Towards a Real Virtual Classroom

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[Abstract]
Distance education is well regarded as a better way to bring education to those who are unable to attend classes at traditional schools and universities. In recent years, new Web technologies and systems such as Ajax, RSS, Wikis, blogs, social networks, online image and video sharing, online whiteboard and mind maps have made distance education more efficient and effective. However, in today's distance education practice, distance learners still cannot get some of the benefits that traditional classrooms have offered. In this paper, we present the design of a Web-based course delivery system that is intended to provide a classroom like environment to learners distributed across the Web. Within such a system, learners are more closely connected, and helps can come more timely from their peers or the instructor and tutors. We discuss the design and architecture of the system, as well as the implementation.

Keywords: virtual classroom, online course delivery, distance education, LMS

1. Introduction

With the advances in technologies and education practice, online learning has gained its great popularity at all levels of education across the globe. Today online learning is being used as their main stream of course and program delivery by open universities such as Athabasca University (http://www.athabascau.ca) and the Open University in the UK (http://www.open.ac.uk). Hence, it is reasonable to say that the success of today's distance education essentially depends on the quality of online learning.

In today's technology and practice, the best form of online learning is through an online learning management system (LMS) [8]. Well-known examples of learning management systems include aTutor (http://www.atutor.ca/) , Blackboard learning system (http://www.blackboard.com/), Moodle (http://moodle.org/), Learn.Com (http://www.learn.com/), Sakai (http://www.sakaiproject.org/), and TotalLMS (http://www.sumtotalsystems.com/). The main functionalities commonly provided by these popular LMSs include managing users, roles, courses, instructors, facilities and generating reports, managing course calendar, generating and managing learning paths, supporting student messaging and notification, handling assignments and tests, displaying scores and transcripts, and grading course work. As can be seen, none of these functionalities is really about learning itself. That is, these systems do not really help learners to learn, and show no effort to ensure learners can get the needed help in a timely fashion from instructors, tutors and their peers. In these popular LMSs students are essentially isolated from their instructors, tutors and their fellow students. Learners taking courses through these LMSs don't have a sense of attending a class. They feel lost and left on their own. Furthermore, there is no effective way for learners to foster friendship with their fellow students who are taking the very same course, which is often another major benefit one could get from attending classes at traditional schools and universities.

Let's take Moodle as an example. As an open source learning management system, Moodle has been adopted by thousands of schools and universities as their learning management systems for online course delivery. What does it offer to learners?

Figure 1 is a screenshot from a running session of Moodle being used to deliver a course on technologies for Web-based systems. As can be seen from the figure, the system provides good mechanisms for the delivery of all course components such as study guide, study plan, assignments and other course materials; it also provides a drop-box for assignment submission, and threaded forum for discussion. However, within

this system, learners feel no different from browsing a Web page. Learners can hardly get a sense of being in a class, and they don't know who are in the class at a given time available to be called for help.

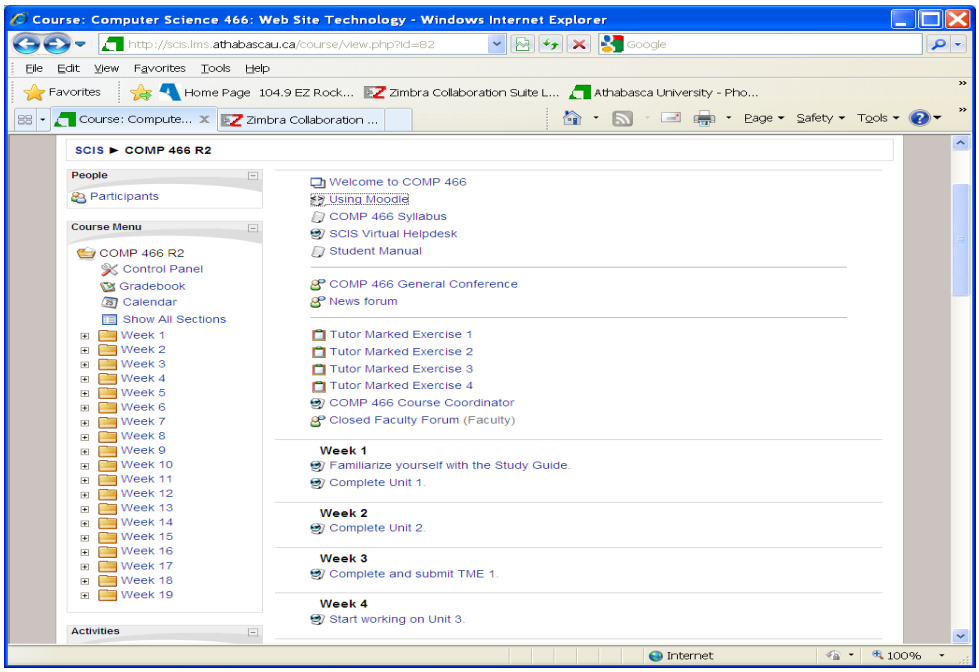

Figure 1: Moodle interface for learners

2. Design considerations for the course delivery system

As we mentioned, the main problem with today's online education is the isolation of learners from their instructors, tutors and peers. Students cannot get help in a timely fashion when they desperately need; they cannot get a sense of being in a classroom where they can help each other and make friends. The purpose of this research is to try to solve these problems through the development of a Web-based course delivery system.

Therefore, the design goal of our Web-based course delivery system is to provide students with a better virtual classroom – a real virtual classroom. In such a virtual classroom students should be able to:

1) Access all kinds of learning materials and relevant information needed for the course;
2) Communicate effectively with others;
3) Get help from instructors, tutors and their peers in a more timely fashion;
4) Know who are in the classroom available for help;
5) Foster friendship with others.

We achieve these goals by providing carefully selected tools within a carefully designed computer human interface, as shown in figure 2.

In the layout shown in figure 2, panel A contains links to all course components and tools for navigation, while the actual contents of these components or tools are presented in panel B. A typical course may contain the following components:

1) Course syllabus
2) Course overview or instruction
3) Course study guide which defines all activities required to complete the course
4) Course contacts showing contact info of the instructor, tutors and other personnel
5) Study plan, which defines the deadline for major course events such as assignments submission

6) Some units: unit 1, unit 2, unit 3…
7) Some quizzes: quiz 1, quiz 2, and quiz 3 …
8) Some assignments: assignment 1, assignment 2 and assignment 3 …
9) Documents containing frequently asked questions and answers
10) Documents containing how-to questions and answers
11) A document of terminology
12) A document of references
13) Datasheet if needed for the course, chemistry data, for example
14) Tools needed for or desirable for the course

In the above, a unit may further have the following components:

1) Unit overview
2) Unit learning objectives
3) Some lessons/sections: lesion 1, lesson 2, lesson 3 …
4) Review questions of the unit
5) Unit exercises or homework problems

In turn, each lesson or section may also have an overview, learning objectives, review questions and exercises as well as other learning objects. Hence, a tree structure will be a good choice for navigation.

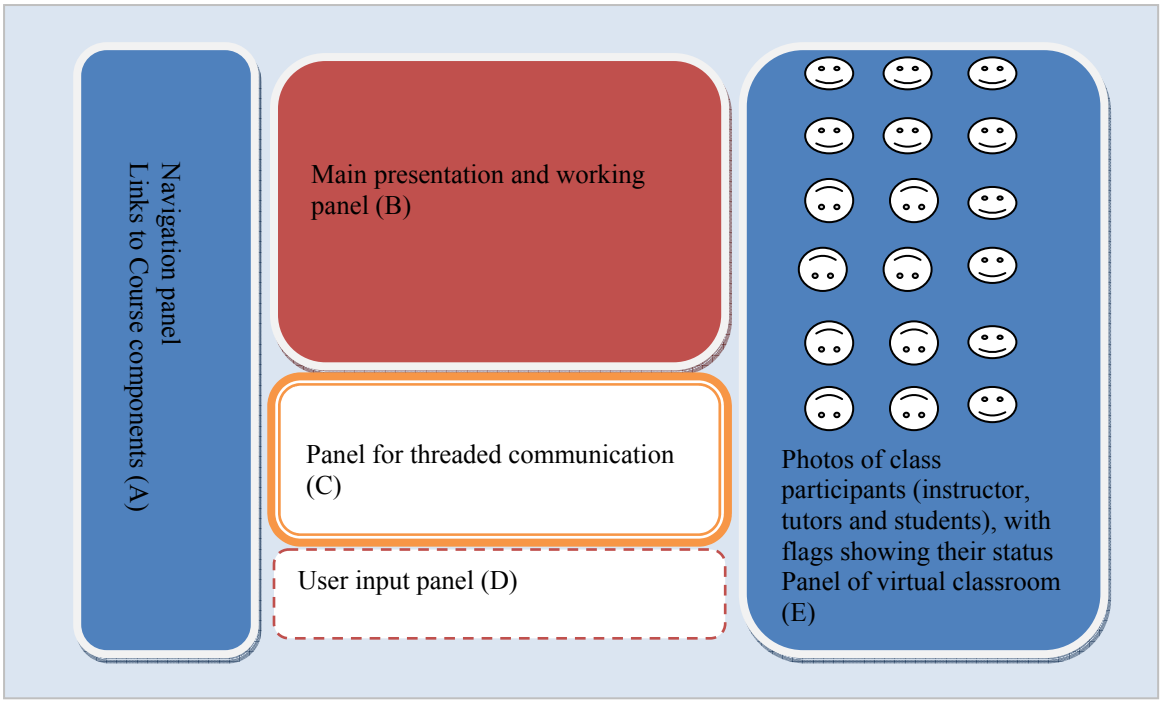

Figure 2: human computer interface of the course delivery system

3. System architecture

Modules in the system layout shown in figure 2 can be divided into two groups: a group for learning and a group for monitoring and communication. The learning group include A and B, while the communication group include C, D and E. Since the system is Web-based, we hence put our focus on the system architecture on the server side. We first present the system architecture for monitoring and communication, as shown in figure 3.

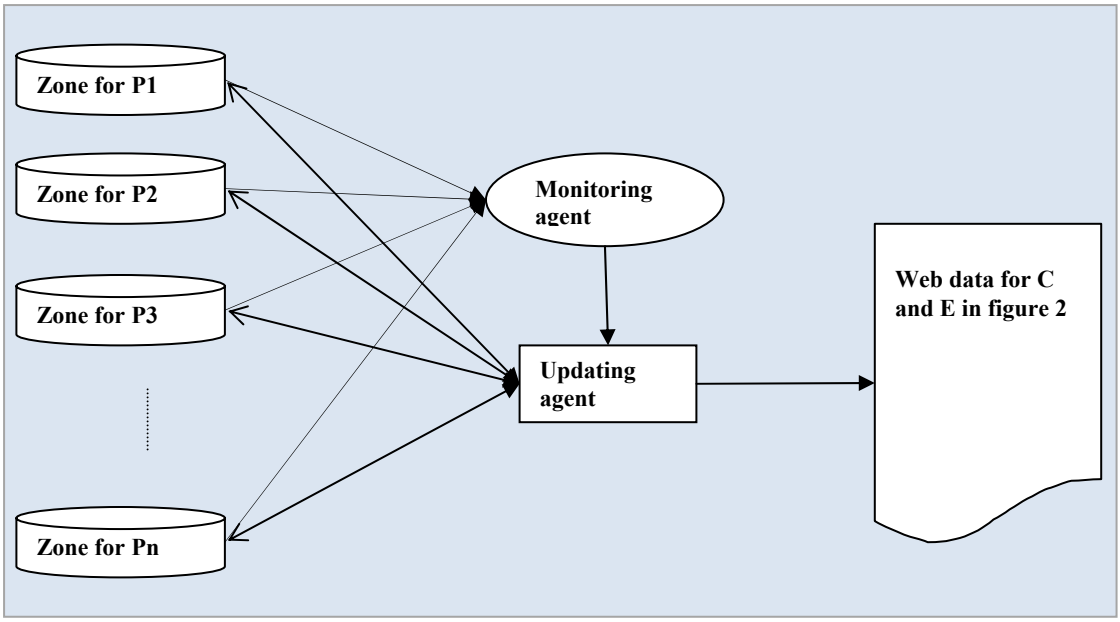

Figure 3: system architecture for monitoring and communication

In figure 3, zone for Pi is a collection of information for participant i, where i=1, 2, 3… n and n is the number of participants in the class, including instructor(s), tutor(s) and learners. For learners, the collection may include information collected at enrolment, information about his/her program status, information about his/her course status, information about his class status (whether he or she is currently in the virtual classroom, for example), information about his/her personality and learning style. Note that these collections of information are not automatically shared among class participants, though they are all accessible for the monitoring and updating agents.

The monitoring agent in figure 2 is used to monitor the following changes in the zones:

1) New participant is added to the class
2) A participant is removed from the class
3) A participant has just signed into the virtual classroom, and can be a helper if needed
4) A participant has just signed off, and temporarily unavailable to help
5) A new message has just been posted by a participant

Changes 1 to 4 are made by an account management agent at a high level, whereas change 5 is made by participants through posting.

Once a change is observed by the monitoring agent, it will send a message to the updating agent, which will then act accordingly to update the Web data for panel C and E in figure 2.

Please note that Web data in the navigation panel and presentation panel are not controlled by the monitoring and updating agents shown in figure. Navigation items in the navigation panel were determined entirely by the course designer, though the layout (whether using a linear or tree structure or a map) of these items were mainly the decision of the system developer.

For a particular user/participant, Web data in panel B (the presentation panel) was initialized based on the user/participant profile, a snapshot of information contained in the corresponding zone. A profile should include the role of the user/participant, status of last access to the system, and personality and learning style for course content personalization especially for learners. To generate personalized content for presentation in panel B, a profile management agent and a content personalization agent are needed. The relationships among these data and agents are shown in figure 4 below.

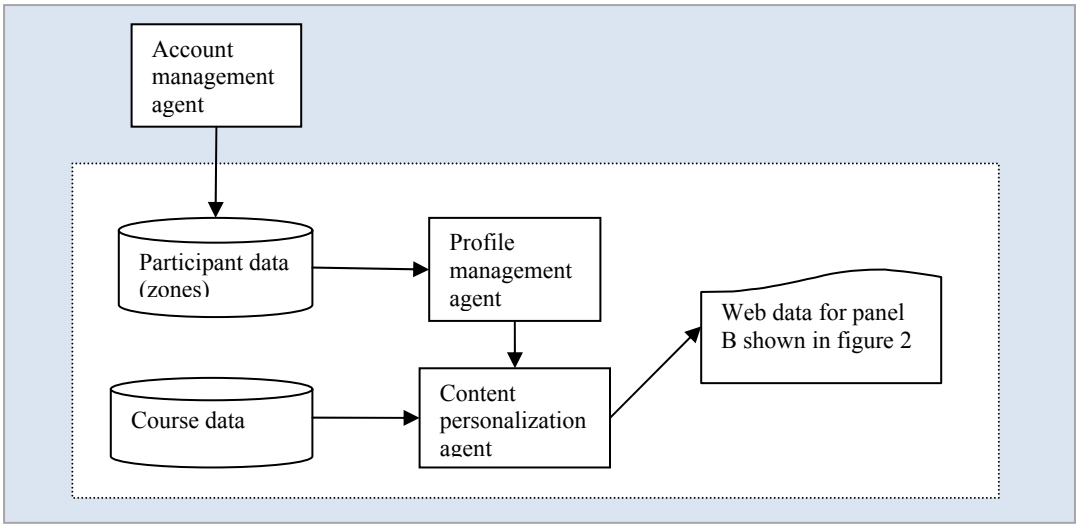

Figure 4: system architecture for course personalization

4. System implementation

The system is being implemented using PHP and MySQL on the server side, and using JavaScript with Ajax on the client side. On the server side, MySQL is used to store course content and user data, whereas PHP is used to process users' requests, update users' data, and generate Web data to feed Web browsers on client side. On the client side, the contents of panel B, C and E are updated individually through Ajax.

To implement the system is to design the create database tables and to implement the monitoring agent, the updating agent, the profile management agent and the content personalization agent. Assuming the online courses have been developed and stored in a database, we need only to create the user account database table and a database table for postings. However, our focus in the section about implementation will be on the implementation of the four agents.

A. The monitoring agent is needed to monitor changes in the class participant status, and new postings from class participants. For the former, we use a flagging field in the user account database table, together with fields on account creation time, time of last login, time of last logout. Data in the flagging field is coded to indicate whether it is a new account, if the user has just signed in, or has just signed off, or the account has just become dormant due to withdrawal from the class. Flowchart in figure 5 shows the decision making process of the agent.

B. Updating agent is designed to update contents of panel C and E. Its updating actions are triggered by the monitoring agent. There are four types of updating actions the agent may take:

    a. Adding a new class participant to panel E, which means the agent will create new area for the participant, and add a cluster of information representing the participant. The information may include a photo, name, contact info and a symbol indicating the status;
    b. Change the status symbol to 'in class';
    c. Change the status symbol to 'away';
    d. Delete the area designated for a participant if he or she has withdrawn from the class.

C. Profile management agent is used to generate a profile for a given class participant from information available in the participant data. The profile is then fed to the content personalization agent to generate personalized learning material presented in panel B.

D. Content personalization agent receives user profile from profile management agent. Based on the received profile, the agent will then generate personalized learning material to feed panel B on the web browser window. Content personalization is a big topic to research on, and the degree of

intelligence of the system can only be improved over time. The intelligence also depends on whether the course was designed with different learning styles in mind, and how well the profile management agent can understand different learners.

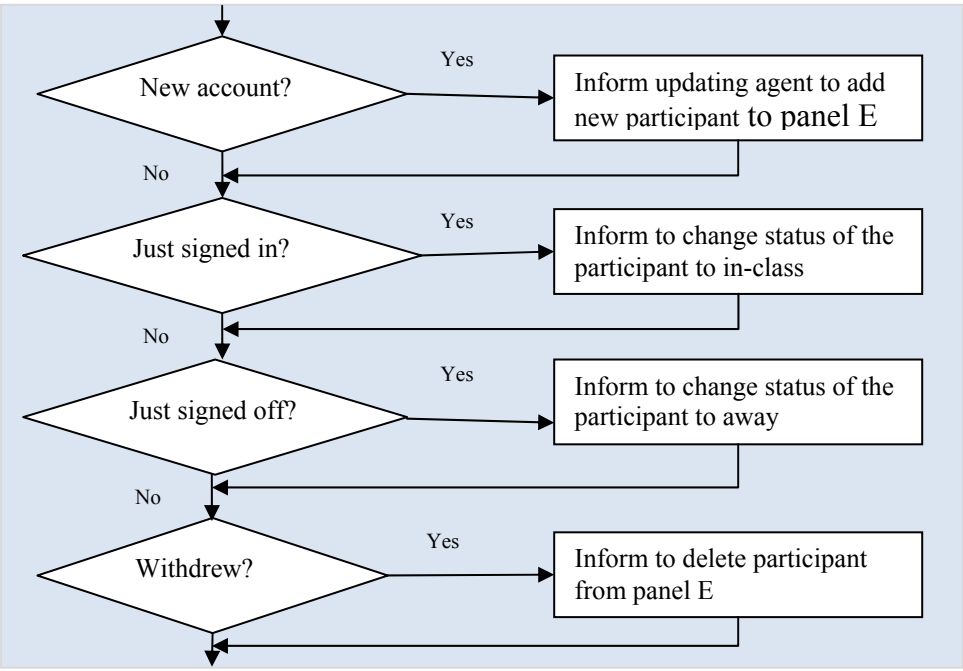

Figure 5: decision making for the monitoring agent

5. Conclusions

In this paper we presented the design and implementation of online course delivery system intended to provide distance learners with a better virtual classroom or virtual learning environment [2][3][4][5][6]. We first talked about some special considerations for the design, and then presented the architecture of the system on the server side. We also discussed about how the system can be implemented using publicly available Web technologies including PHP, MySQL, JavaScript with Ajax and others, though we didn't show the details of coding.

Compared to other course delivery systems such as that provided in Moodle, the system presented here can give learners a better sense of being in a classroom, in which learners will be able to know who are in the virtual classroom, and who may be willing to help or be future friend.

For class collaboration, we currently have only threaded forum designed in the system. Although we agree that discussion forum is an effective way of group collaboration [7][8], we do have a plan to add other ways of collaboration into the system. These may include Wikis [19], blogs, social networks, online image and video sharing, online whiteboard and mind maps [17]. In our future research, these systems and technologies will be carefully studies for their effectiveness. We will implement only when we believe the new addition(s) will not distract students' attention.

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