Distance Education between Immersive Indoor and Outdoor Environments using Multimedia Satellite Network System

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Abstract

We developed a multimedia satellite network system based on the Internet protocol (IP) and personal computers. It enables collaborative distance education between outdoor and indoor environments. Integration of IP technologies and satellite communications enhances the flexibility of the network system. The satellite communication system enables us to communicate to and from outdoor environments where terrestrial infrastructures are poor or do not exist. Personal-computer-based systems allow us to utilize already available software and to make the outdoor system portable and easy to install outdoors. We conducted an experiment for collaborative distance education between a farm and an immersive display environment by using the multimedia satellite communication system and a transportable earth station outdoors. The experiment showed that our system could be used for collaborative distance education between outdoor and indoor environments, and could reduce the amount of equipment needed outdoors.

1. Experiment

After several preliminary experiments in the National Institute of Multimedia Education (NIME), we conducted an experiment to demonstrate that the system we developed can be used for distance education requiring communication between outdoor and indoor environments. Both environments were connected with the Space Collaboration System (SCS) [1], which is a bi-directional satellite communication system.

We chose a horticulture farm of Chiba University as an outdoor environment and used a 360-degree panoramic imaging (recording) system with four cameras in order to enhance the understanding of situation in the outdoor environment, and to show the usefulness of the system’s multiple video streams and flexible resolution and frame-rate control functions. The panoramic camera used the reverse-pyramid type of mirror as shown in Figure 1(a). The panoramic videos were encoded by an MPEG4-based software encoder, and the encoded video data was transmitted through SCS transportable earth station (Figure 1(b)) and received at the NIME.

The panoramic view was shown in an immersive indoor environment by using a Tele-Existence Environment for Learning exploration (TEEEleX) system [2] implemented at the NIME. TEELeX is a surround display system and has a multi-screen display using the immersive projection technique. Figure 2 shows a schematic diagram of TEELeX and a snapshot of inside of TEELeX in the experimental session.

The usability and functionalities of the system was confirmed in the experiment.

1. References