A Design of Real-time and Interactive Distance Education Environment

Aiguo He, GuoZhen Zhang and Zixue Cheng, University of Aizu, Japan

ABSTRACT

This article systematically discusses the design of a distance educational supporting platform, RIDEE, for performing real-time and interactive distance educational activities over a high-speed network, by summarizing the requirements for RIDEE and giving its hardware and software architecture. Several core parts and subsystems of RIDEE had been developed. RIDEE’s effectiveness has been verified by experiments and a regular distance lecture course. This article also describes RIDEE’s implementation and the application results.

Keywords: distance education; real-time and interactive high-speed networks

INTRODUCTION

By the constant spreading of broadband network services such as ADSL and FTTH, it became possible to perform communication with not only text/graphics but also audio/video. In Japan, there is a special high-speed network, Japan Gigabit Network (JGN), providing a test-bed for the research on the next generation of high-speed networking (TAO, 1999).

Before, almost all real-time and interactive distance education environments in Japan were established based on satellite communication systems (Araki et al., 1999; Tanaka et al., 1999; Suzuki et al., 2000), expensively equipped, and staffed for system management. But now, we can use an ordinary equipment-based system without a satellite communication system, to perform interactive distance education activities such as distance lecture, distance computer exercise, or distance seminar between sites (organizations).

There are several research articles on real-time and interactive distance education support systems (Kosaka et al., 1997; Segawa et al., 2000; Watanabe, 2000), but many of them are designed as a simple application of video conference system and support only few sites.

On the other hand, it has become possible that every one can join a distance education activity with his own information processing equipment such as a personal computer, a PDA or a cellular phone.
On such an assumption, a distance seminar support system has been developed to allow the participants (lecturer, students or presenter) to attend the seminar with their own computers (Yoshino, 2002), but that system depends on the operating system of the computer, supporting few presentation materials, and the procedure to connect a computer to the system is not so smart.

At the authors’ university, as research on the application of JGN, the “Real-time Interactive Distance Educational Environment (hereafter RIDEE)” project has been promoted. By now, several subsystems of RIDEE have been developed, and the effectiveness of RIDEE was proven by applying it to several experiments and regular distance lecture courses (Cheng et al., 2000; He et al., 2001; He et al., 2002).

This article focuses on the design, development and application of RIDEE. In the remainder, the requirements for RIDEE and a design of RIDEE are described; the software implementation of RIDEE is discussed and finally the applications of RIDEE are described.

THE DESIGN OF RIDEE

The ultimate goal of RIDEE is to support real-time and interactive distance education activities (lecture, seminar, computer exercise and group study) with so much presence that the participants have the illusion that they are in a traditional classroom or seminar room. But this goal can not be carried out by today’s ordinary information processing equipment. So the urgent goal of RIDEE is providing useful tools to enhance the effect of present real-time distance education activities based on high-speed network and ordinary information processing equipment.

The Requirements for RIDEE

As a realtime and interactive distance education support system, RIDEE should satisfy the following basic requirements:

(1) Live audio/video transmission

By using high-speed network and high-quality equipment, there is no problem in transmitting high quality audio/video between the remote sites. But when the number of remote sites becomes larger, it is necessary to consider the following points:

- Remote operation or automatic control of audio/video equipment. For example, though some videoconference systems support remote controlled video camera, the remote operation is bothersome.

- Audio/video stream control. It is not realistic to establish fixed complete symmetrical audio/video channels between all the sites because the communication equipment and required bandwidth of the network will increase rapidly when the number of sites increases. Audio/video stream switching, based on a rule possible to consent, is necessary.

(2) Presentation support

The presentation materials or teaching materials need be displayed with the same resolution over all the remote sites. According to circumstances, the pictures of the materials, even transmitted by high-quality video, cannot maintain enough display resolution (Tanaka et al., 2000).

Another purpose of presentation support is the distributing and sharing of the materials between the participants. “Microsoft Windows Netmeeting” has partly achieved those purposes by sharing applications between computers, but in