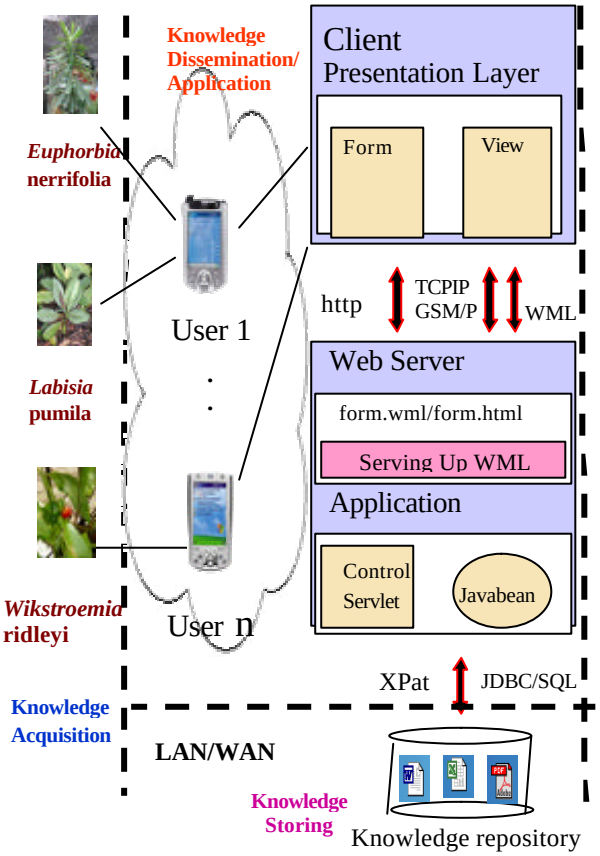

Figure 2: System Implementation Model

5.0 CONCLUSION

Mobile KM offers users the ability to access and send information anywhere, anytime and at their own place. A mobile computing environment also allows a collection of individual to work together on a task for a common objective of business. It occurs when all the individuals have computers connected to a network that allows them to send e-mail to one another, share data files, and schedule meetings. Knowledge Management System (KMS) is a system that managing the gathering, organizing, refining, analyzing, and disseminating of knowledge in all of its forms within an organization. The advanced KM systems will need to address issues such as agent technology, encryption, pattern recognition, biologic models, replication, personalization, localization, collaborative filtering, natural language, object-oriented structures, and other methods of electronic information management.

This paper proposes a framework of collaborative KMS in mobile environment in bioinformatics domain especially in herbs plantation.

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