

The Design and Implementation of Web-based E-learning Examination System Based on J2EE

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Abstract: In this paper, the architecture of web-based self-adapted examination system and its implement method of design were introduced. In the course of implementing this system, J2EE system structure was studied. Also, the CELTS standard was employed as a metadata standard, And relevant standard was used to design the question pool, and set up standardization and portability question pool structure of the examination question structure.

Key words: e-learning, J2EE, self-adapted examination system

1. Introduction

Computers and web applications bring a significant revolution in our social life and especially to our traditional mechanism of education. The era of education enable us to access mass of information whose remarkable character is digital so that computers can recognize and deal with this kind of expression of information. Digital campus construction is already on going in order to catch the new trend in quality education. The main functions of digital campus cover with distance education such as web classroom, courseware on demand, distance examination. The digital campus information management system includes information management system, office automation system, administration examination system and virtual community such as online tutoring, bulletin board system etc. With the intensification of distance web education, how to estimate learning effect locally is an important issue. Thus a web-based examination system which conducts exams through web will reduce a large proportion of workload on examination, training and reviewing.

Networking Institute's demonstration project is a comprehensive education system which utilizes information technology of the network to carry on college course to educate, it offers from the network classroom, essential study links discussing, answering questions, and processing homework to examination to teachers and students. This system should also support management activity of the educational administration, such as online course project, roll management, follow-up of quality, etc. The self-adapted examination system is a sub-system of the Networking Institute's demonstration project which was funded and supported by the China government.

2. Architecture of Web-based Examination System

Develop a web-based examination system is very important to the digital campus. Several key technologies such as data storage, data call, user identity certification, data security and self-adapted test questions random generation and online marking in developing the system should be solved. Fig.1 is the scheme of the examination system.

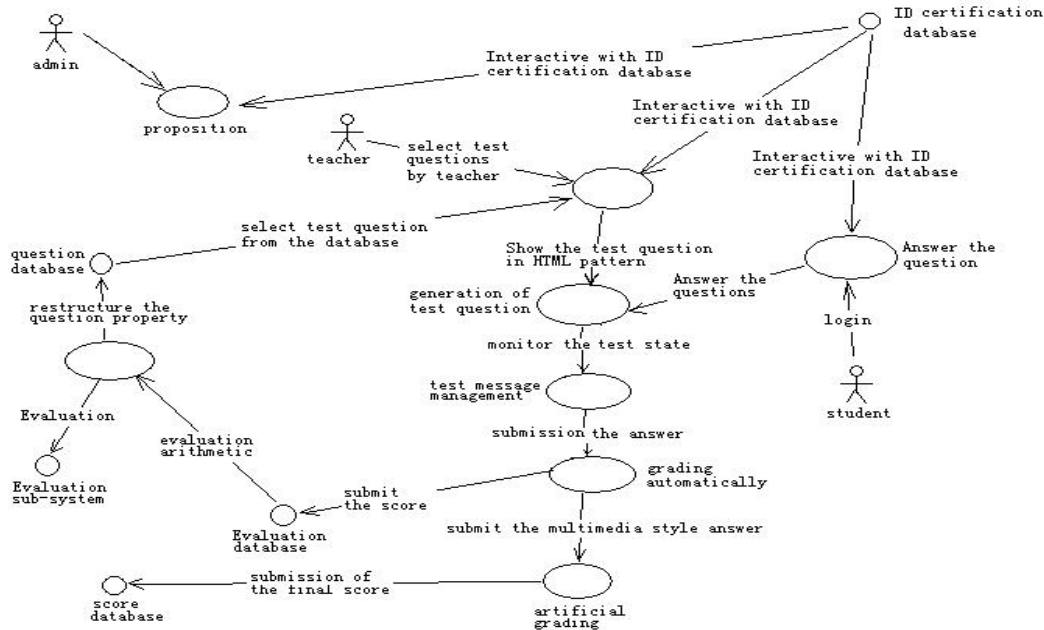


Fig.1 scheme of the examination system

Each implementation section of the system is demonstrated in Fig.2 as follow.

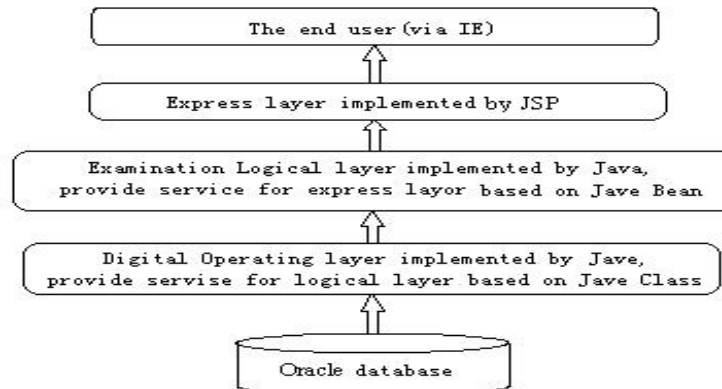


Fig.2 Implementation section of the examination system

3. Function Models of Examination System

3.1 Questions Generate Module

The function of this model is to draw questions and store them to questions database management system or update the questions database.

3.2 Students Answering Module

This module gives an examination web logon interface with user ID (student), user name, login IP and so on. After user ID certificate, the system server creates a log dairy for recording students answering process. Questions are drawn out for the self-adapted examination based on self- adapted algorithm. When students submit their answering records, no update is allowed anymore.

3.3 Examination Information Management Module

The aim of this module is to record the student information. If the student re-logon or continue to take the exam after a break, the system will recover to the break point and keep the exam going on. After the exam is finished, the module will submit all the final exam information to the system. When the students enter in the system, each user is provided with a temporary record on his/her examination information. When a submission is committed, temporary record stores all these student examination information back to the automatic grading sub system (in case of a customer interrupts, the system will take record each time when he gives the answers).

3.4 Result Evaluation Module

This module will perform many kinds of evaluation, and then feed back or amend the property of the question. It can be accomplished here redefining the level of difficulty of a question by evaluating the grading, calculating the average record, getting the statistics of the difficult questions based on the times of presenting, requesting statistic the average score for every difficult level. To accomplish it, the data mining theory and arithmetic concerned would be used.

3.5 Question Generating Module

This session will show the two ways to generate questions, one is artificial generation, the other is self-adapted generation, and both of them are based on the question database and get questions from it.

3.6 Automatic Grading Module

This module is to accept the final answers that come from the examination management module, in which, the system will compare with the student's answer to that of the standard.

3.7 Teacher Grading Module

This session will accept the score automatically and allow teacher to adjust the final result for students. The result will be recorded in a certain table (database), when the final score is applied, the system will calculate it automatically and put the result to student management system. The main feature of the examination system includes:

- Security certification; which can prevent from the illegal login such as illegal IP range, illegal user, etc.
- Support the whole process of examination question management. Such as setting up exam library of different types, setting up knowledge point structure, setting theme, checking examination result and so on.
- Support the individualized editor's examination question, support preliminary multimedia edit function like uploading and viewing multimedia stream, static picture, support uploading and downloading files.
- Maintaining knowledge point structure within the exam library.
- Support many kinds of tactics generating papers including random choice, self-adaptation generating.
- After the teacher confirms the paper achievement, student's achievement and relevant statistics will be issued through the data interchange module.
- Receive the arrangement of the testing that the course door module issues, providing the teacher with facilitated interface of arranging paper.
- Check results automatically, keep detailed exam paper message for teacher's inspecting later.
- Can be used in various types of examination and various disciplines.

The designing requirement of Web-based Examination System is to strive to reach: having dynamics in management, easy to use and occupy in using, have continuity and advance in developing, have safety reliability on security system.

4. System Design in detail

4.1 Web-based Learning Standard

In recent years, the Web-based Learning technical standard has been paid attention to more and more by various countries; our country has begun the formulation work of serial standards too. The value that a standard system exist lies in the instance, standardization will become important guarantee that the tutoring system operates each other, it is the sharing of resources of the courseware, study improvement of quality and realization studying the system all the life and offer the basis.

In numerous norms of CELTS [1] standard system, having most directive significance to the designing and implementing of Examination System are the following two norms:

(a) Specification for Learning Object Metadata [2]: Require testing and practicing resource accord with LOM norm. It has become increasingly evident that the educational community will not be accepting Metadata technology for very quickly, although the potential benefits are many. [3] LOM norm provides support for the

learner or the educator to finding out, assessment, obtaining and using by defining a unified Metadata model. User can confirm the key collection according to Metadata model further that is to say that the essential data element in this system is confirmed. Resource in examination system that expresses with these essential data elements can be managed as metadata accord with LOM norm management in unison.

(b) Question/Test Interoperability (QTI) [4]: Require the question using for testing and examination accord with QTI norm. QTI norm consults relevant standards including IMS [5], IEEE [6], form three parts of files draft, ASI information model, result and report information model and XML binding specimen. ASI information model has offered expression form and organizing method to the content of the examination question library, answered question on 'how to describe the structure of existing content'. Assessment, Section, Question Item (Item), these three targets constitute ASI model together. 'Question Item' is similar to 'examination question' which can be constructed by a series of present forms and responding structures. 'Section' is an aggregation concept, which is made up of question items or a lot of 'Section's; Concept of 'Section' is just correspondent to 'examination question library' and 'knowledge point' in our design. And 'Assessment' is correspondent to the 'paper' concept in our design, is the set of 'Section'.

4.2 System compatibility and portability

Strengthening the support to CELTS standard system, make the whole data structure of Web-based Examination System greatly standardize. Exchanging data with a system which also follows CELTS standard system will be very easy. The author has developed a series of API, can be used for importing the questions and question library following CELTS standard system in batches. They will be consummated in order to study the compatibility between this examination system and other systems.

Web-based Examination System has a natural advantage in the using in cross-platform, after adopted a large number of J2EE components in the design and implement, especially made every effort to adopt EJB frame to develop with the interface with mutual outside system; When choosing develop environment , adopt Weblogic 7.0 with excellent performance and middleware technology as application server, have laid the foundation for distributed deployment in the future; Dividing the implement levels and modules clearly in the system, has guaranteed to software reusing furthest, have given full play to the utility of module technology; All above ensure the portability of this system.

4.3 Supporting for Question Type

The Web-based examination need to rely on the computer and network, which makes choice of the question type limited. It is mostly all standardization tests, only the multiple-choice question and filling in the blanks. Web-based Examination System that we expect not only can set theme based on examination question library instead of traditional way totally by hand, but also can realize diversification of question type , finish automatically judging the result, realize intelligent Web-based examination. Question type realized by Web-based Examination System finally should include standardization question, still there should be question of filling a vacancy, asking and answer question, and operate the question (such as the test for operation of the Office series software), programming question, can realize a certain degree fuzzy in judging examination result.

In the page of the attribute editor of examination question, the author has offered a multimedia editor toolkit. This toolkit supports carrying on common text edit functions on the text inputted, such as edit on script, color, size, etc. Question management module has offered uploading files, recording, uploaded videos and audios in the editor of the examination which completed the multimedia support of the examination question preliminary.

4.4 Knowledge Point Management

The ‘knowledge point’ concept stems from Course structures originally similar to the chapter in the course structure having its own characteristics. Knowledge point structure has obeyed ASI information structure in QTI norm, which has been set up in order to classify and manage the examination questions. Each examination question belong to a unique knowledge point, all questions from each knowledge point make up of one extensive set of examination question – Examination Question Library. Knowledge points inside an examination question library are organized according to tree-like structure instead of only one single layer structure as we usually see. It will do great help to users setting up flexible and complicated question library organization.

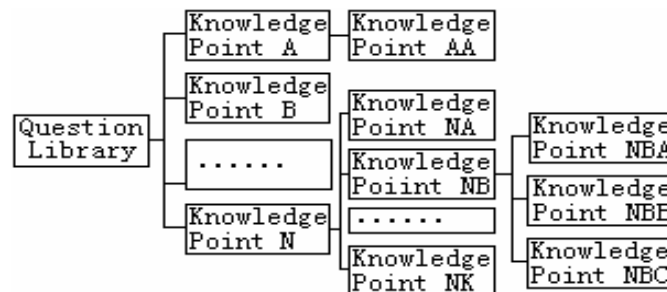


Fig.3 Tree Model of Knowledge Points within Question Library

4.5 Intelligent Technology in Setting Theme and Checking Paper

By dint of support from intelligent template technology, teacher may generate papers from the question library conveniently as long as setting up paper parameters. It offers many kinds of tactics of setting the theme: selecting by hands, random choice, self- adaptation generating; as well as different examination types according to the examination environment: For instance the text type and multimedia type, etc.. After the automatic generating paper has finished, teachers can also adjust the content of the paper manually, such design synthesizes advantage of both automatic generating and manual selection, receive better result in practical application. After examination finish, system can make unified correcting to the paper that students refer to automatically, analyses every characteristic and result parameter of examination. For the subjective question type, it would be necessary that the teacher reexamine and confirm the auto checking result. By dint of related analysis of data mining technology, it may find various kinds of potential factors and related effectively, explore examination result fully, receive content detailed and high level analysis conclusion, thus help the teacher to improve the teaching method, receive better teaching result.

4.6 Security Control

Because the protocols used in WebPages transmitting in the network is open TCP/IP protocol, its opening will cause serious underlying danger to systematic security control and system management. In order to solve this problem, the system has record cryptographic keys including user's personal information and logging IP information for each user at the same time while carrying on the normal hookup among WebPages. When accessing WebPages directly without logging in with personal password or browsing time out, there will be no correct cryptographic keys to be checked, causing system warning automatically and no proper WebPages content. The system still supports to expansion interface of encrypting information transmission with the more reliable encrypting algorithm.

5. Conclusion

This system has been used at Tsinghua University for about Four years. And the evaluation result would have great help to education reform and quantity education.

This system is also in upgrading. On the implementation technique of Web-based Examination System, adopt JSP (Java Server Pages) / Java Servlets combines with Java Beans technology, have realized separating view layer from logic layer. At the same time, a lot of complicated services required in the client are divided into several actions, corresponding different services on the server, more complicated movements can be divided into several stature actions, fix some specific Java Bean to realize the action finally. Such a implementation method with abundant and clearly knowing to the requirement, have fully utilize the advantage of module technology, has improved the software module reusing and reliability of the system.

At present, all code work of Web-based Examination System has already been accomplished. This system had been used in the teaching practice of more subjects, and run well till now.

Reference

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