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This paper appears in the publication, International Journal of Distance Education Technologies, Volume 6, Issue 3
edited by **Qun Jin © 2008, IGI Global**

Multipoint Multimedia Conferencing System with Group Awareness Support and Remote Management

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ABSTRACT

A multipoint, multimedia conferencing system called FocusShare is described that uses IPv6/IPv4 multicasting for real-time collaboration, enabling video, audio, and group awareness information to be shared. Multiple telepointers provide group awareness information and make it easy to share attention and intention. In addition to pointing with the telepointers, users can add graphical annotations to video streams and share them with one another. The system also supports attention-sharing using video processing techniques. FocusShare is a modularly designed suite consisting of several simple tools, along with tools for remotely controlling them. The modular design enables the system to be easily adapted to various situations entailing different numbers of displays with different resolutions at multiple sites. The remote control tools enable the chairperson or conference organizer to simultaneously change the settings for a set of tools distributed at multiple sites. Evaluation showed that the implemented attention-sharing techniques are useful; FocusShare was more positively evaluated than conventional video conferencing.

Keywords: *collaborative work; distance education; flexible configuration; group awareness; multimedia communication; remote management*

INTRODUCTION

The National Institute of Multimedia Education (NIME) operates a multipoint videoconferencing system for education and research using satellite communications in Japan. This is called Satellite Collaboration System (SCS) (Tanaka & Kondo, 1999), which is based on H.261 (ITU-T, 1993). It has one hub station at NIME and 150 VSAT (Very Small Aperture Terminal) stations at universities and research institutes across Japan. A next-generation system utilizing IP networks is needed to promote large-scale distance education. Thus, we are designing

and prototyping a new and effective multimedia conferencing system for large-scale distance education.

Conventional videoconferencing standards using Internet protocols (IPs), such as H.323 (ITU-T, 2007), are widely used. Commercial videoconferencing products based on H.323 are widely available. Microsoft NetMeeting (Summers, 1998), Ekiga (Sandras, 2001), and other videoconferencing software systems based on H.323 can be used on personal computers (PCs). Video chat systems, such as Yahoo! Messenger and Windows Messenger, can also be used on PCs. While these systems can be used in distance education, they are insufficient and inefficient to support large-scale distance education. This article will explain why conventional systems are insufficient and inefficient.

Conventional videoconferencing systems based on H.323 do not provide group-awareness information to participants sufficiently. Group-awareness information enables participants to better understand the situations and intentions of others. There are various methods for providing such information. We think that pointing and attention-sharing are basic and important in distance education. Here, pointing involves the use of telepointers, and attention-sharing involves the use of either telepointers or video processing techniques. Telepointers play an important role in interactive distance education (Adams, Rogers, Hayne, Mark, Nash, & Leifer, 2005).

Conventional videoconferencing systems only support one telepointer or none at all. While the telepointer can be shared among users in some systems, it is usually controlled by one user at a time. Before someone else can use it, the current user must relinquish control. This control transfer is time-consuming and slows down communications. Multiple telepointers would eliminate this problem and thus multiple telepointers should be supported.

Conventional H.323-compliant systems are designed for point-to-point connections. These systems thus cannot use the multicast capability of IPv6/IPv4 (Internet protocol version 6/version 4) networks, so they are not efficient for large-scale distance education. Multicast support is an important requirement for large-scale distance education.

Moreover, as large numbers of people can attend lectures in distance education, differences in the system settings for the different locations can be a problem. Instructing participants individually about the settings using video and/or audio is tedious and time-consuming. The ability to adjust the settings remotely would facilitate the preparation and management of remote lectures. Although general-purpose remote control software tools are available, they generally cannot handle multiple sites simultaneously. Tools that can handle multiple sites are thus needed.

Conventional videoconferencing systems restrict display and window configurations and are not easily adapted to differences in environments. They usually support only one type of display. Some conventional systems are based on H.239 (ITU-T, 2003), which defines dual video stream functions, such as People+Context, and data collaboration. They support one main display and another display, but the use of dual video stream functions requires two displays at all sites. Any site with only one display cannot participate in a conference using dual video stream functions. Any site with more than two displays cannot fully utilize the multiple displays even when multiple sites send and receive videos simultaneously. To process multiple video