

An Effective used on Web-Based E-Learning System in Educational Institutions

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Abstract— Research works in the field of electronic learning are represented by a broad spectrum of applications, ranged from virtual classrooms to remote courses or distance learning. In this, paper we propose a simple web-based training(WBT) and quizzes system, in which, teachers and trainers can conduct any type of courses and set different types of quizzes and exams. The system allows potential users to store, update, and delete questions from the database using the web, in a very easy and simplified manner. In addition, teachers can track the activities of their students and can guide them to reach the pre-determined objectives of the courses. Our system can be used successfully in distance learning as well as in self-training. We are developing the system with different type of courses taught in Adamas Institute of Technology, ranged from basic to advanced namely: introduction to computer science, programming concepts using C++, digital logic design and fundamentals of database systems. Few feedback from both teachers and students were highly promising.

Keywords: Educational System, WBT, E-Learning, Distance Learning.

1. INTRODUCTION

The educational use of computers has evolved from numerical calculations, spreadsheets, and word processors to multimedia and web-based applications [8]. The introduction of the Intranet/Internet access in universities, schools, and companies has encouraged the development of new tools and systems within the scope of education and training [9]. As a result a new era of learning and training approaches have emerged, where students can learn independently at any time and from any location, simply by using their computers connected to the net along with the appropriate systems and tools. Teachers also can teach from on-line location and can schedule their lectures and exams without the classical physical constraints. This electronic learning approach known also as e-learning, has opened new horizons in teaching for both teachers and students.

The assessment process in an educational system is an important and primordial part of its success to assure the correct way of knowledge transmission and to ensure that students are working correctly and succeed to acquire the needed knowledge. Many assessment methods can be used: conducting some experiments, realizing different mini-projects, making quizzes and exams [10,11]. The evaluation mechanism help students to discover whether they have gained the required knowledge as expected, and provides appropriate and timely feedback to teachers to adjust their lectures, exercises and exams.

In this, paper we propose a simple on line web-based training and quizzes system which can be used with any course and may save hours in exams and quizzes preparation and correction, as well as may save resources like, photocopying and distributing the exams papers, locations of these exams, teachers and assistants, etc. The proposed system has the following functionalities and features:

1.1. Assignment submission: A student can submit his or her assignment on-line respecting a pre-fixed deadline using any computer connected to the net.

1.2. E-Lectures: The system has a tool to build web-based tutorials and training.

1.3. Knowledge evaluation: Students can evaluate their understanding levels, and teachers can track the students activities and guide them to acquire correctly the expected knowledge.

1.4. Questions generation: Teachers can build many types of questions like multiple choice, true or false, fill in the blanks, and parallel list connections. The system uses an intelligent algorithm to generate quizzes and exams with different levels of difficulties. In fact, the teachers can prepare their questions, set their difficulties and insert them into the database and ask the system to generate automatically the quizzes with different levels

of difficulties.

1.5. Exam grading: Practices and quizzes can be marked automatically by the system. Thus, students can get instantly their marks in a given quiz immediately after submitting their responses and see also the corrected answers.

1.6. Communication: The system has a communication tool that allows students and teachers to interact together and discuss their activities.

1.7. Course management: The system is highly flexible and doesn't necessitate any programming skills from its potential users. Thus, teachers can delete and update their course materials at any moment through the web.

2. E-LEARNING SYSTEMS

Currently, many e-learning systems exist like WebCBT, Black Board, iCampus, Claroline, QMWeb, and QUIZIT [2,3,4]. However, each system has its own features and tools, and research in this area is still open as many ideas can emerge to facilitate the electronic education process, thus new set of electronic systems appear yearly [5]. Our system is different from some open-source systems based on Zope or Moodle concepts or general Web-based approaches where, in many cases, the system is designed to be very open, encouraging general use of Web-based resources [14,15]. The danger with these alternatives lies in the openness itself: the material accessed by the students has no built-in quality assurance but more importantly the Web itself in completely unstructured, this does not encourage the focus required to solve hard problems, understand complex issues or learn difficult methods. On the contrary, too much flexibility can easily lead users of any system to spend the day pushing different buttons in search of something appropriate happening, rather than sitting down and tackling the issue at hand using the brain as a tool. Thus if it correct that a plateau is being reached in the use of Web-based resources in higher education [1], then the above arguments can be put forward to suggest that perhaps the use of Web-based resources can sometimes be too much of a good thing.

3. SYSTEM OVERVIEW

The system interface is entirely web-based, and fully compatible with almost all well-known browsers. The WBT and quizzes applications are developed with a friendly user

interface, which doesn't necessitate any technical skills from the potential users. Teachers can easily create web-based tutorials, quizzes and exams. The system consists mainly of three independent components as shown in Figure 1, the client, the server, and the database management systems(DBMS). The main advantage of this architecture is its scalability with the possibility of moving the DBMS to another workstation, totally separated from the www server, and establishing a connection with it through a local network. The system environment can be divided into two major blocks. The first one is the client side application, which is developed in HTML, XML, ASP, and Java script. The second block is the server program, which is developed in PHP and ASP.NET. It acts as a gateway between the database and the clients. The system is compatible with different platforms.

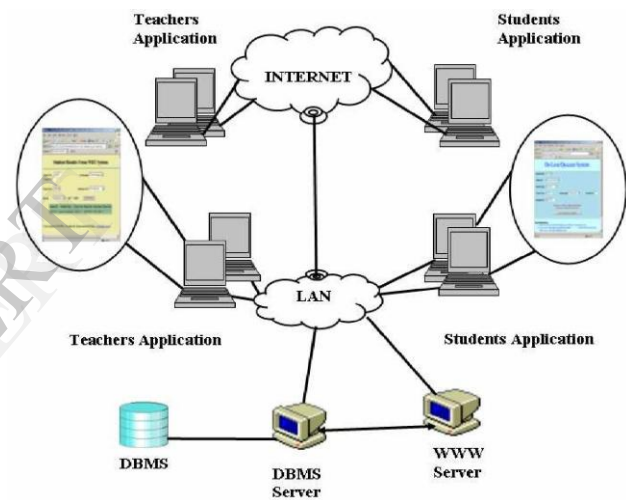


Figure 1. System Architecture.

The teachers application is used to insert, update and delete questions from the database. The server application carries out some additional tasks to improve the performance of the whole system, for example, it retrieves and prints the student scores. The students application provides the WBT and quizzes. The client application accesses the system in order to retrieve the questions provided by the teachers.

3.1 The Server Machine :

The server machine is the key factor in our system. Its main components are the following:

An Internet web server, which provides access to

the HTML pages.

A DBMS which keeps and classifies all the questions in an Oracle database.

The PHP and ASP.NET applications that include the ODBC (Open Database Connectivity) driver and act as an interface between the client stations and the DBMS.

Clients do not interact directly with the database. In fact, the communication between the clients and the server applications is performed through the PHP and ASP.NET. As shown in Figure 1, the system is appropriate for on-campus teaching, with access to the Internet, or off-campus teaching using the local network. Currently the database and the server application run on Microsoft Windows 2000 Server.

3.2 Development Tools :

XML: XML (Extensible Markup Language) was chosen as a basis for system development. It is performed by means of XML Schema, which determines the question structure. The XML Schema defines the composition of each kind of question considering all the necessary fields [6,12].

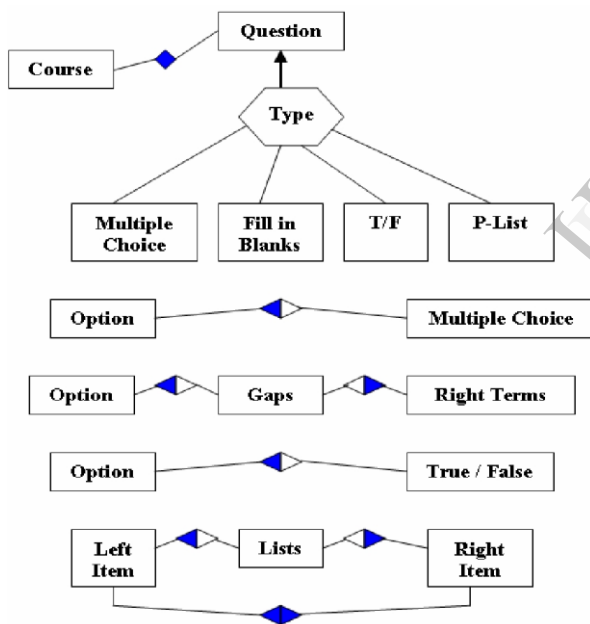


Figure 2. Entity-relationship diagrams showing the different types of questions.

PHP: which is used to carry out the dynamic practice and quiz presentation [12].

Database Management System: The DBMS store the questions, the quizzes, the student profiles, and some related statistics. Database access is achieved using the Oracle ODBC driver. We have chosen the entity-relationship model [13]. Figure 2, shows the entity-relationship diagrams of the

four basic question types accepted in our system which are as follows: Multiple choice, Fill in the blanks, True/False and Two parallel lists that have to be connected.

We used different DBMS for developing the database of our system such as, MS Access, and MySQL. The use of different DMBS produces good results and shows some differences among these databases.

3.3 Quiz Generation Algorithm :

The DBMS of the WBT and quizzes system includes an innovative and intelligent algorithm for managing the difficulty of the questions. The algorithm uses the difficulty attribute set by the user as input parameter. The teachers set the difficulty levels of their questions at creation phase using a numbering system. The value assigned to a specific question identifies how difficult (or easy) it would be for a student to reply correctly to the question. Our algorithm can generate automatically different quizzes with different levels of difficulties. Obviously, teachers are not always as accurate as would be desirable in estimating the difficulty of a question (as they don't know the exact level of the students using the system) our algorithm can update the difficulty and the easiness of the questions based on the responses given by the students. The algorithm has the ability to detect the difficulty/easiness of a question based on students reply and adjust the difficulty value accordingly. As a result, some of the feedbacks of the students in a given course are used to adjust the level of the questions. The following are the methods of our algorithm:

3.3.1. Get_Difficulty(): This method determines the difficulty of a specific question.

3.3.2. Calc_Margin(): This method calculates the lower and the upper bounds of error percentage in the students' responses.

3.3.3. Calc_Error(): This method calculates the percentage of wrong responses to a question, as a ratio between errors and a constant value named Max_Num_Access. The involved variables are reset after each difficulty evaluation.

3.3.4. Mark_Ques(): This method activates a Boolean field in the register of a question if the difficulty level reaches the thresholds

Four difficulty degrees have been considered rangy from level one to level four. If a question has a value higher than four, it could be too difficult or it could be ambiguous. Similarly, if a question has a value of 0, the question could be too easy, or too obvious, and nearly all the students can

answer it correctly. The questions that are out of bounds are marked, so they cannot be used for any quiz or WBT, and the teachers must update them. Table 1 shows the upper and lower bounds for determining the difficulty of the questions

Table 1. Questions Levels

Difficulty	Lower bound (%)	Upper Bound (%)
1	10	30
2	30	50
3	50	70
4	70	90

Algorithm: ManageQuestion(Difficulty)

1. Access random question from the question database.
2. Check the Max_Num_Access of the question
Get_Difficulty(); Calc_Margn(); Calc_Error();
3. Recalculate_Difficulty();
4. if (Error < LowerBound) then
Difficulty--;
- else if (Error > UpperBound) then
Difficulty++;
5. if Difficulty is out-of-bounds then
Mark_Ques();

4. WBT AND QUIZZES APPLICATION

One of the main distinctive feature of our system is the utilization of XML. Although there are other XML-based courseware generators [7], they do not use PHP, XML, and SQL database. The client application (used to access the WBT and quizzes system) is divided into two applications, called teachers (or staff members) and students applications.

4.1 The Teachers Application :

The staff members or Teachers application is used to provide the potential users with a simple tool to manage easily the information of the WBT and the quizzes. It saves much time in exams preparation and correction as it can generate automatic quizzes, make the corrections and

provide the results. The following features are available in the teachers application:

Add, update, and delete questions: Teachers can add, update, or delete questions and answers for courses using the web. The questions are inserted into the database dynamically, so new questions can be added during the configuration of a quiz or practice. For instance to insert a new question into the question database, the teacher simply has to access the “Add WBT Questions” tool, types in the question text, enters the answers, set the difficulty levels, and indicates the correct answers. After introducing the questions the teacher can modify their questions and answers as they can delete them.

Print students scores: The teachers can use this tool to print the scores report for the students who took the web-based quizzes.

4.2 Students Application :

Students can access the WBT and quizzes by using the students application. This application allows the student, to take free practices and select quizzes. The following are the different set of windows in the students application:

Registration: Student must register to be able to take an on-line quiz. The contents of the registration page given in Figure 3, depends on the course level and the students registered in that course (allowed students).

Validation: Each field value in the registration form must be correct and matches with the corresponding value stored in the database, otherwise an error message will be displayed. Whenever the student completes his registration correctly, a validation message appears on the screen and thus the student can start the on-line quiz.

On-Line Quiz: After a student get registered he can select the quiz, where the questions will be selected randomly by our algorithm from the database. Our system covers many types of questions as mentioned before, such as: multiple choices, True/False, fill in the blank and parallel lists. The quiz will be over either whenever the student finishes it and select the submit button, or whenever a pre-allocated time will be over. The system will calculate the number of correct answers and display the result. Finally, the student score will be saved in the corresponding database for possible tracking.

Free WBT: The student application allows the student to take free web-based practices for the courses and set the number of questions in the practice as well as the questions type (random or sequential) with their difficulties levels, in addition to the total time.

5. USER INTERFACE

The system uses a friendly graphical user interface. In the following sections, we will describe the user interface.

5.1 Students Application Interface :

The Registration Page: Students access the registration page to take the quiz. A student must input all the required data correctly. For instance, if the course number entered by the student doesn't exist in the database, an error message will be displayed and requests the student to re-enter a valid course number. When the entered course number is correct the corresponding course name will be displayed.

Figure 3. Registration page.

On-Line Quizzes Form: The on-line quizzes form given in Figure 4, displays the quiz questions (from the database), the quiz date (system date), the time allocated to the quiz, and the student name.

Figure 4. On-Line Quizzes Form. The quiz is displayed based on question-by-question methodology. A navigator is included so the student can go backward and forward over the questions in single steps.

When the last question is reached, the student can go back to the previous one, and if the first question is reached, the student can go forward to the next questions. When the student finishes the quiz, a record will be created in the student_exam table, and stored in the database. This table includes the quiz information such as: student id, semester and year, course number, section number, quiz date and time, and the student mark. Teachers can consult these tables to track the activities of their students.

The Free WBT Page: Student can access this page to take a free web-based practices for his courses as shown in Figure 5 and Figure 6. Once the student selects the desired course, the students management application will be launched and allows the student to set the practice mode.

Figure 5. Free WBT Page.

5.2 Teachers Application :

The Teacher Login Page: The teachers can login at any time to manage their WBT and quizzes of their courses. They can add, update and delete questions and answers from the system database. The login page is connected with the database through the PHP files. The system searches in the table named "users", if it finds the username and its corresponding password it directs the user to the required page otherwise it redirects the user to the login page again for three attempts.

Add, Update, and Delete Questions Pages: Teachers can access the tools that allow them to add, update and delete the questions and answers for their courses.

Print Student Scores Page: Teachers can print reports about their students, and can guide them by means of electronic messages or on-line discussions.

6. CONCLUSION

We proposed a simple and easy to use e-learning system that is used currently in Adamas Institute of Technology by both students and teachers of the department of Computer Science and Engineering and Information Technology. The system is fully web-based and can run on any platform and compatible with most known browsers. In addition to its ability to manage electronic tutorials, the system uses an intelligent algorithm to generate quizzes and exams with different levels of difficulties according to the desire of the potential users. This algorithm adjusts the pre-set difficulty levels of the questions based on the feedback of the students. The students can see the solutions of their exams along with their marks immediately after submitting their answerers. The system reduces the constraints of the classical education system and save time and resources. In fact, teachers can set their courses, exams and quizzes at their convenient time and can track the activities of their students and guide them to acquire correctly the requested knowledge without be obliged to be physically in the college campus. Similarly, the students can use the system freely and independently from their, labs and home through the web. A discussion tool is also provided to allow teachers and students to interact together at a specific time. A bulletin board is also used to make some announcements to students about their courses and quizzes and exams.

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