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A Transport Method for Distance Education Reconciling Visibility and Presence

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Background and Purpose

The distance education which transmits a video stream to a remote place through a network has become popular. Construction of a distance education systems are already in progress many fields, and there are many trials using the ATM, satellite networks, and so on.

In the distance education, the material presentation is a very important element as well as transmission of a live lecture video stream. In the style of transmitting only one video stream that contains both lecturer and the materials, the video stream must be high resolution. In the low resolution, too low visibility to read the presentation materials. This highly obstructs deployment of the distance education.

Accordingly, distance education using electronic media is attracting many people's attention. In this case, the presentation materials are presented by application such as shared white board "wb" ,WEB pages and so on. These applications are synchronized between a lecturer and participants. This technique has advantage in video stream clarity and share of presentation materials between a lecturer and participants.

The quality of a remote lecture system is depends on the approach to the lecture form that converses directly with participant and a lecturer

at one lecture room. However, separation of electronic media materials and a video stream spoils the presence which is one of the elements that determines the quality of a system.

In this research, I aim at reconciling improvement in participant's visibility for the presentation materials and improvement of concentration and presence by a single screen.

Proposal

To achieve this goal, I propose the method of extracting both lecturer's area and screen area and composing two video streams of both an original video stream from a sender and clear presentation materials on a receiver side. On the receiver side, a lecturer on the video stream is detected and composed tranlucently over the this.

Therefore, the presentation materials that is static sources of sharable information can be shown to participants in detail. And, a video stream that is a dynamic source of information causes tele-presence with the single screen is able to provide.

Design and Implementation

In this method, the detection of the screen area, that is composite area, is an important element. I investigated the following three kinds of area detection method.

- The method of using infrared light

  The screen illuminated by infrared irradiation equipment is shot with an infrared camera, the detected screen area is based on the luminosity information on an infrared domain.

- The method of using visible light

  The detected screen area is based on the luminosity, hue and so on, by using the light which the projected video stream on a screen emits by itself.

- The method of using point source of light

    The point rays are arranged in the four corners of a screen, and the screen area is detected from the area of the rays.

From these methods, I adopted the method of using luminosity in consideration of simplicity of device composition, a small amount of the devices to be used.

For the methods except that uses point source of light, geometry of the screen must be determined by image analysis. Hough transform is used for this propose. The Hough transform is the method which detects straight lines in the video stream and has the robust characteristics in detecting lines in the video stream with strong noise such that the line is in some are a broken. The Hough transform needs feature points to detects the line. Usually the points result of an edge detection process, or boundary points of a binary blob.

Luminosity is converted into feature points by the threshold test, and these points are converted to straight lines by Hough conversion. And they are grouped into a straight line group. Four straight lines are chosen from the straight line group, and a rectangle is constituted. I adopted four evaluations of by a size, an angle, an aspect ratio and the difference between the luminosity of inside and outside, to choice the most highly evaluated four lines as a rectangle of the screen area.

Lecturer's screen area is detected by background subtraction method that uses the difference of the background and the video stream. In addition, the background used for background subtraction method was generated by integral calculus method.

And, I decided Microsoft PowerPoint as a material presentation tool and presentation materials are shared on both transmission and reception sides in advance.

By adopting the method of fitting a PowerPoint window into the PowerPoint in the video stream, the window is difficult to zoom in and out flexibly, or to be translucent.

Therefore, I left these process to the drawing function of the video chip. And the PowerPoint output is copied to the memory.

However, the output of the PowerPoint is able to be obtained only the screen of PowerPoint displayed now. And the screen is unusable because

of the screen occupied the final output that output projector and s o on.

Therefore, I created the driver which have the virtual screen. This problem was solved by using this driver and drawing PowerPoint to the virtual video interface.

Evaluation

In this method, The detection accuracy is depends for the luminosity and quality of the video stream and surrounding brightness. I clarified relation between these factors and detection accuracy in the experiment. As a result, two things were confirmed. One is strong to degradation of the quality of video stream by compression. And the other is it can detect about 80 percent of the template of PowerPoint. Moreover, since luminosity information was used, although the background color of presentation materials had restrictions, it was confirmed that the area of a screen is detectable.

Conclusion

In this research, to improve visibility and presence, I proposed that the presentation materials in the video stream is replaced to the clear one and the image area of the lecturer is compounded with the vide o stream translucently, and in addition, it presents with the single screen.

I adopted the detection method of the screen area which using luminosity and the screen area of the lecturer which using the background subtraction method to for proposal realization. And I designed and implemented the system. Moreover, I experimented with the screen area detection system using luminosity in the environment which imitated a real employment , and I prove that screen area detection in the screen area using luminosity was possible.