Technical Research of Streaming Media Video Course Development Platform

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Abstract—To solve the problem of streaming video courseware high production cost and low efficiency, the video recording and broadcasting system "Estone" gathering multimedia data integration with streaming media video recording is designed and developed. With the video recording and screen data acquisition functions, it is an appropriate support tool for teachers to prepare lessons, teaching and classroom teaching information collection, providing high quality education and teaching resources for information platform such as multimedia network, mobile reading and 3G phones.

Keywords- multimedia data integration; streaming media; video courseware production; mobile education platform; online course

I. INTRODUCTION

With more sophisticated streaming media technologies on the internet, network video coursewares on all kinds of streaming media platform have come forward, which greatly improves the students' learning efficiency and expands the learning space. But network video courseware production technology and cost are still the bottlenecks of network multimedia education development. Through teaching practice, two main reasons of this issue are found. Firstly, production process of streaming video courseware is more complicated and difficulty, making it difficult to spread; Secondly, streaming video courseware production is a mixed-technology including video recording and audio recording; individual teacher is difficult to complete the series of work independently in class. Therefore, how to reduce complexity and technical difficulty of streaming video courseware production process, making each teacher independently produce streaming video courseware, is a fundamental problem of multimedia network education and distance education development.

After years of teaching practice and our in-depth study on teachers' teaching process, combining today's latest multimedia video processing technology, a streaming video recording and broadcasting system integrating multimedia data and streaming media video recording (referred to as "EStone") is designed and developed, providing a good tool for teachers to create video courseware individually. The software can produce videos in real time in the classroom courseware, but also upload classroom content to remote servers through network for distance education. At the same time, its integration of recording and collection function provides a very appropriate tool for teachers to preparing lessons, teaching in class and network information collection [1]. The main features of the system are as follows.

A. Computer-aided Teaching
Multimedia courseware integration, play, ordinary camera screen presentations, streaming video, audio playback are gather in integral multi-media teaching.
- Multimedia integration: a variety of multimedia teaching resources, text, pictures, animations and PPT teaching slides in the teaching process are integrated to play and present.
- Audio and video recording: record partial and full video of the demo content, generate and play streaming media AVI files.
- Embedded web browser and text editor; achieve the text editor and web page browsing in the system.

B. Computer-assisted Instruction Classroom Management
Directly write and erase on screen and does not affect the original content, you can achieve "electronic blackboard" using a variety of paint colors, realize screen cut and partial amplification anywhere and multimedia control and operation.
- Screen writing and drawing: design drawing tools on the screen.
- Screen electronic blackboard: alternative whiteboard and blackboard.
- Local amplification and save: using zoom and storage technology to achieve the amplification and preservation of screen and writing contents on whiteboard and blackboard.

C. Economics and Simplicity
- Low cost: no professional cameras are needed, ordinary cameras can be used.
- The system is easy to operate, no need for professional cameraman, teachers in lectures can independently complete streaming video courseware production at the same time.

II. FUNCTIONAL STRUCTURE OF STREAMING MEDIA VIDEO COURSE DEVELOPMENT SYSTEM

"Estone" is composed of two interrelated, also using independently software components: multi-media integration platform and screen recording tool, whose application structure is shown in Fig. 1.
Classroom teaching under the conditions of modern education technology puts forward higher demands of teachers, which makes multimedia-aided teaching tools to satisfy the maximum demand in functionality and performance for teachers. Based on the huge demand from teachers, the main design idea of "Estone" is that a variety of information capturing, editing and integration tools (such as courseware, material database design tool, a unique text editor tool, an image editing tool and a video capture tool) make teachers to be able to create common streaming media electronic courseware adapting in multi-media classrooms, laboratories and Internet while teaching; supporting classroom teaching and classroom teaching management using e-coated brushes, multi-functional "blackboard" and multimedia presentation tools. The system function diagram is shown in Fig. 2.

The system has mainly achieved the eight functions: intelligent resource management capabilities, teacher preparing courses based on students' need, IE-based courseware (teaching plans) editing, WEB-based multi-media classroom teaching, electronic pens based on mouse-controlled, real-time playback of multimedia audio, video, real-time subtitling during video recording.

A. Intelligent Data Management

With the development of multimedia and computer network technologies, teaching in various disciplines has produced a wealth of courses and courseware resources; "Estone" has achieved different types of resources (including several of supporting teaching resources and teaching management resources) integration and sharing in different environment with intelligent technologies. Assisted teaching resources provide a information sharing platform for teachers to prepare lessons and teach. Teaching management resources provides a personalized working platform for teachers in the classroom and extra-curricular.

"Estone" data intelligent management reflects in the integrity support to different types of data [2]. Click selected files in resource management directory, and you can open different types of data in a unified environment, which can not only be any data type of text, graphics, images, animation, audio and video, but also be fully compatible with all MS Officer software such as PowerPoint, Word, Excel and so on. Fig. 3 shows the opening interfaces of MS Officer PowerPoint and Word.

B. Preparing Lessons Based on Teaching Needs

Traditionally, the preparing lesson is to write lesson plans and teaching content, and then made courseware and play to students using PowerPoint. But there was a significant shortcoming, teachers preparing lessons is only equal to preparing themselves. They can not understand the needs of students in the lesson preparing process, resulting in the serious disjunction of teaching content and student acceptance. Teachers preparing lesson system based on the needs of students has realized the online browsing of students' information acceptance and extra-curricular feedback, teachers make the right decisions on the teaching progress and content according to student feedback to achieve targeted lesson preparation.

C. Various Forms of Courseware Editing

IE-based courseware editing is a courseware editing system taking Microsoft Internet Explore as platform, the system with powerful multimedia and network functions has achieved the complete integration of courseware and lesson plans. The main functions are as follows.

IE-based courseware editing is a courseware editing system taking Microsoft Internet Explore as platform, the system with powerful multimedia and network functions has achieved the complete integration of courseware and lesson plans. The main functions are as follows.
• Courseware editor: directly edit and modify PowerPoint courseware in the courseware browser, which is shown in Fig. 4.
• Courseware list: Teachers may load multimedia resources (pictures, all kinds of office documents, web pages) required in the class into courseware list to achieve the synchronous browsing.
• Electronic blackboard: According to the characteristics of the traditional blackboard, achieve an electronic blackboard real-time display using a special technique, users can paint on blackboard. If users have the tablet, you can also write.

Figure 2. "Estone" function structure.

Figure 3. The opening interfaces of Powerpoint and Word courseware.

Figure 4. Edit and modify courseware in the browser.

• Electronic blackboard: According to the characteristics of the traditional blackboard, achieve an electronic blackboard real-time display using a special technique, users can paint on blackboard. If users have the tablet, you can also write.
• Painting tool: You can tag, paint on any screen location to enhance screen visual effects.

D. Network, Mobile Classrooms

With the rapid development of network technology, the multimedia teaching method of "a computer, a screen, a
courseware, a book" has been challenged by online education. The traditional multimedia education thinking can not meet current education development. WEB-based classroom teaching model will become the mainstream classroom teaching. Based on the above understanding, we have implemented the three-dimensional classroom teaching, intelligent teaching strategies and unified courseware platform in the software.

- **Three-dimensional classroom teaching**: expends the space and time. First, integrate the internet into classrooms, build classrooms on internet. Teachers can access online teaching resources at any classroom teaching time; or upload the content that is not taught in classroom, classroom problems, teaching videos to the web classroom to enable students to continue learning and discussing. The second is to create the streaming media courseware library in classrooms, generating real-time streaming video courseware when lecturing. Third, build the laboratory in classrooms; teachers can carry out discipline experiment demonstration in classrooms through the camera.

- **Intelligent teaching strategies**: an intelligent teaching strategy is an important part of the teaching information flow control in the classroom teaching. Teachers can adjust teaching strategies based on learn state of students, classroom atmosphere and to knowledge grasping situation. At present, we provide for teachers the automatically setting function of teaching strategies in the teaching system, such as interactive teaching strategy, situational teaching strategy, and interest teaching strategy.

- **Unified courseware platform**: as rapid development of courseware development tools, teachers are using different tools for courseware development. Estone can integrate teaching courseware produced by several of courseware development tools into a unified platform, facilitates the courseware resource sharing and exchange.

### E. Multimedia Demonstration

As a computer input device, the mouse is given more functions in the multimedia classroom teaching, but in a large number of teaching medias, it is simply used to select, control, or circle, paintings. In this software, we give the mouse a number of functions, such as electronic chalk, coating pens, drawing pens, marking pens, etc., it greatly facilitates the teaching needs for teachers.

- **Annotation**: you can use text or different color graphics (brush, straight line, broken line, oval, rectangular, etc.) to label and show the presentation courseware.
- **Electronic "blackboard" or electronic "whiteboard"**: at the same demonstration courseware time, teachers can enter two different boards to demonstrate or calculations.
- **Collect or enlarge**: if teachers want to highlight certain part of the content during presenting, they can collect and zoom text or images. if they select the "Acquisition and Storage" function, the system will store each collected content in picture mode in the system directory.
- **Special symbols**: teachers can quickly insert types of numbers and symbols in the screen to mark emphasis or identify mistaken in classroom teaching.

### F. Real-time Playback of Multimedia Audio and Video

"Estone" integrating multimedia platform supports recording and playback of audio and video, and ensures the integrated processing of multimedia materials [3]. The system allows users to config video capture devices, whether the camera device based on the video card, or USB-based universal camera, realizes the maximum guarantee of personal convenience in recording streaming videos.

### G. Real-time Subtitles in Video Recording Process

Streaming video courseware with subtitles not only overcomes the lack of relatively heavy pronunciation of teachers, but also can enhance the presentation effect of video courseware. This function is another feature that the software is different from other software.

In addition to teaching application, "Estone" can also serve as personal information gathering and editing tools, web page video recorder, games recorder, digital video recorders and so on.

### III. DESIGN AND IMPLEMENTATION OF STREAMING MEDIA VIDEO COURSE DEVELOPMENT SYSTEM

#### A. Software Module Design

1) **Design of multimedia resource management module**: According to the difference of management content, we have taken different data processing approaches. Text materials are managed through using the dialog box or the view mode, and are stored in TXT files, RTF document. This facilitates heterogeneous courseware for a different platform. Graphics and graphic materials are managed respectively according to the bitmap or vector; audio and video elements are displayed and played through calling the system player[4].

2) **Design of screen real-time recording module**: Streaming video recording is the most significant feature of this software. Real-time recording module has six components: screen control, subtitles editor and display, recording process control, recording regional control, recording audio and video encoding, recording audio and video choices.

- **Screen interface control**: select the personalized recording screen interface based on the recording needs, the traditional approaches is commonly known as "three-screen" including three parts of human figures interface, course content curriculum interface and PPT courseware interface.
- **Subtitle edit and display**: At the bottom of the video courseware interface, users can display the needed teaching content, focus and difficulties, course
outlines and other content in the way of subtitle flying to enhance the screen visual effects.

- Recording process control: complete three basic video recording functions (start, pause, and stop), the choice, settings of camera etc.
- Recording area control: select and locate the screen area that will be recorded; you can complete a variety of user-defined area functions, such as full-screen, fixed region and selected area.
- Audio recording and video coding: it is used to set the encoding mode of the video recording.
- Audio and video recording options: it mainly complete the sound recording option in the video recording, if user need to the latter dubbing, they can only record the video section, if users need join the audio section in the video recording process, they can make audio and video recording at the same time.

3) Design of real-time data acquisition module: Real-time data acquisition is an important function of "Estone", teachers in teaching process can collect any information appearing on screens, and change in size, move and store them according to the needs. The key technology is the image processing and data acquisition technology.

B. Design Method of Key Modules

In the design process, we have adopted the object-oriented design method, especially using class mechanism to establish reusable components of the classroom presentation module; it facilitates the software operation and maintenance. A complete classroom teaching software contains very rich contents, its design would also be relatively complicated. At first, we decompose the system according to the teaching discipline and teaching characteristics, the software is divided into two parts of integration and presentation.

1) Design of multimedia integration:
   a) Document management: Document management mode is used in system to facilitate users (shown in Fig. 5).

   b) Remote data management: The system combines with web and remote data access technology[5], users can use the integrated Web browser for remote data access.

   ![Figure 5. File management mode.](image)

2) Design of multifunction coating pen: "Estone" is used in classroom teaching and learning process, teachers can not only use the multifunction coating pen, but also use many other functions, such as the electronic blackboard in analog chalk mode, various forms of painting, tagging, largerly display, etc.

   a) Graphics, image class design: Because of the limitation of information dissemination tools and display devices in multi-media teaching, the dominant role of teachers and teaching methods flexibility often cannot obtain the proper display. Some teachers mark focus or difficulties on the screen. We use the object-oriented class mechanism for the realization of painting, altering, marking, amplifying and archiving functions without damaging the original screens.

   b) Design of data collection and zoom window: Data acquisition and zoom window is an important function of the electronics coating pen. Any information appearing on screen during classroom teaching not only can be collected, also can be changed in size, moved and stored.

C. Software Platform Design

As an integration platform of courseware demonstration and screen real-time recording, the system has the
instructional design and lesson preparing function using integrally multimedia teaching resources and strategies, flexibly processes teaching critical data based on the background knowledge base, and effectively manages students' learning conditions and learning process in the process of preparing lessons and teaching[6]. Therefore, a software development platform with strong database maneuvering and unstructured data-processing capabilities is needed. Viewing all of the software platforms, we have chosen C++ Builder 2006 as the development tool. The software is compatible with courseware and courseware materials developed by majority of programs, the software testing sample and help documents is the WORD format, so users should install Microsoft Office 2000 or later version in computers before running the software.

IV. APPLICATION ANALYSIS

"Estone" is current widely used in multimedia classroom teaching, tutoring, teaching management and teaching resources management, which includes multimedia classroom teaching and streaming media courseware production. The software has realized real-time streaming media video production technologies on computers. If add tablet pen, wireless mouse or other Bluetooth devices to computers, teachers will be able to make real-time streaming media courseware during lecturing."

According to the typical connection diagram, streaming media courseware production is mainly completed on teachers' demonstration computers. The concrete steps are: 1) install cameras and microphones and other equipments on teachers' demonstration computers, 2) install "Estone" software on teachers' demonstration computers, 3) start "Estone" and debug each device, 4) open courseware using the integrated environment, 5) enter the teaching status and record, 6) upload streaming video courseware to servers when recording is completed, 7) students read through web browsers or download to a PDA, MP4/MP5, or 3G mobile phones to read.

"Estone" has achieved intelligent information management of teaching and learning environment, teaching resources, streaming media data, and finds a shortcut for teachers to independently product video courseware. From the point of the development of streaming media, "Estone" has achieved real-time streaming media courseware production; from the perspective of classroom teaching management, "Estone" provides an integrated platform for different types of courseware, increases the flexibility and adaptability of a variety of courseware resources that teachers use in classroom teaching, improves the work efficiency of teachers and education quality, has high economic and social benefits; from the perspective of teaching, teachers can make it a preparing lessons and teaching data acquisition and integration tool, also a classroom presentation tool, or an extra-curricular learning and guidance tool. At the end of one semester, teachers complete the discipline personalized video courseware, which not only saves a lot of courseware purchasing costs, but also help teachers improve their own quality and curriculum construction. The system has been widely used in video teaching in several of primary and secondary schools, students' skills training in normal universities and fine course construction of colleges and universities.

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