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Design and Development of an E-Learning Management System

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ABSTRACT

The trend of e-learning technologies is expanding fast. Web-based learning environments are becoming very common in the higher education institutions. Nowadays e-learning management systems are very popular. Many universities throughout the world deliver educational programs via the Internet. Developments of e-learning systems are generating great impact in the field of education services to improve the teaching and learning process, and overcome geographical distance. In recent years, various kinds of Internet technologies have become available for developers to implement such e-learning system that provide an e-learning gateway on the Internet. The rapid advancements in information and communication technologies, especially the networking and multimedia, have led to the development of many advanced e-learning systems these days. A user-friendly interface and a sophisticated data model are the essential design considerations to make the e-learning system easy-to-use for the instructors and learners. The need for such architecture is critical for designing the system and standards development. The system is developed under Computer Supported Cooperative Work framework and web portal technology. The system integrates all the critical and valuable communication tools that effectively improve the collaboration in an e-learning environment.

Keywords: e-learning, distance education, online education, virtual class

1. INTRODUCTION

Since the Internet emerged as a global information network, learning materials and information are available to any Internet user from any place at any time. For quite some times, people in education have been tremendously interested in using the facilities provided by the technologies of information and communication (TIC) [1]. In the recent years, the rapid advancements in technology and telecommunications, especially the Internet, have led to an explosive growth of web-based courses. The World Wide Web (WWW) is emerging as the most popular medium for delivering instruction and an increasing number of instructors are integrating various features of the Web in novel ways to provide exciting learning opportunities for their students. In addition, the use of Internet for education purposes has revolutionized distance learning. People have been tremendously interested in delivering online teaching and distance learning over the Internet. WebCT and Blackboard are the two of the most comprehensive systems widely used in most higher education institutions [2][3]. Course management system is a general term for server capabilities enabling online teaching functions, including presentation of contents, discussion groups, class management and related services. WebCT and Blackboard are the two e-learning systems which provide the most comprehensive tools and capabilities to support a sophisticated Internet-based learning environment. This paper introduces a new web-based toolkit Cyber Campus for instructors to deliver database-driven web systems in e-learning management.

This paper will provide an overview of the system structure in the Cyber Campus. Next it will focus on issues relating to the development of the communication and assessment modules in the system. These issues include some of the enabling technologies used in the development. After that, the performance of the system will be examined and compared with other e-learning systems. Finally, this paper will be concluded with a summary of the system.

2. CYBER CAMPUS E-LEARNING SYSTEM

Cyber Campus is an all-in-one web-based e-learning system that integrates components including student management, course management, assessments, classroom allocation and communication into one complete package solution. The system is designed by using the framework based on Web Content Component Model (WCCM), which is a suitable model of web application that supports maintenance of content oriented web application [4]. In addition, the components will be developed using portal technology. An e-learning web portal serves as an integrated gateway in the online education centre website and provides users (instructors, learners and administrators) with a single point of access to the e-learning services [5]. Cyber Campus is implemented in PHP, MySQL and Java technology [6][7][8]. Figure 1 shows that the system provides users with a single access point to the e-learning portals.

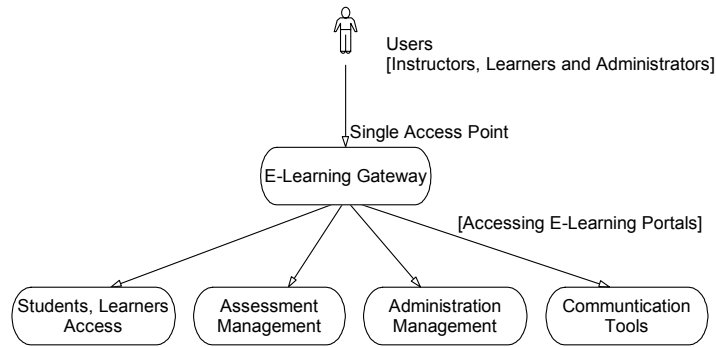


Figure 1. E-Learning Portal Gateway

Figure 2 shows the interaction between users under an e-learning environment. Cyber Campus integrates web technology with database system and provides a

user-friendly administrating, teaching and learning environment. It has provided administrators with a centralized control in the entire system.

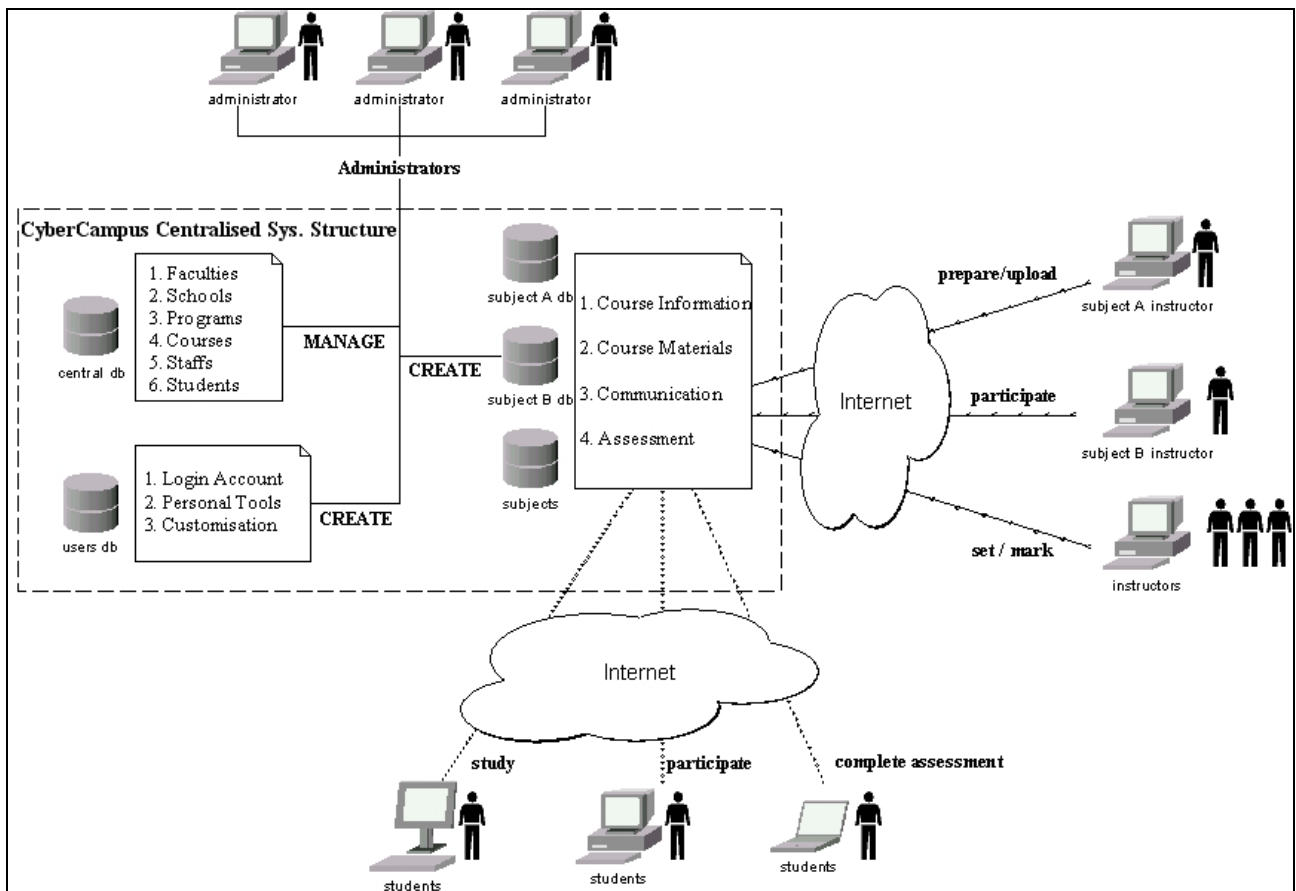


Figure 2. Cyber Campus e-Learning Environment

In addition, it includes many useful online education tools for the instructors and learners. The administration management module contains a set of functions, which help the administrators to manage the information resources in an easier and more efficient way.

3. SYNCHRONOUS CHANNELS COMMUNICATION

Cyber Campus is designed with a very comprehensive set of communication component on top of the core course management framework. This communication module is designed and implemented according to the concept of CSCW (Computer Supported Cooperative Work) [9]. Individually, the communication tools that Cyber Campus is designed to have many competitors that are currently in use by the corporate community. The synchronous collaboration component features the following sub modules:

3.1 E-Chat

The E-Chat module is written entirely with core Java and Java applet. The applet had to be compatible with Java 1.1.5 so as to work with Microsoft's default Java VM plug-in for Internet Explorer. The objective of this design is to ensure that the applet can be run from the most common web browser (i.e. Internet Explorer or Netscape Communicator). The online chat system is designed to be easily extendible and configurable no matter what sort of system it is deployed on, with minimal dependencies. The server includes a multithreaded object class, which spawns threads when users connect through the Java applet embedded in the dynamic html page. A maximum client limit is

imposed so as to hinder Denial of Service attacks. This design enables the server to handle multiple clients without heavy demand on the system.

The client's Java applet is designed to run from any web browsers. It is designed in a highly object-oriented behaviour, with the separation between the different design patterns of the back-end functions and the front-end graphical user interface. In addition, the client and the server communicate via TCP socket, which provides reliability and error correction in the network environment. Every e-chat session is saved in the database system. The user may, at a later stage, view the session information and the chat contents in each session. Instructors and learners can review any previous online chat discussion any time. Figure 3 shows the E-Chat module and its sub components.

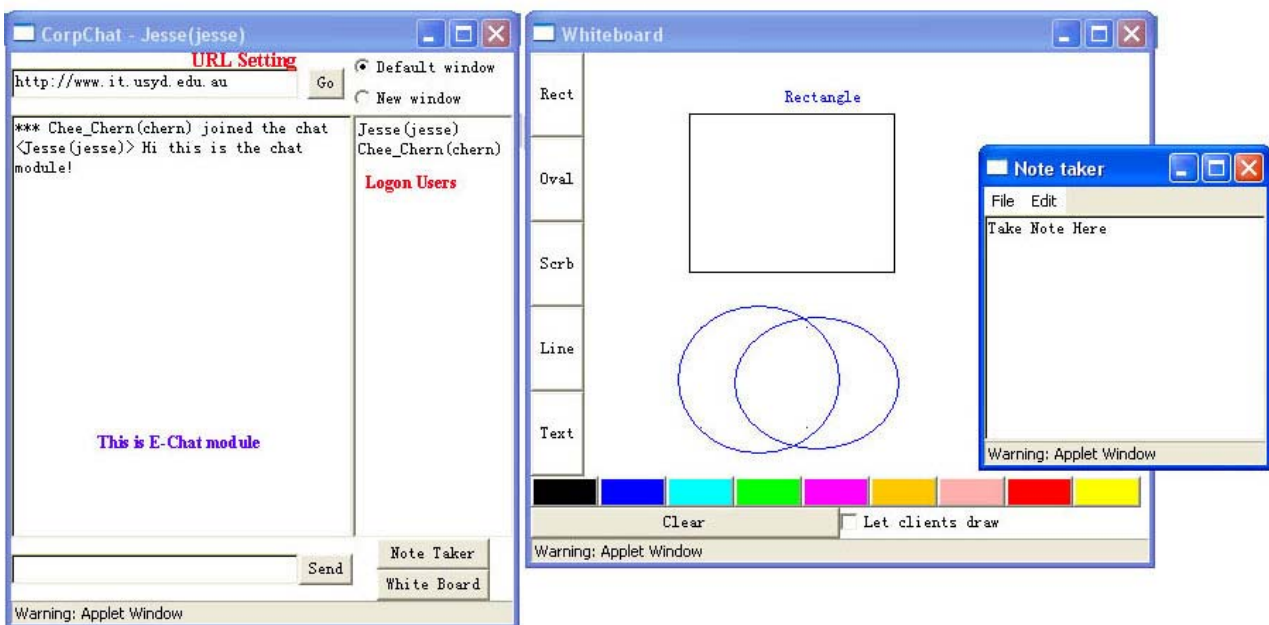


Figure 3. E-Chat Module And Its Components

3.2 Peer-to-peer File Transfer

In the e-chat module, the system also provides a 'File Transfer' function. This function allows active user in chat session to send file to other user in the same session. This function helps to improve the collaboration between the system users. In most existing system, users can only exchange files through email. Thus, any user without email is not able to communicate with other users. Cyber Campus has provided another alternative way for users to communicate in a much efficient way.

3.3 Electronic Whiteboard

In order to further improve the collaboration for students and tutors in their e-learning environment, the idea of having an electronic whiteboard is implemented

in the Cyber Campus. The whiteboard allows students to perform drawing on the Internet. Users can share ideas and communicate in a graphical ways. Users can enter text; draw lines, rectangles, scribbling and ovals of any colour. The whiteboard is designed to have the option of saving the drawing and opening previous saved drawing or other standard image files. Again, this improves the communication and collaborative group work between the users. This component is similar to the E-Chat module, it is implemented purely in Java, and thus users can operate from any standard web browser on any platform.

3.4 Synchronized Group Web Browsing

Synchronized group web browsing is the next feature in the communication tools. With the combination of chat and synchronized group web browsing, users can be notified automatically when anyone joins or leaves

the session. The system is just like a virtual classroom and the user in the same session can interact with each other. In addition, instructor can direct active users' browsers to the designated page by setting an URL address. Unlike other solutions, by utilizing Java technology, this module can be directly integrated in the Cyber Campus without any additional effort. Figure 4 shows the interaction between users' browsers in the virtual classroom. Instructor 'Jesse' creates a new

session, student 'Chee' joined instructor in the chat session. The instructor can set an URL address in the chat applet. When an URL is set, the instructor and every student in same session will have browsers displaying the contents from the preset specific URL. Instructor can use this tool to deliver teaching on the Internet. This achieves the basic requirements of a virtual classroom.

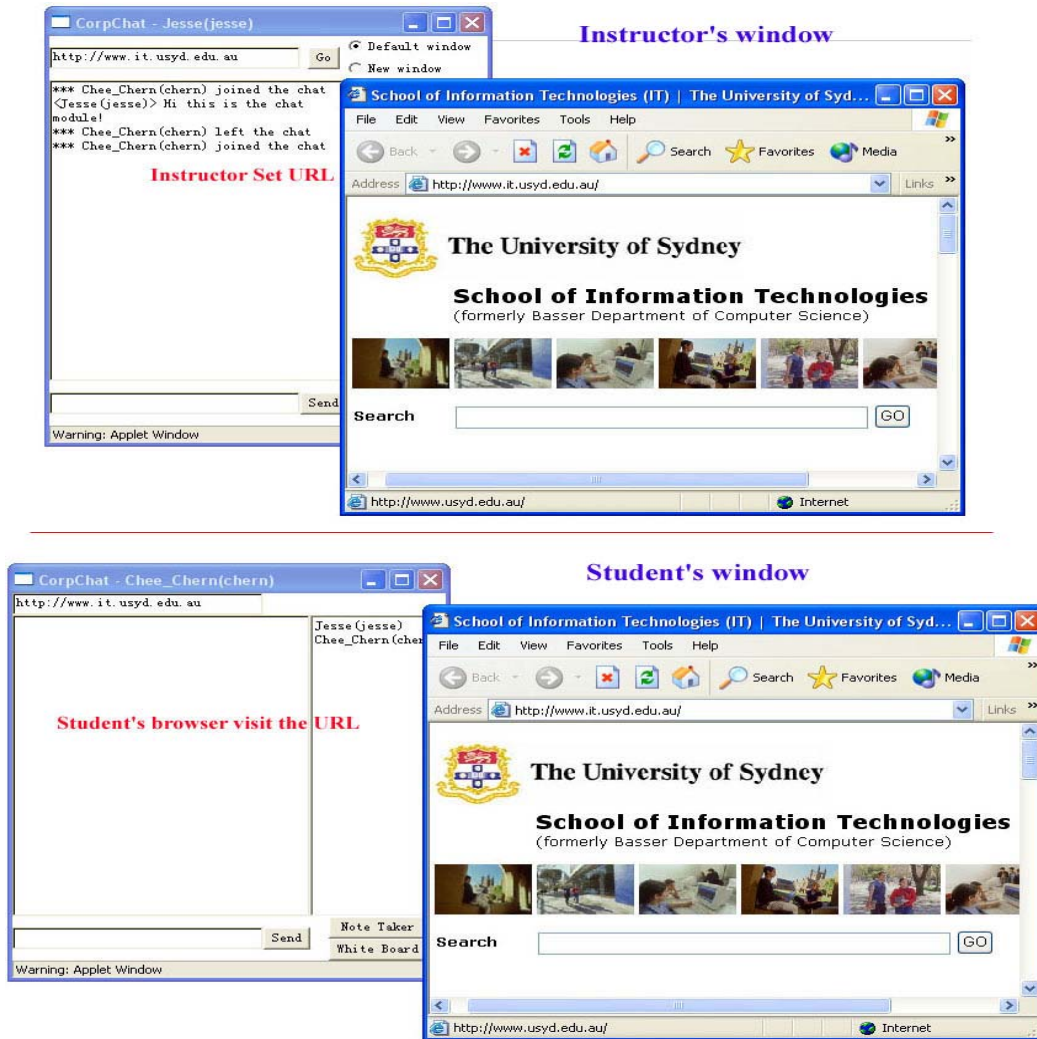


Figure 4. Synchronized Group Web Browsing Between Users

4. ASSESSMENT MANAGEMENT

Assessment management is a very important module in any e-learning system. Cyber Campus has provided a wide range of options in setting up different kinds of assessments. The framework allows instructor to either create online assessment questions or upload project's related documents. In addition, the system allows instructor to create submission gateway and perform auto-marking on the online assessment. The following sections will further explain the design and functionalities in the assessment module.

4.1 Online Assessment

In Cyber Campus, assessments are identified into two categories in term of the assessment nature: creating questions online or uploading the files. Instructor can easily setup assessment questions through a user-friendly interface. The system provides tools to construct questions including the following question format: multiple choice, true or false, short answer or essay-type questions. In addition, in the process of creating or editing assessment details, instructors can configure additional settings such as assessment's online

status, date, time and duration, time limit on each question, solution and explanation. Once the assessment and questions are properly setup, students can login to the system and participate in the test. All students' answers will be recorded for later use in the assessment marking.

4.2 Online Submission

For non-online assessment or non-hardcopy submission, instructors can setup gateways to receive softcopy or electronic submissions of assignment from the students through the Internet. For each submission gateway, instructors can set some restrictions such as submission's due date, allowed number of submitted files, acceptable file extensions, late penalty and its online status. Furthermore, instructor can define each own marking scheme and use it as marking sheet in marking the submissions.

4.3 Assessment Marking

This section can be further divided into four modules:

1. Auto-marking in online assessment.
2. Marking sheet on students' submissions.
3. Enter mark for traditional assessment.
4. Normal distribution on mark scaling.

For the online assessment with multiple choice or true/false questions, the system can perform auto-marking on the students' answers. However, for short answer and essay-type question, instructor is still required to review the answer and enter the mark manually.

From the submission management, instructor can view and retrieve students' submissions and mark the submissions with pre-define marking scheme. Late penalty will automatically be calculated upon the submission received from the student. Instructor can download submission's files and view history record of each student's submission.

As for traditional assessment, Camber Campus has provided an additional interface for instructors to manually enter the result into the system. Finally, instructor can perform mark scaling with function calculating the normal distribution. With graphical presentation of the results, instructor can easily identify the marks distribution of students' results.

5. SYSTEM PERFORMANCE

Cyber Campus e-learning system is successfully deployed in the School of Information Technologies, University of Sydney. One subject is selected to participate in the beta version of the system. The system is installed on a Window platform machine running on an Apache server. The system is used to serve as an e-learning system that provides instructor and learners with the full system functionalities

including course documents dissemination, tutor/learner interaction, assessments and course management. The system has successfully delivered teaching and learning tools for instructor and students in an e-learning environment. The system has proven its abilities and stability in its beta version.

6. CONCLUSION

This paper introduced an e-learning system that integrates students management, course contents management and users collaboration into an all-in-one web-based application. The framework is carefully designed according to the model of WCCM, and the entire system will be implemented using portal technology [4][5]. In addition, the communication component is designed according to concept of CSCW [9]. The web-based multimedia e-learning system provides a centralised control in the database. CyberCampus is platform independent. It can be installed on any server and users can access the system through Internet/Intranet using standard web browser regardless of the client's operating system. The efficiency of collaboration and consultation is improved by providing an online chat session and simultaneous group web browsing environment that user could aware the presence of other participants. In addition, the system supports peer-to-peer connection for efficient files transmission between logon users. However, the system is still currently under constant improvement in the development phase. The latest version of whiteboard is still unable to save the drawings and open imaging file. Overall, Cyber Campus satisfies the requirements of a virtual classroom. The system will be the ideal system for any size of education organisation and it has proven its stability and abilities in its beta version.

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