ADAPTIVE COURSEWARE AUTHORING AND DELIVERY SYSTEM FOR WEB-BASED EDUCATION

B. Anbumani, K.K. Thyagarajan and V. Ramachandran, Anna University, Chennai.
E-mail: banbumani@yahoo.co.in, kkthyagarajan@yahoo.com, rama@annauniv.edu

ABSTRACT

The primary objective of this paper is to develop an architectural model, which coordinates all the phases of online web-based education and helps the instructor to launch an interactive course by automating most of the work. A standardized, flexible courseware development framework built in this paper offers a practical solution to the challenges of how to design, build and deliver an integrated web-based education system. The model discussed in this paper has been developed with the essential elements of a web-based system with an adaptive content creation engine that supports streaming media and it has easy-to-use simple interfaces with personalizing content delivery based on individual’s study pace and knowledge background. This model creates a real classroom environment with instructor-student interaction and enhances the teaching and learning methods.

Keywords: multimedia, streaming, authoring, web-based education, adaptive content creation.
INTRODUCTION

There is currently a high degree of interest within teaching and learning organizations in the development of strategies and processes that will support the reusability of web-based resources. Internet-based instruction has grown strongly during the last years. In the beginning most Internet-based courses consisted only of a collection of static HTML pages. They are simple translations of already existing scripts and papers. These could easily be created using simple authoring tools, but these systems are not adaptive and do not provide any guidance that would be needed to support learners when learning a new topic on their own. Most of the current sophisticated learning systems are proprietary solutions and can only be built by experienced programmers and skilled web-based instruction authors. This creates high demands on authoring tools to create adaptive Internet-based instruction courses. It has been observed that an illustration of an interactive lecture section is a strong motivation to understand the contents easily.

Today, many institutions are implementing a broad range of online education services. More and more courses are embedded with multimedia and deployed as courseware over the Internet. The web-based education is dynamic, as it provides the learner with interactive interfaces and integrating all kinds of media within a hypertext environment. From the early stage of online education, the bandwidth capacity has significantly increased. The development will continue in future and provide online education with opportunities for more rich media content (Paulson, 2003).

Many educational websites were designed as information containers, which focus on the delivery of instructional materials. The need for more efficient and effective teaching techniques requires developing computer-animated simulations in a web-based format (Sam Villareal, 1998). Web-based learning therefore helps the learner to develop skills to collaborate and gain knowledge from the extensive resources available (Chris R. Jesshope, 2001).

Understanding the learning styles of the students can improve planning, production, and implementation of the courseware so that they are more appropriate to the expectations of the students and enhance their learning, retention and retrieval (Federico, 2000). Generally, adaptation is defined as the concept of making adjustments in an educational environment in order to accommodate individual differences. Several levels of adaptation can be made depending on who takes the initiative to the adaptation: the learner or the system (Kay, 2001). Adaptive interaction refers to adaptations in the interface without modifying the learning content (Alexandros Paramythis, 2003). The student is provided with a rich, personalized learning system, configured based on feedback, assessments and the profile. The presentation sequence for adaptation is defined based on the classification of content as foundation topics, examples, additional examples, complementary material (pictures, movies, simulations, and links to additional information), exercises and the complexity level stated as easy, medium, or high (Jose Palazzo Moreira de Oliveira, 2003).

ARCHITECTURE OF THE PROPOSED MODEL

The proposed model for web-based education is based on client-server architecture and it is shown in Figure 1. The major enhancement of this model is an adaptive content creation engine that supports streaming media. As multimedia content is an integral part of web-based education, a heavy load is imposed on web server for streaming multimedia data. So, a separate streaming server is adopted to store...
media files in order to reduce the load on the web server and to enhance the security of streaming media contents. The web server is destined to respond only with text and other non-streaming content. If a client makes a request for streaming content, the web server is capable of providing the reference file that contains the path of the streaming server. The client cannot see the path of the streaming server from the reference file. So, the actual location of the streaming server is secured. This enhances the security for audio and video files. A database is maintained for lecture notes, prerequisites and test questions. The adaptive content creation engine has been developed to control and manage the complete web-based education system and consists of an authoring system, XML translator, adaptive delivery system and online evaluation system.

The authoring system helps the instructors to enter the contents of the lecture notes and transfer to the XML translator. The XML translator in the authoring side receives the contents from the authoring system for each web page and creates an XML object. This XML object contains the elements that are used to represent the information to be displayed in the web page. The XML translator at the server side parses this XML object and stores the content in the database. Whenever the client requires a web page, the XML translator searches the database, retrieves the content, converts them into an XML object and sends to the adaptive delivery system. The adaptive delivery system delivers the content according to the requirements of clients. The online evaluation system tests the knowledge of the students in a specific topic. The students can learn either through live online lecture or through archived lecture contents.
ADAPTIVE CONTENT DELIVERY

If any student wants to learn a specific topic, called the goal, he should already know the low level concepts related to this topic. These pre-requirements are called prerequisites. The instructor can set the prerequisites for the specific topic using the tools given in the system. To learn a specific section, all the direct and indirect prerequisites are set by the instructor during authoring. These learning goals are useful for learners who do not need the complete course. The proposed model requires most of the content for the course to be developed offline. This allows correcting the errors easily. This model also permits to record the online lecture video and audio/video conferencing by using the record video option provided in the live lecture.

Adaptive Delivery System adapts to the learners experience, knowledge, goals or preferences to deliver the contents. The pages with in a section are navigated using NEXT and PREV buttons. The adaptive content creation engine enables items in the combo boxes dynamically based on the student’s current state of knowledge and hence the content is adaptively created. The knowledge of a student is decided from the results obtained by the evaluation system using the following algorithm and it is used for adaptive content delivery.

1. start
2. do {conduct an objective type test}
   while (marks scored< minimum required marks)
   {allow the student to revise the current lecture section
   conduct the test again
   }
3. add the section name in the students’ background knowledge data area
4. end

Based on the objective type test conducted at the end of each section and the time taken for navigating through each page, a report is generated automatically to have an idea of how the students have grasped the information. This report contains the number of pages viewed by the student and the total time spent on each page, the number of times the same page visited. These details are stored in the data area of the student. The registration details of the student along with the background knowledge are also stored in the data area for content adaptation.

Another technique used in this model to deliver adaptive content for the students of different disciplines is to develop a common courseware for example ‘Microprocessors’. If the course offered in a particular discipline requires only the 8085 Microprocessor, then the student is adaptively exposed only the chapters related to 8085 Microprocessors and this adaptation is done from the course code.

SAMPLE COURSEWARE

The model discussed in this paper is developed with an example courseware for the subject ‘Microprocessors’. In case chapter 5 of the example courseware as shown in Figure 2 is the current learning goal, chapter 4, section 3.5 and chapter 2 are prerequisites. Section 3.3 is indirect prerequisite. So, without studying these chapters and sections, the student is not permitted to go to chapter 5.

![Figure 2 Adaptive Navigation](image)

1. Introduction to Microprocessors
2. 8085 Architecture
3. 8085 MPU
   3.1 Pin Diagram of 8085
   3.2 8085 Signals
   3.3 Decimultiplexing address and data
   3.4 Decoding I/O/M signal
   3.5 Address, Data and Control buses
4. Instruction Execution
5. Timing Diagram
6. Addressing modes
7. Instruction Set

When a student wants to learn chapter 5 the adaptive content creation engine searches the prerequisites for the chapter from the database and identifies that the first prerequisite is chapter 4. It then checks the student’s knowledge background data area in the database to identify whether the student has already completed chapter 4. If it is so, the adaptive delivery system delivers the web pages for chapter 5. While all the web education authoring tools are using colored text for link annotation and hiding, this model has combo boxes, which simplify the process and make it effective. The combo boxes also occupy less space in the web presentation page and the contents are loaded dynamically.

CONCLUSION

The model discussed in this paper does not require an instructor to be an expert in multimedia programming and web technologies. It also supported adaptive learning and adaptive presentation of streaming audio/video. Using a separate streaming server improved the security for the audio and video files, and reduced the load on the web server. The online evaluation system is capable to check the students whether they have mastered the basic concepts and examples, and to deliver the content adaptively to them.

REFERENCES