

A Web-Based Course Management System

Lingxi ZHOU, Zhiyi FANG, Bo SUN, Binbin HE and Xinyu ZHANG
School of Computer Science and Technology, Jilin University
Changchun, 130012, P.R.China

an.James.naqi904@gmail.com, zyfang@public.cc.jl.cn

ABSTRACT

Based on the analysis to the development of the CMS (Course Management System), this paper proposes a novel Web-based CMS system (WCMS) by using the MVC and some programming tools along with the developed educational requirement. The whole system is divided into four components: course management, teaching management, personal information management and system management. Each component is further classified into several modules. The course design is presented as an illustration. The overall system evaluation is according to the standards listed in Edutools. The difference between the WCMS is listed in this paper and the Edutools are summarized.

Keywords: CMS (Course Management System), WCMS (Web-based CMS), E-learning.

1. INTRODUCTION

From a global point of view, the development progress of every walk of life has been accelerated by Internet and its great power [1]. Being the headstream of new ideas and technologies, education industry pays more and more attention to the tremendous potential benefit of Internet. Many top-ranking colleges and universities have applied Internet to eliminate the obstacles during teaching activities and to enrich the teaching experience of both teachers and students.

E-learning was born under such a background. It firstly came up in 1990 in North America with the definition of learning and interacting based on Internet and other information technologies. It takes full advantages of the learning environment that has a whole new communication mechanism and abundant materials supplied by modern information technologies, which result in a completely new learning method. This method would change not only the role which teachers used to play in traditional education but also the relationship between teachers and students, which would eventually influence the architecture and essential of education. So the need for developing an E-learning application system is becoming more and more urgent.

Web-based Course Management System is such a system which meets the demands of E-learning. A typical Course Management System (CMS) is a network system which is able to organize, present, manage, evaluate the contents of the courses and the teaching activities, and to promote the interaction between students and teachers [2]. It focuses on helping the colleges and universities build a truly interactive web-based learning environment where everyone is able to browse the contents, obtain resources, evaluate education effect and cooperate with each other at any time.

The teaching method of Moodle system is based on the concept of social constructivism. It attracted many users by its powerful functions and free of charge. Blackboard provides a powerful

virtual learning space with high price. Dokeos has a unique management for learning path. Claroline provides an easy way for teachers to build a course. Besides these, there are many other similar systems and each of them has its own features and specific users.

Although CMS seems to have gained vigorous development, there are still many problems. First of all, no available CMS can lighten the burden of teachers in their work. Teachers are responsible for building, maintaining and updating the courses, at the same time they have to rely on traditional teaching method for certain work. Secondly, different courses are not treated differently. The courses highlighted by its presentation of vivid images and materials are much more suitable for CMS systems than ones that are mainly composed by logical reasoning subjects. The current CMS systems pay no attention to this obvious difference. Finally, a unified standard for evaluation of CMS does not exist. Of course we can use Edutools standards to evaluate the function of each system, however, besides the learning effects, the evaluation of web-based education should depend on the effects and positive response of students who take part in it. By taken above problems into consideration, this paper presents the design and implementation of a new Web-based CMS.

2. COURSE MANAGEMET SYSTEM

Web-based course management system makes E-Learning possible. Ease-of-use and enterprise architecture are its main characteristic. What makes the system unique is a set of integrated solutions provided. It optimizes and strengthens the application of every module to the max, such as teaching management platform and resource management platform. The open environment for developing web-based education system as well as its adaptability and collaboration with the industry standard make various organizations capable to extend or customize their functional modules according to requirements, which brings an interconnected and interactive web-based learning environment to reality.

Focusing on courses, web-based course management system integrates teaching and learning environment. Teachers can set up online courses on the platform and students can choose courses and study by themselves. Discussion and Communication can take place between students or students and teachers. This provides a powerful online virtual environment for teachers and students, and makes it the most important application system for remote education. The web-based course management system has following advantages:

1) Student-centric.

It changes the traditional educator-centric education mode, which pays little attention to the activities of students [3]. In WCMS, one of the things an educator needs to do is to gather statistic information of student behavioural trait, such as: how much do they like the course? Do they work hard on it? Whether they have any difficulty in learning the

course? In this way, students can gradually develop an effective learning method of their own.

2) Improved working efficiency for teachers.

With the help of teaching management tools provided by WCMS, teachers may find it much more convenient to build up online courses and interact with their students.

3) Flexibility.

Students are free to choose what to learn, according to their own conditions, studying purpose and learning methods, which supplies them with more control over the time and location for studying and makes it very convenient for them to have a test of what they have learnt and get feedback promptly.

4) Interaction.

Interaction is regarded as a major vantage of traditional face-to-face education, but in a remote web-based education environment, "Interaction", on a larger scale, provides a new method to help stimulate students to study. In a network environment, people can communicate with each other by email, voice mail, mail list, RSS, chat room, BBS, web conference or other two-direction medium. Sometimes other methods like the immediate feedback, inquiry and answer, control of pace, control of frequency are also used. These procedures make collaborative learning between students or interactive communication between students and teachers come true.

3. REQUIREMENT ANALYSIS AND DESIGN OF WCMS

3.1 System architecture design of WCMS

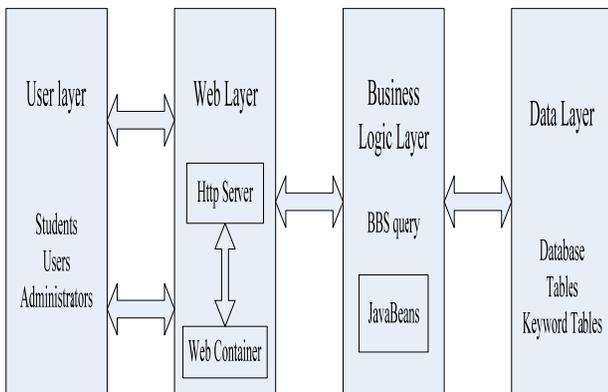


Figure 1: System architecture of WCMS

WCMS creates an integral teaching environment. Students can browse the courses on the Internet web sites, register courses, choose textbooks, select studying schedule and so on, which represents a complete teaching process. Teachers are able to manage their teaching work, prepare courseware, arrange online test, examine students' homework, answer students' questions online and gather statistics on students' learning. The platform is a powerful learning tool which supports customization by students' need. And students can choose the courses they want to take, arrange their learning plans, submit their homework, cooperate with others, check out the scores and take part in the community discussion. The platform is also a bridge of communication between students and teachers. WCMS should be a system that can help teachers issue information, accomplish routine management, and make some modification to the database according to their needs. Considering these system requirements, as shown in figure 1, MVC model is adopted to design the architecture of WCMS.

1) User interface implementation in user layer.

It provides a visual interface for information gathering and data presentation.

2) Web layer.

Web layer delivers user's request to business logic layer for analysis and process and then transmits the results back to the user.

3) Business Logic layer.

This layer responds to the request delivered by Web layer, queries the database about the information on user's demand and returns it back to Web layer.

4) Data layer.

This layer is mainly responsible for data definition, maintenance, access, updating and management. It also responds to the request from business logic layer.

3.2 Function design of WCMS

According to the requirements of WCMS, the functional architecture of the WCMS system is as shown in figure 2.

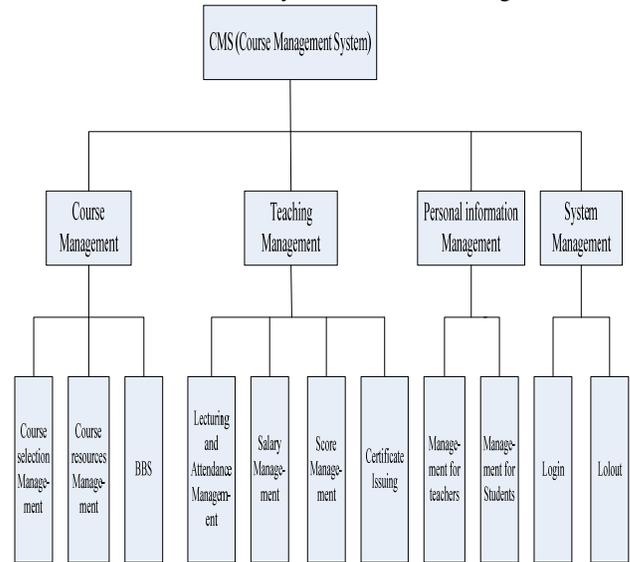


Figure 2: Functional architecture of WCMS

1) Course management

Course selection management. Students choose courses according to their interests and they are free to make any changes before they pay relevant fees. Administrators can maintain and manage these choices students make. Teachers can see the students who have selected their courses.

Course resources management. Course resource information includes course title, classification, total class hours, chapters and sections, etc. All registered users can browse and query information. Administrators and teachers are responsible for the maintenance of information.

Teaching bulletin board system. Administrators can issue announcement and discussion on the homepage. The items of the announcement should include the course title, delivery time, the name of the teacher, etc. A more detailed introduction of the course can be accessed through the link on the homepage. Apart from the functions an ordinary BBS has, the discussion here can be customized, that is to say teachers are allowed to initiate, open or shut down a discussion.

2) Teaching management

Lecturing and attendance management. The statistics record of lecturing (for teachers) and attendance (for students) are gathered by relevant administrators.

Salary management for teachers. The salary a teacher should get for each course he or she gives is calculated by the administrators.

Score management for students. This includes adding, modifying, querying and gathering statistics of students' scores. Students are only allowed to launch queries.

Certificate issuing. After a student has finished a course and passed the exam, he can see the certificate issued online. The administrator announces the names of students who have gained the certificate online.

3) Personal information management

Management for teachers. This may contain the adding, updating, query and deletion of a teacher's information which includes his or her education background, research direction, research achievements, published papers and obtained awards [4]. Only the teacher has the permission to modify the above information while only the administrator can delete a teacher's information.

Management for students. Teachers can add, modify or delete a student's information here.

4) System management

This part is for users to login and log out.

3.3 Database design

WCMS deals with large amount of data, so a good scheme for the database becomes quite important [5]. Since the users of this system could be located anywhere, the real-time property and running speed are taken into consideration when the database designed. The SQL Server 2000 has the following advantages: high efficiency both in running and data storage, highly distributed, multiple threads concurrency, combined with reasonable data storage allocation and classification. All those advantages make it running stable.

As a tool for communication and collaboration in WCMS, the design process of BBS is quite representative. Apart from the fundamental functions an ordinary BBS has (such as starting a topic, editing or deleting an existing topic, responding to a topic, etc) the BBS in WCMS can be customized, which is a specific character of WCMS. A particular BBS is subordinated to a course and it allows the teacher to create, open and shut down a discussion in BBS. Based on this requirement analysis, figure 3 presents the E-R (Entity-Relationship) diagram of the database of a customizable BBS. The database contains four entities: Course, BBS discussion place, Discussion topic and Response to topic, three relationships: Setting, Issuing and Responding.

3.4 Course selecting

Course selecting is the most valuable module. Figure 4 below is the use case diagram. This module allows students to select the courses they want to take at the beginning of a semester. Course catalogue presents all the courses offered in a certain semester. Students can modify or delete a certain course they have selected. The objects communicate with each other. The behaviour model depicts the dynamic behaviour of the system by connecting the objects who communicate with other objects. Figure 5 shows the state diagram for course selecting module.

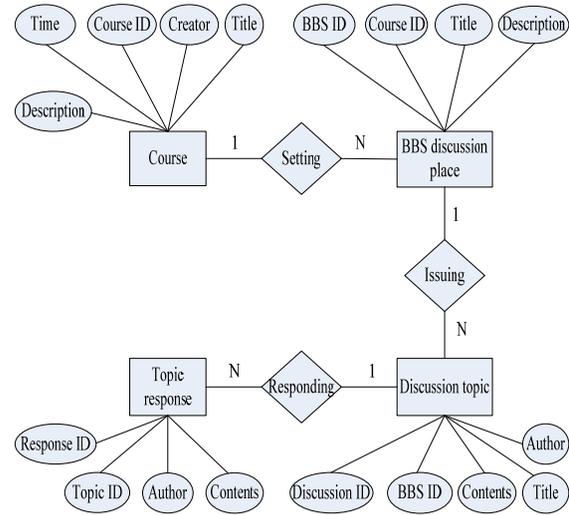


Figure 3: E-R diagram of BBS

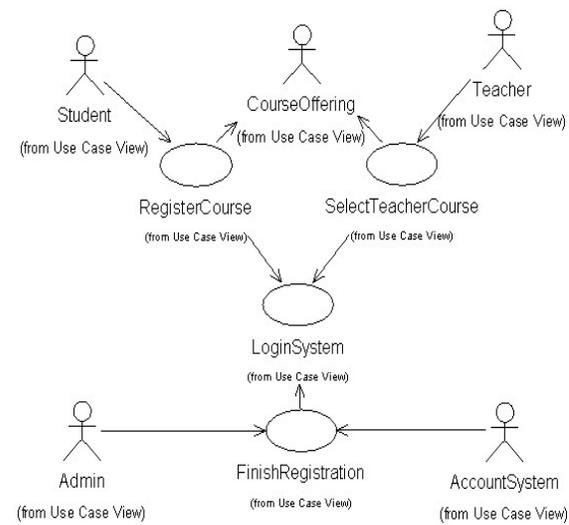


Figure 4: Use case diagram

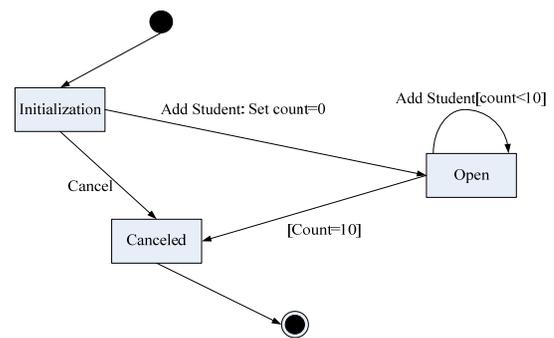


Figure 5: State diagram

4. IMPLEMENTATION AND EVALUATION OF WCMS

By applying MVC architecture, a system is designed and implemented in this paper, WCMS, which partially satisfies the demands of E-learning platform using developing tools such as Rational Rose, Rational Application, etc.

The goal of testing WCMS is to make sure that the system can run smoothly. The test is aimed at each function of WCMS. It builds up an online education platform which simulates the

whole process of online learning and online management in an objective and real way so that each function is tested and also some experience can be gathered before the system is deployed.

WCMS is a comprehensive web-based education platform which provides various functions. There have been a lot of people working on the evaluation model for the systems like WEAS [6] and LMS [7]. And this paper here compares and analyzes the functions of the system according to the standards given by Edutools. Edutools pays a lot of attention to education-supported tools and it compares the function and performance of around 35 course management systems.

Table 1: Evaluation result according to Edutools

Functions evaluated	Functions implemented in WCMS
Communication Tools	Discussion Forums File Exchange Internal Email Real-time Chat Video Services Whiteboard
Productivity Tools	Bookmarks Orientation/Help Calendar/Event notification Searching Within Course Work Offline/Synchronize
Student Involvement Tools	Group work Student Community Building Student Portfolios
Administration Tools	Authentication Course Authentication Hosted Services Registration Integration
Course Delivery Tools	Automated Testing and Scoring Course Management Online Grading Tools
Curriculum Design Accessibility Compliance	Course Templates Curriculum Management Customized Look and Feel Instructional Design Tools Software/hardware

The table 1 contains the detailed implementation of the CMS system presented in this paper. The evaluation is mainly classified into six categories: communication tools, productivity tools, student involvement tools, administration tools, course delivery tools and curriculum Design Accessibility Compliance. The CMS system designed and implemented in this paper generally meet the evaluation standard except the following points: online journal/notes are not considered when it comes to the communication tools; when it comes to productivity tools, calendar and event notification are implemented, which receives a positive feedback; the self-evaluation component is deleted from the student involvement tools part for simplicity compared with the Edutools; the instructor helpdesk is replaced with other functions in course delivery tools; and finally, the curriculum design accessibility compliance part took the hardware and software environment into consideration. All above modification makes the system running efficiently and smoothly. The detailed evaluation should be based on a longer period of observation, especially the feedback of students and teachers, this may take some time.

5. CONCLUSIONS

This paper analyzes the requirements and functions of web-based course management system, introduces the system design and implementation. According to the result of the test, compared with the existing E-learning platforms, the one used in WCMS has many advantages, such as platform-independent, multiple databases, etc. As it concerns about lots of practical problems and technical details, E-learning platform requires a great deal of complex and heavy work. Like many other course management systems, there is still room for WCMS to be improved and perfected.

6. REFERENCES

- [1] Z. Zhang, "Design and Implement of Web-Based Intelligence Network Tutoring Framework Model", **Distance Educational Journal**, 2004, vol. 4, pp. 35-37.
- [2] J.H. Li, and Y. Zhao, "On the Course Management System (CMS)", **Modern Educational Technology**, Beijing, 2008,9(18), pp. 64-71.
- [3] Y. Yang and G.Y. Wang, "An Evaluation Model for Web-Based Learning Support Systems", **Proceedings of the 2005 IEEE/WIC/ACM International Conference on Web Intelligence (WI'05)**, 2005, pp. 680-683.
- [4] J. Chen, and X.J Yang, "Research and Development of Web-Based MIS Using Struts Framework", **Microcomputer Applications**, 2005, vol. 21(4), pp. 34-35.
- [5] S.X. Sa, and S. Wang, **Introduction to Database System**. Higher Education Press, Beijing, 2002.
- [6] L. He and P. Brandt, "WEAS: A Web-based Educational Assessment System", **Proceedings of the 45th ACM Southeast Conference, ACMSE 2007**, 2007, pp. 126-131.
- [7] C. Snae, and M. Bruckner, "Web-based evaluation system for online courses and Learning Management Systems", **2008 2nd IEEE International Conference on Digital Ecosystems and Technologies, IEEE-DEST 2008**, 2008, pp. 332-339.