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Research Article

The Design and Application of Multimedia Teaching System Based on Web Technology

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Abstract: In this study, we presents a design and application of multimedia teaching system based on web technology, in which the mainframe of multimedia teaching system and some related technologies have been proposed. Some key technical issues such as software frame, MVC design pattern and Oracle database are shown in the paper. We also analyze the advantages of this system, which inspired us to use it in modern teaching process.

Keywords: Multimedia, teaching system, web

INTRODUCTION

The traditional mode of teaching is teacher-centric, this mode completely dominate the classroom by teachers, neglect of students' cognitive main role, cannot get the support of more teaching resources. Student-centered teaching mode, into the next decade with the growing popularity of multimedia and network technology, especially based on the wide application of Internet education network gradually developed together. Multimedia and network technology to provide user-friendly, interactive learning environment, the image of the self-concept can provide a variety of integrated sensory stimulation. Organization on the Internet this way to construct the knowledge base, the vast information base and has become the world's largest information resources that promote students' construction of meaning on current knowledge and thus on the formation and development of students' cognitive structure, is very beneficial, but also other instructional media or other learning environments cannot match (Guli and Ling, 2007; Hall, 1994).

Multimedia is a hypertext, graphics, image, animation, sound and other media carrying information together and integrated processing by computer technology. Multimedia computer as a kind of instructional media, it is to store information transfer education and teaching. Media original two meanings, one refers to the entity to store information, such as disk, CD-ROM, magnetic tape, semiconductor memory; refers to the transmission of information carrier, such as numeric, text, sound, graphics and so on. Literally, multimedia is composite made from a single media (Shen and Lin, 2010; He and Tian, 1999).

Multimedia is a set of hardware and software equipment, combined with a variety of visual and auditory media, can produce impressive visual and audio effects. Visual media include graphics, animation, images and text media and auditory media. From multimedia computer user can get a variety of media sources at the same time.

The multimedia system is mainly composed of the following four parts: multimedia hardware systems, multimedia operating system, media processing system tools and user application software. Multimedia operating system, also known as the multimedia core system with real-time task scheduling, multimedia data conversion and synchronization control of the drive and control multimedia devices and graphical user interface management. Multimedia hardware systems, including computer hardware, audio/video processor and a variety of media input/output device and the signal conversion apparatus, the communications transmission device and the interface means. Media processing system tools, or software development tools, called multimedia systems is an important part of the multimedia system. Demand and customized application software or user application software system for a particular area, it is the product of the system for large-scale users (He and Tian, 1999; Nunan, 1987).

The application of multimedia in teaching, due to its inherent advantages and features, making it in the teaching of strong vitality, played an indispensable and irreplaceable role:

- Accept differences in ability exist, speed learning different students study the same materials and the degree of acceptance is different. Conventional teaching, teachers face many students in the class, often only to take a compromise approach to teaching object is set to "medium" level of students, the result is caused by "poor students could eat, eugenics enough to eat." . Both affect the progress of the under achiever, but also limited the development of the honors. Although the teachers in the classroom always strive to reduce this difference the result of the limitations of classroom teaching with little success. And computer

multimedia technology into the teaching, but it can "student-centered" through man-machine dialogue, really varies from person to person, individualized to stimulate students' enthusiasm and initiative, so that all students have received development.

- Various functions the multimedia using sound, light, electricity, shape, color, multi-channel delivery of teaching information, more realistic and expressive, can lead to a great deal of interest and attention of the students, induce students on the emotional and behavioral actively involved in the mobilization of the eyes, ears, mouth, hands, brain and other senses into the learning activities, the students' cognitive activities along with rich emotional and unpleasant emotions. The rich imagination of students, active thinking will form a good atmosphere for learning, to improve learning efficiency and enhance the learning effect. Computer multimedia technology into the teaching of the language of abstraction vivid image of contagious through some of cartoon characters, such as the interesting figures doll, smart and lively small animals such as storytelling game, the wisdom of the elderly form of amusement evening, among the abstract teaching resides amusement scene, so that science and fun as a high degree of unity, learning content has become a lively and interesting. In this case, a high concentration of the energy of the students, thinking highly active, teaching can have a multiplier effect.
- Multimedia courseware can demo graphic changes, the simulation process and the process of thinking, abstract knowledge specific boring knowledge interesting, dynamic and static knowledge, intangible knowledge into tangible intuitive knowledge to show the student front. Computer multimedia technology in teaching, lively and fun image change, so that the student has experience with the concept of associative combination, to establish the concept of abstract thinking and methods to further deepen the understanding of the knowledge to the students to stay under a clear and profound impression.
- Traditional teaching is often due to the writing on the blackboard, drawing and repeated explain a waste of time, so that the student class exercises, homework heavy burden. Computer multimedia applications, saving teaching time, increase practice capacity and strengthen the practice for and scientific characteristics of strong due to its rapid response and help students achieve knowledge intensive. Multimedia teaching not only provides a new idea of teaching, but also on behalf of the media used in teaching, even if the knowledge and information transfer faster and effective regulation of the teaching (Shen and Lin, 2010; Huang and Fan, 2010; Schank, 1994).

Multimedia teaching technology has been widely used in the industry and some literatures give its application status. The object of the study is to design a multimedia teaching system based on web technology and discusses the key technical issues such as software frame, MVC design pattern and Oracle database in the system.

MATERIALS AND MAINFRAME

The mainframe work of the multimedia teaching system showed as in Fig. 1.

Sub-system of teaching in web:

- **Study guideline:** Enable students to understand the course, such as course description syllabus, learning methods and engineering applications. Learning coaching skills in the teaching and learning environment, teachers, students to learn the mental process, the creation of a favorable environment for the student's own learning, student motivation, processes, methods, guidance and direction, so as to promote the development of students, teaching behavior.
- **Explain context:** Made to the knowledge of the curriculum content by pages and chapters based on the hierarchical relationship between knowledge points to establish a hierarchical tree directory navigation links, indexes and other functions, so that between the knowledge to facilitate students in leaps and bounds learning.
- **Example figures:** All examples with explanation and problem-solving process and all the exercises with the knowledge points, some exercises with reference to the answer. In addition, it also contains some outstanding foreign textbook on the original examples and exercises, to broaden the thinking and increase their knowledge.
- **Communication in internet:** Students can communicate with each other with Email or other tools.
- **Engineering practice:** Including engineering background of this course, engineering applications, disciplinary review, professional experiments, professional skills and subject-related policies and regulations, new academic point of view and scientific research.

Questions management subsystem: Test management support teachers through the network upload questions able to complete the conventional test management features, such as questions to add, delete, edit, query. Figure 2 shows an example of question management subsystem.

Management subsystem of the senate: The subsystem completes user management and teaching resources management two functions. User management, including certification of student registration, student

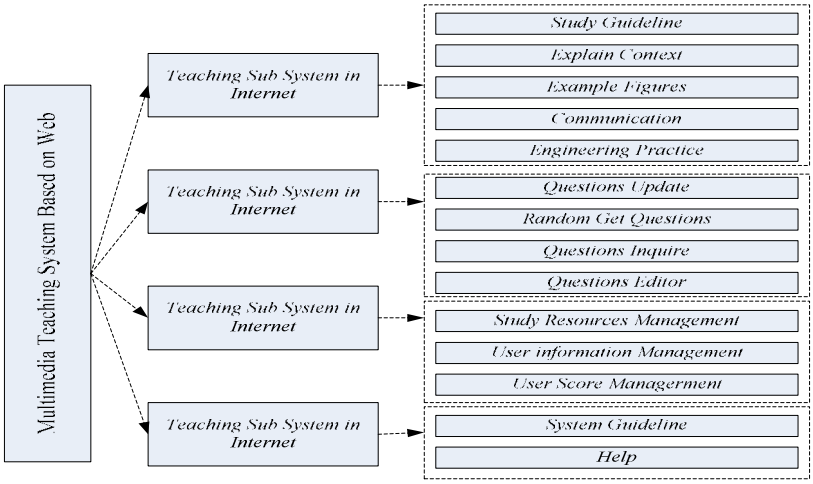

Fig. 1: Encoder and decoder diagram of H.264

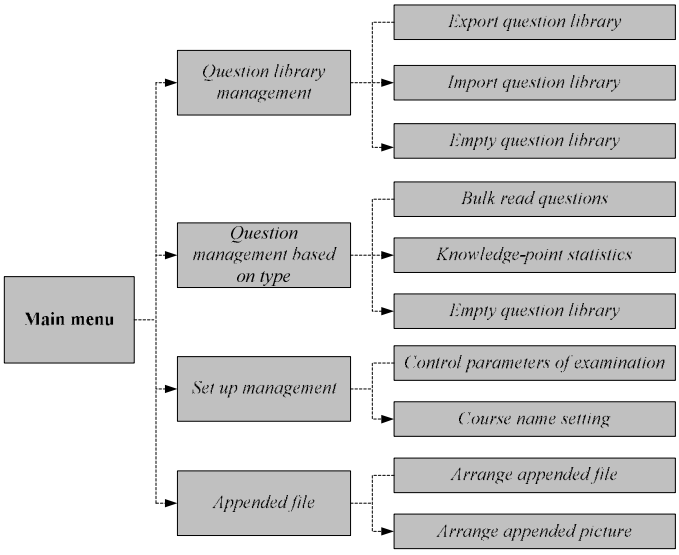

Fig. 2: Example of question management subsystem

records management, teacher management, student management; provide a wide range of user security mechanism, the user permissions descending into academic administrators, teachers, students and different user for permission provide different system resources. Permissions highest academic administrators can manage the entire system of other non-administrator user passwords and permissions, enjoy the right to test management, such as entry, delete, modify and query. Teachers to enter the teaching subsystem, enter the item management system queries questions, automatic test paper query sets of volumes upload questions; students to enter the teaching subsystem, query browsing this course sets volume into the auxiliary subsystem. Teaching resources management, including teachers' lesson plans upload, storage, classification and management of multimedia teaching resources.

Auxiliary subsystem: The auxiliary subsystem includes system navigation, system help file and others. System navigation is used to guide the students' learning, make learning not lost. The system help information used to guide students to make the better use of it. Other sites related connection established in order to facilitate students' access to information related to the discipline connected.

METHODOLOGY

In the realization of the software system the latest J2EE technology used to build a entire multimedia network teaching system software platform. J2EE technology system software system used to achieve fully adopted a three-tier structure for software design. The adoption of MVC design pattern as the blueprint for the design of the entire software system. Use JAVA

language for software system development. The system uses B/S structure and opened design architecture based on internet (Pea and Gomez, 1992).

Architecture of software: The architecture of J2EE technology is the SUN for the development of enterprise applications based on the JAVA platform proposed a specification. It is a proven security model. J2EE is a full-featured, reliable, secure and fast enterprise-class computing platforms by a variety of JAVA-based technology, including Enterprise Java Beans (EJB), Java Server Pages (JSP), Java Naming and Directory Interface (JNDI), Java Transaction API (JTA), CORBA, JDBC data access API. Using J2EE as the application development platform has the following advantages:

- **The platform independence:** Users do not have to own bundled on a particular hardware or operating system, you can choose according to your own circumstances appropriate hardware, operating system and database to ensure the system's openness.
  J2EE is a component technology and the completed components can be easily ported to any other place. J2EE as middleware, providing a powerful feature, developers only need to focus on the business logic, which can speed development, improve operating efficiency and stability of the system.
- **Protect user investment:** When the user want to replace the platform J2EE-based system which can be easily ported to other platforms, without the need to re-development, can effectively protect the user's investment.
- **Broad support:** J2EE technical specifications, SUN, IBM, ORACLE, NETSCAPE, BEA and other J2EE-based software products have been offering broad support from international companies to free software developers. According to the definition of SUN J2EE system has a structure as shown in the Fig. 3.

MVC design pattern: As we all know, when an application system that contains the data access code, business logic code, the foreground performance statement code, if not a better design model and design approach, the application is very easy to become a simple mixture of these codes in this case, the application system will often occur various abnormal conditions (Ragozzine, 2002).

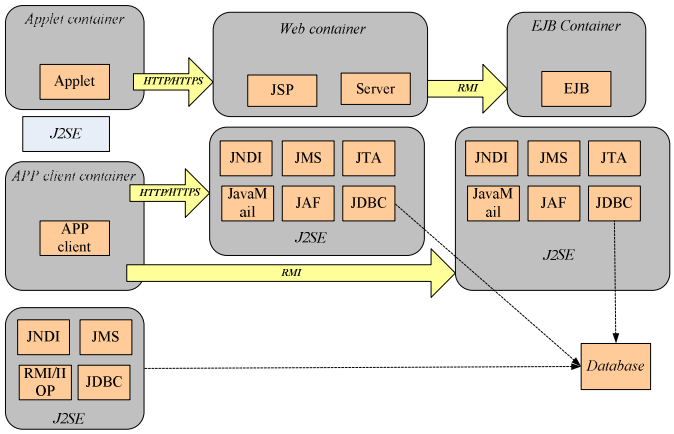

Fig. 3: System main frame of J2EE

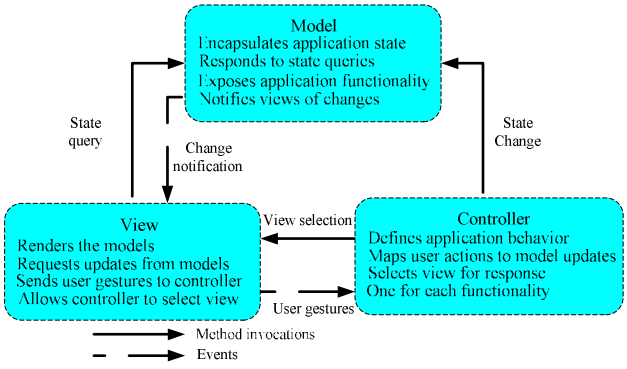

Fig. 4: Mode definition diagram

Therefore, in the design process of the software system, a good design pattern to the target system benefits will be endless. That given the conditions of the technical system, to find a good design pattern is undoubtedly an important part of the systems development, MVC design pattern is the great way to solve these problems. MVC design pattern realize M (Model), V (View), C (Controller) three separate goals. Its schema definition is shown in Fig. 4.

THE RESULT AND APPLICATION

In the network environment, through the effective organization and management of teaching information at different levels to achieve different forms, the different requirements of the teaching activities, which mainly consists of the following ways: classroom teaching, experimental teaching, remote learning, ability testing (Guli and Ling, 2007; Hall, 1994; Liu and Zhao, 2010).

Classroom teaching: Teachers display the pre-class preparation of courseware, software and graphics with multimedia system. Either now or in the future, classroom teaching has always been the main form of schooling, the operation of the old ways of teaching: teachers-teaching materials-lesson plans-blackboard-students law; teachers throughout the teaching activities dominate, to his knowledge, teaching methods, personal qualities, physical condition and even the emotional impact on the success or failure of the entire teaching; teaching materials brought to the important position of teachers around textbooks taught students around the textbook learning; less information, monotonous teaching environment, resulting in students receiving knowledge of low capacity (Tang *et al*., 2005).

Multimedia teaching will greatly improve classroom teaching and learning environment, such as text, graphics, images, sound, animation to a vivid reflection of people want to express, enhance sensory stimulation, so that students in a more close to reality, learning, thinking characteristic of this dynamic picture and suitable for young students to attract their attention, increase interest in learning.

Experiment teaching: The experiment is an important part of the teaching and learning activities, generally with the completion of the related conditions of the laboratory, but due to the limitations of the equipment and premises, the experimental creation rate is relatively low, the experiment is limited; Not only that, like mathematics, philosophy, economics such courses, the experiment is relatively difficult, is difficult to establish a corresponding experimental models; multimedia teaching system, the use of text, images, sounds and other comprehensive information technology and simulation technology, can be the perfect imitation of real experimental environment, it broadens experimental areas, abundant experimental content.

In the experimental part, the students are the main implementers and feelings, they already have under the premise of the theory of knowledge, of their choice and to determine the object of his experiment and the need to achieve the purpose of experiments, the complete validation of knowledge and deepen before the experiment, corresponding courseware or software, must be prepared to provide the necessary material, this experiment achieved critical and requires a lot of input and is generally divided into two categories: First, the general standard experiment, organizations related to technology developers to create or purchased; students under the guidance of a teacher-made, to enable students to participate in courseware planning, design, production and the whole process of the demo.

Remote teaching: Local teaching network is connected with the outside world through the internet and without any geographical constraints and no time limit.

Remote learning is a new open teaching methods developed in recent years, it is built on the basis of relevant teaching network system, in principle, as long as there is a computer connected to the network, you can achieve online teaching, remote learning network should have the following functions: to provide a user-friendly, easy to operate window; possess perfect match data information systems and related courses or disciplines; rich content of the exam; teachers and students in an interactive dialogue mechanism, while the multimedia teaching system will be able to meet this demand.

Ability test: In a network environment to establish a large item bank, so that the objective of teaching evaluation, just tracking and monitoring of the quality of teaching and the establishment and application of multimedia teaching network system.

Bank system should be an open subsystem, its data is an ongoing accumulation and improvement process, enter the title should objectively reflect the basic requirements of the syllabus; can automatically generate a variety of problems and exercises, automatically generated questions and judge and has a certain capacity analysis and review; achieve the diverse forms: teacher questions, student-on self-test.

Placement of the system: LAN service teaching is divided into the teaching layer and front-end back-end control layer and through the campus network and Internet connection. Control system to achieve the overall network management, control and data storage

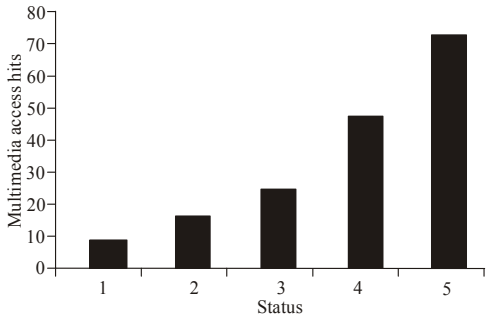

Fig. 5: The statistical data of the multimedia teaching system usage

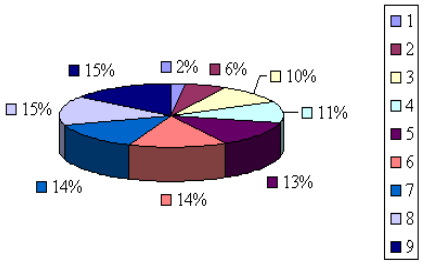

Fig. 6: What have done by students when they access the system

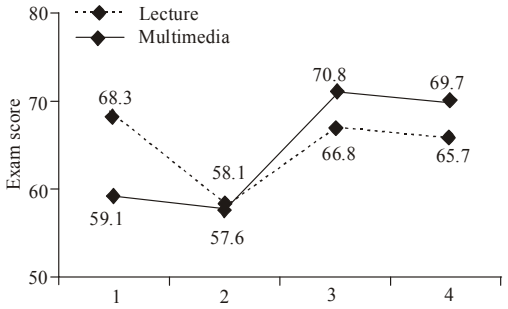

Fig. 7: Mean exam scores of students exposed to either lecture or multimedia teaching styles

and management of teaching the required data in the multimedia teaching object with a large amount of information, computer and related equipment requirements higher, therefore, control system. The configuration can be determined according to the specific requirements.

The main venue for multimedia teaching are classrooms, laboratories and conference rooms and can be extended to every computer connected to the network; geographic location of each multimedia classroom as much as possible to adjacent, in order to manage and wiring, if the distance, can be connected to the campus network; classroom should have air-conditioning equipment and shading measures, so that the normal operation of the equipment.

In Fig. 5, the statistical data of usage of multimedia teaching system during 1 month:

Table 1: Mean student ratings of multimedia class and lecture class

Item	Multimedia class	Lecture class
Was enthusiastic about the course	4.00	3.93
Used relevant technology effectively	3.73	3.96
Encouraged student discussion and questions	4.55	3.96
Clearly presented objectives of the course	3.81	3.81
Evaluated my work fairly	3.36	3.22
Introduced stimulating ideas about the subject	4.18	4.00
Was available and helpful outside of class	3.80	3.72
Clarified how each topic fit into the course	3.86	3.81
Explained subject matter clearly	3.45	3.74
Getting a good grade	4.59	4.27

1: Poor; 2: Below average; 3: Average; 4: Above average; 5: Excellent

Table 2: Mean exam scores and standard deviations either lecture or multimedia teaching styles

	Mean	S.D.	Student number
Exam 1: Lecture	68.3	13.8	29
Exam 1: Multimedia	59.1	17.3	29
Exam 2: Lecture	58.1	24.6	29
Exam 2: Multimedia	57.6	23.5	29
Exam 3: Lecture	66.8	19.9	30
Exam 3: Multimedia	70.8	20.3	30
Exam 4: Lecture	65.7	15.6	28
Exam 4: Multimedia	69.7	13.2	28

Status 1: Means the students who access the system times is less than 10

Status 2: Means the students who access the system times is less than 20 and more than 10

Status 3: Means the students who access the system times is more than 20 and less than 30

Status 4: Means the students who access the system times is more than 30

Status 5: Means the students who access the system time is more than 30+

In Fig. 6, we show what have done by students when they access into the system:

1. Means memorize notes, tables and definitions
2. Means reflecting upon new material
3. Means planning and goal setting
4. Means no comment or not strategy used
5. Means making connections to what one already knows
6. Means mapping
7. Means asking questions and testing oneself for understanding
8. Means taking and organizing notes
9. Means searching for main ideas

Analyses performed on students' ratings of the course indicated a single significant outcome. Specifically, students in the multimedia class gave higher ratings than did students in the lecture class on the item referring to the use of technology. The detailed information showed in Table 1 and 2.

Form the Fig. 7 *et al*., we can found that these results could also be taken to suggest that a combination of multimedia and traditional lecture approaches would be useful. However, the primary

purpose of this investigation was not to determine the optimal teaching approach but rather to demonstrate that individual differences moderate the impact of multimedia approaches on student learning.

CONCLUSION

Multimedia teaching network system can simulate the real environment, changing a single way of teaching; powerful data storage capabilities and teaching information for effective organization and management, to achieve different levels and in different forms, the different requirements of the teaching activities. The core of multimedia teaching management information system is a Web services based intranet browser/server architecture, it will see server as the important role of data storage and management, workstation as a teaching tour interface and the web page will integrate and control a variety of electronic media and finish the establishment of a logical connection between them.

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