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Model-Based System Development for Asynchronous Distance Learning

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ABSTRACT

The innovation and diversification of development in multimedia technology and network infrastructures have brought a significant impact to education, especially for distance learning. This paper presents a model-based asynchronous distance learning system development that consists of a presentation semantic model called the multimedia augmented transition network (MATN) model and an asynchronous distance learning system called the Java-based Integrated Asynchronous Distance Learning (JIADL) system. The MATN model is powerful in modeling the synchronization and quality-of-service (QoS) for distance learning multimedia presentations. The JIADL system can support diverse asynchronous distance learning services by integrating RealPlayer and Java technology to augment the superiority of both models. A course sample is used to illustrate and validate the effectiveness of the system. How to use the MATN model to model the diversity requirements of a distance learning multimedia presentation is also discussed. Furthermore, the initial experimental results show that our system is cost effective and has a wide range of applications.

Keywords: *multimedia augmented transition network; distance learning; Java media framework*

INTRODUCTION

The recent advances in multimedia technology such as the high-speed communication networks, large-capacity storage devices, digitized media, and data compression technologies have drastically changed the way learners communicate with their instructors and with each other, especially in distance education. With the innovation of new network and Internet infrastructures and the development of multimedia technology, the distances perceived by the learners have been virtually diminished and distance learning has become one of the most interesting new directions for education.

Multimedia information has been used in several applications including education, computer-based training (CBT), manufacturing, medicine, entertainment, video conferencing, etc. In particular, distance learning has become the mainstream of computer-based training and education. For

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example, there are 247 articles with the distance learning subject published on IEEE/IEE Library in 1997 and 1999 (IEEELibrary), and different surveys show that there are one million students taking distance learning classes via the Internet and predict that the number of college students enrolled in online courses will reach 2.2 million by 2002 (Syed, 2001). Moreover, the seamless integration of the overwhelming World Wide Web (WWW) and the emerging Java technology further endorses the universal accessibility to diverse distance learning services. The former provides a cross-platform consistent visual user interface for accessing information whereas the latter allows the application code (applets) to be downloaded over the Internet and run on any Java-compliant Web browsers.

In general, distance learning services can be delivered in three ways: synchronous (real-time), asynchronous (on-demand) and hybrid of both. Synchronous distance learning systems provide live lecture contents as in the traditional classroom. Asynchronous distance learning systems offer archived lectures by using Web and/or streaming technologies and try to provide the most of the capabilities and experience that an in-class participant can have to a remote participant. Hybrid systems supply complementary services to those listed above.

For the asynchronous systems, an early development is to use television to broadcast courses (Egan, 1993). The main drawback of this type of television instruction is the lack of interaction between the students and the instructors. Later, the Web is used to support asynchronous activities. One example is to develop the online programs using Web pages to access course materials, announcements, and other information for a course. Another example is to provide the online activities that include forums, chat rooms, and emails. Also, the students can submit their assignments online in multimedia formats and receive online reviews of the assignments in the same formats from their instructors.

Maly et al. (1997) proposed a synchronous distance learning system. In their system, a virtual classroom is developed to allow the students to have a conventional classroom experience through a workstation since the students and the instructors interact with video conferencing. Such an environment incorporates an X-Windows-based group-collaboration system called XTV (Abdel, 1994) so that any participant can take control of a window to multicast his/her inputs to the distance participant. Under this environment, those tools such as Netscape and PowerPoint can be shared through a window-sharing engine. However, there are two disadvantages in such an environment, namely speed and bandwidth. In other words, an extraordinary load is put on the reliable multicast protocol and the environment works only on high-speed networks. Another system proposed in Saini (1999) studied how to immerse the students in a virtual environment that provides them with feedback. In their system, the student interactions are computed and the system reacts like an educational game. However, the issue of how to share a virtual world among the students is not discussed.

In this paper, we present a project that aims at digitizing and distributing video tapes recorded in a synchronous distance learning classroom to improve curriculums, to provide another channel for learning, and to complement synchronous/asynchronous learning. In order to broaden the functions and the effectiveness of such service, a number of interactive and cooperative services are integrated by mainly applying Java

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