The Use of Ontology Using Protégé Ontology Editor Tool in Developing Syllabus Management System

Chandrika Mohd Jayothisa[1], Mohd Syazwan b. Abdullah[2]

[1]*Centre for Diploma Programme (CDP),*
Multimedia University (MMU),
Melaka, MALAYSIA
chandrika.mohdjayothisa@mmu.edu.my

[2]*College of Arts and Sciences,*
Universiti Utara Malaysia (UUM),
06010 UUM Sintok,
Kedah, MALAYSIA
syazwan@uum.edu.my

ABSTRACT

The management and the academic staffs of the Centre for Diploma Programme's (CDP) will usually gather and prepare hard copies of syllabi as part of documentation collection in order to obtain the MQA's accreditation for the courses offered. The creation of Syllabus Management System for the DIT has helped the management staff in organizing, updating and retrieving Diploma in Information Technology's (DIT) syllabi. The concept of ontology has successfully used throughout the development of the system. Unified Modeling Language (UML) is used to capture the requirement models while ontology development methodology is used during the development stage. The prototype of the system is deployed on the Protégé ontology editor tool.

Keywords
Knowledge Management, Ontology, OBE, Protégé

1.0 INTRODUCTION

Knowledge Management (KM) has managed to become a success factor for organizations in building and representing their Organization Memory (OM). With the help of Information technology (IT), KM is supported throughout the development of organization memory, such as human resource management and enterprise organizations. The integration of informal, semiformal, and formal knowledge helps to facilitate its access, sharing and reuse by the members of the organization(s) for solving their individual or collective tasks (Thorsten & Sure, 2002).

A common approach to tackle the knowledge management problem within an organization is to design an organizational memory (Abel *et al*., 2004). Such a memory can be seen as "an explicit and persistent representation of knowledge and information in an organization, in order to facilitate their access and reused by members of the organization for their tasks" (Rabarijaona *et al*., 2000).

The core concept that supports the knowledge base is the Organization Memory (OM), where it defines a comprehensive computer system which captures a company's accumulated know-how and other forms of knowledge assets and makes them available to enhance the efficiency and effectiveness of knowledge-intensive work processes (Vasconcelos, 2000).

Vasconcelos *et al*(2002) have summarized some knowledge based features which are stated below:

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1. The ability to semi-automatically assist user queries and support related decision making tasks by providing a guidance structure based on proposing hints and alternatives, showing the reasons 'why' and 'why not', or presenting future perspectives on existing information.

2. The ability to perform context-based information retrieval, presenting contextual (or situational) knowledge about information sources, and assisting the execution of business and problem solving tasks;

3. The ability to perform reasoning upon the conceptual structure (e.g., based on ontological descriptions) and its particular instantiation in order to categorise (create) and classify new corporate knowledge assets.

With the emerging of ontology's applications, it has lucratively helped to expand various domains areas such as E-commerce, E-Learning, E-Business, Clinical System, E-Marketing and Knowledge

Management System (Sridharan et al., 2004). That is to say, ontology defines shared vocabulary for facilitating knowledge communication, storing, searching and sharing in knowledge management systems (O'Leary, 1998).

2.0 SYLLABUS MANAGEMENT SYSTEM

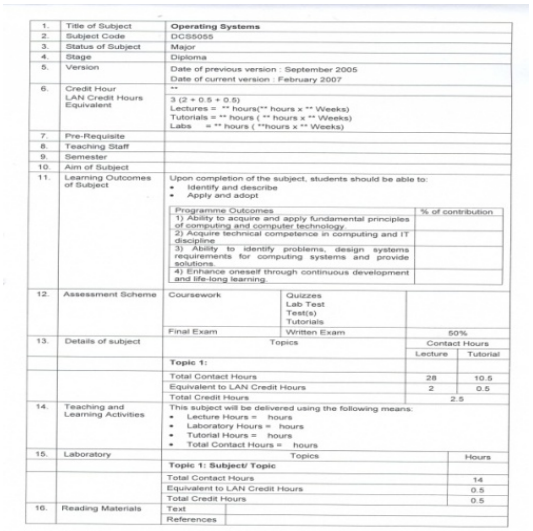
Syllabus Management System is developed based on the combination of both Malaysian Qualification Assurance (MQA) syllabus guidelines with CDP Outcome Based Education (OBE) format which focuses on the end-product, and defines what the learner is able to do for a particular subject within a programme. This structured format has been introduced and implemented since 2005, and the lecturers will be referring to this as their lecture plan and syllabus. The system is able to store, search and retrieve basic information required and requested either by the lecturer or the management staff.

Syllabus Management System caters only for the DIT programme syllabi and does not include the details of the topics or chapters for the subject. The button, for add, edit, delete and view button are provided by the Protégé GUI, therefore, it is hard for the users to understand the icons functionalities. The system will not display the DIT course structure and there is no access level and security implemented in this system.

The OBE's concepts are divided into three topics; (1) Outcome-based approach; (2) Outcome-based learning and (3) Outcome-based assessment. Outcome-based approach defines a method of teaching that focuses on what activities will the students do after they are taught for a particular topic (or topics). This approach of designing the curriculum should focus on the learning outcomes defined in the course syllabus. Outcome-based learning are publicly defined, learner centred, focused on life skills and contexts.

Subject coordinators are the person who will create, update and maintain the course syllabi and the subject lecture plan. The syllabus will be updated from time to time based on MQA requirements and the suitability of the classes and programmes.

The components of the course structure are divided into 4 parts, which are University or MQA subjects, Mathematics subjects, Core/Major subjects and finally Elective subjects. The syllabus structures are divided into two sections: variable and static information. Static information consists of attributes that are fixed and can only be changed upon the approval of MQA such as subject name and subject code Reading materials, learning outcomes of the subject, and details of the subject are few examples of variable information that need to be updated from time to time. Besides that, the coordinator will update the syllabus versions and rename the file based on the current version - current month and year. All archived syllabi are then kept by the management. Figure 1 shows the example of the format used to capture the syllabus attributes for Diploma programme.



1.	Title of Subject	**Operating Systems**
2.	Subject Code	DCS5055
3.	Status of Subject	Major
4.	Stage	Diploma
5.	Version	Date of previous version : September 2005 Date of current version : February 2007
6.	Credit Hour LAN Credit Hours Equivalent	** 3 (2 + 0.5 + 0.5) Lectures = ** hours(** hours x ** Weeks) Tutorials = ** hours (** hours x ** Weeks) Labs = ** hours (**hours x ** Weeks)
7.	Pre-Requisite	
8.	Teaching Staff	
9.	Semester	
10.	Aim of Subject	
11.	Learning Outcomes of Subject	Upon completion of the subject, students should be able to: • Identify and describe • Apply and adopt

Programme Outcomes	% of contribution
1) Ability to acquire and apply fundamental principles of computing and computer technology.	
2) Acquire technical competence in computing and IT discipline	
3) Ability to identify problems, design systems requirements for computing systems and provide solutions.	
4) Enhance oneself through continuous development and life-long learning.	

12.	Assessment Scheme	Coursework	Quizzes Lab Test Test(s) Tutorials	
		Final Exam	Written Exam	50%
13.	Details of subject	Topics	Contact Hours: Lecture	Tutorial
		Topic 1:		
		Total Contact Hours	28	10.5
		Equivalent to LAN Credit Hours	2	0.5
		Total Credit Hours	2.5	
14.	Teaching and Learning Activities	This subject will be delivered using the following means: • Lecture Hours = hours • Laboratory Hours = hours • Tutorial Hours = hours • Total Contact Hours = hours		
15.	Laboratory	Topics		Hours
		Topic 1: Subject/ Topic		
		Total Contact Hours		14
		Equivalent to LAN Credit Hours		0.5
		Total Credit Hours		0.5
16.	Reading Materials	Text		
		References		

Figure 1. Sample of Format Syllabus

Figure 2 represents the general behavior of the Syllabus Management System and Figure 3 represents the general behavior of the subject system.

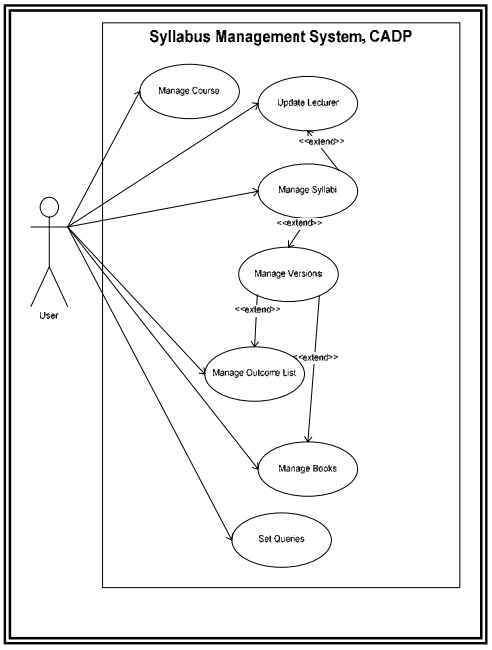


Figure 2: System Requirement of the Syllabus Management System.

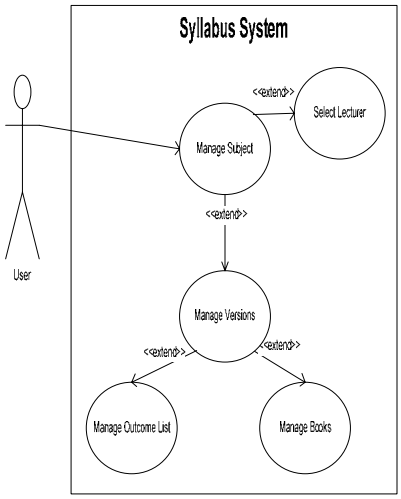


Figure 3: Use Case Diagram of the Subject System.

3.0 THE IMPLEMENTATION OF ONTOLOGY IN THE SYLLABUS MANAGEMENT SYSTEM

The object relationship of the Syllabus Management system is developed based on the models, structure and the defined knowledge based DIT syllabi repository. Hence Ontology is used to module, identifying and representing both the knowledge base and the organization memory on the knowledge of the DIT programme with each syllabus. Pundt (1999) stated that ontology is an adequate methodology to support a variety of knowledge retrieval, storage, sharing and dissemination. It is also a model that is populated by concepts and it is therefore organized in a particular hierarchy Vasconcelos (2000).

Figure 4, shows the class relationship of the Syllabus Management System such as the relationship of the Programme class with the Outcome List class. These two classes are related as the outcome list are matched and guided from the defined programme outcome.

Classes are created and are arranged in a taxonomical manner as shown in figure 5. As a result, the ontology has successfully facilitated in identifying the domain knowledge between the syllabi. The ontology model was build based on the identified competency questions as there were no similar domain available or exist.

Several simple and direct competency questions used to determine the syllabus domain are.

- What is/are the subject(s) offers for that trimester?
- What is/are the requisite for the subject?
  - What are the pre-requisite for the subject?
  - What are the versions available for that subject?
  - Who are the lecturer(s) teaching this particular subject?
  - What are the contents stored in the syllabus?
  - When will the subject be offered?

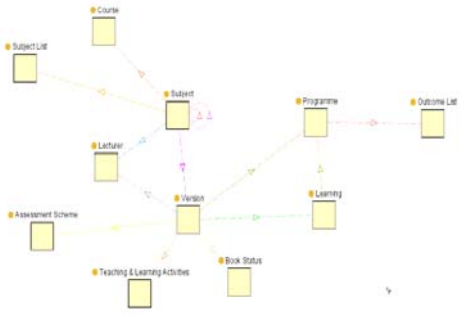


Figure 4: An Object-Relationship Diagram for the Syllabus Management System, CDP

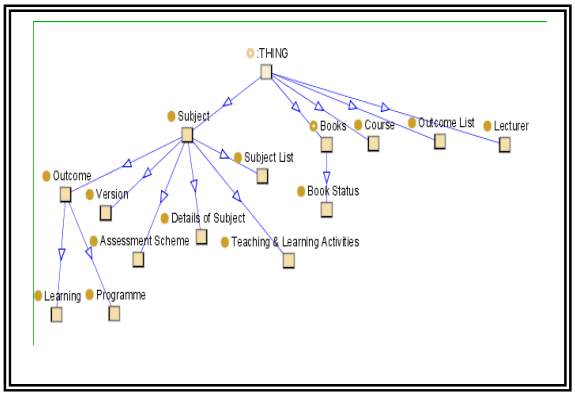


Figure 5: Taxonomy Classes for the Syllabus Management System using Jambalaya.

4.0 PROTOTYPE OF THE SYLLABUS MANAGEMENT SYSTEM

Information of the subjects can be created and updated either by the subject coordinator or the management staff in charge. In the subject page, the user has to enter the subject profile, credit hours, teaching staff, and the versions for every updated syllabus. User also need to update on the books, lecturer's particulars, adding programme outcome and learning outcome , updating subject to be offered

for which course and finally selecting and assigning subject programmme outcome and learning outcome.

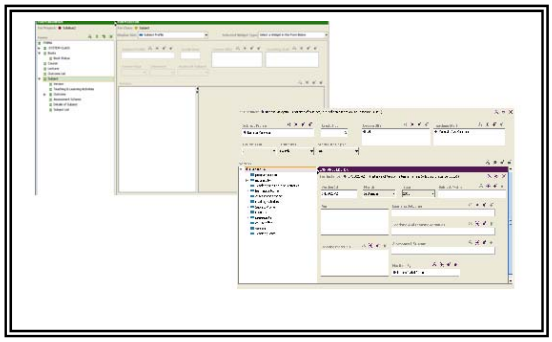


Figure 6: Prototype & Versions of the Subject

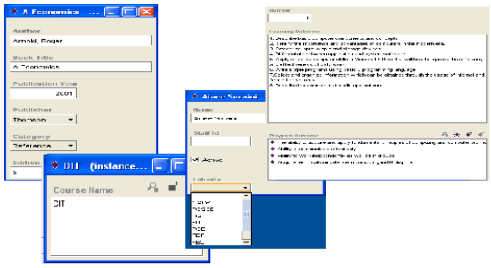


Figure 7. Books, Course Offered, Lecturer Information and Programme and Learning Outcome

Queries were tested based on the identified competency questions. As a result, answers were identified correctly.

Question: What are the pre-requisite for the subject?

Class: Subject
Slot: pre-requisites
Contains subject: Programme Design.

Results of subjects with Program Design as a pre-requisite are Data Structure, Object Oriented Programming, Java Programming and Internet Web Publishing.

Figure 8: Queries to display the subject Program Design as the prerequisite

5.0 CONCLUSION

The main objective of this research is to use ontology to develop the Syllabus Management System by using the Ontology methodologies have successfully been achieved. This project uses UML to model the basic system requirement defined by the expert users. Protégé 2000 - an ontology tool is used as a platform independent environment for creating and managing the knowledge bases. Protégé 2000, a graphical user interface (GUI) also helps to provide system development, hierarchy maintenance and managing slots to the classes. Ontology development is one iterative process that permits knowledge reusability, flexibility, and reusability of domain knowledge that makes it possible to change the assumptions if the domain changes.

There is no one correct way or a static method in modeling a domain. There are several alternatives to choose from but the best solution should always reflect the system requirements or the business process. As described by Jones et a,(1998), the advantages of such domain models have been widely canvassed, and includes enabling the sharing of knowledge, the re-use of knowledge, and the better engineering of knowledge based systems with respect to acquisition, verification and maintenance.

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