§60. Study of Video Monitoring System for Remote Participation

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QUEST experiment is executed with the collaboration of many universities in Japan, and the scientists are remotely taking part in this experiment from various places in Japan. For example, the data acquisition and archiving system is operating in NIFS which locates about 1,000 km apart from the experiment site, and the scientists can retrieve to analyze the acquired in their room without visiting the site[1].

However, in order to realize smooth remote cooperation, they have to know the situation in the experiment site in real time, and the voice and video play important roles. Therefore, the authors have installed a web camera (Panasonic BB-HCM715) in the control room of the experiment site, and the user could view the situation of the control room while they stay in their room. However, because the web camera is not so powerful that the number of the connections is limited and it cannot send the video images to all the participants.

Therefore, the authors have developed a relay server to redistribute the video images retrieved from the web camera to the clients. Fig.2 shows the overview of the scheme. The web camera can be controlled from the web browser using CGI (Common Gateway Interface), and its API (Application Program Interface) is open to use. Using the API, the relay server connects to the web camera and receives the video images as Motion JPEG (MJPEG). When a client connects to the relay server, the relay server copies the frames of the original image and sent them to the client. Different from other video format, such as MPEG-2 or MPEG-4, each frame of MJPEG is independent and it is easy to copy the current frame image without calculating from the previous frames.

Using a relay server, the video can be sent to the more clients than the web camera. However, as the number of the client increases, the relay server cannot handle all of the clients. This is because the connection between the client and server is unicast, or one-to-one communication, and the server and the network loads are proportional to the number of the connections. On the other hand, there is a technology called IP multicast. Using IP multicast, data packets are sent to the multiple clients at same time, and the load doesn't depend on the number of the clients. Therefore, the authors considered IP multicast as a promising technology for the remote participation, feasibility of IP multicast to send video images has been studied.

In order to send the video images using IP multicast, the author have tested a network camera that had a GigE Vision interface. GigE Vision is a standard interface to control the network attached video camera. In order to develop an application to control GigE Vision application,

Fig.1 web camera installed in the control room

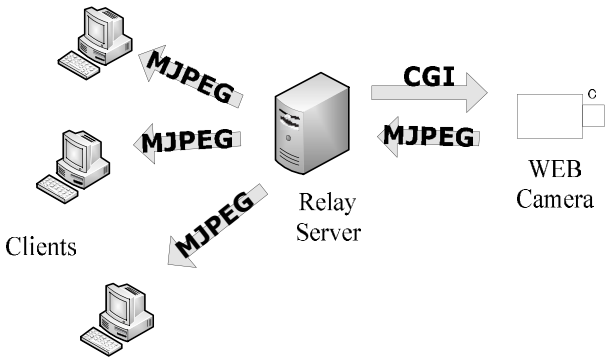

Fig 2. Relay Server

A&B Software's Active GigE was adopted. It is an Active-X component, and the developer can incorporate it into their own software just by drag-and-drop. However, evaluating the performance, the authors found the application was not fast enough to send the smooth video images. Therefore, to enhance the performance, the authors have been studying other options to use GigE Vision.

1) Nakanishi, H. et al.: Fus. Eng. Des., **82**, (2007) 1203