Dynamic Laser Light Source Control by Video Frame and Image Generation method for High Dynamic Range Imagery

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ABSTRACT

Recently, it has become popular in various fields (movies, broadcast, photography, industrial design, CG, etc.) to make of High Dynamic Range (HDR) contents. Along with that, devices and equipment with technology for producing HDR contents such as cameras and displays are being developed. Among them, as a display technology, the dynamic range and the brightness of the screen are expanded by the local backlight control of the liquid crystal display, the current control of the organic electro luminescence, etc.

In the simulator field, we have developed a method of making HDR content and image equipment compatible with HDR. Although the projector is the main image equipment in the simulator, it is considered that it is very difficult to control the brightness locally and in tens of milliseconds. The reason is that a lamp such as a UHP lamp or a Xenon lamp which is not able to drive at high speed is used for a light source of projector.

Therefore, we adopted a Laser Diode and Phosphor capable of brightness control in milliseconds as a light source, and developed a new control method that operates at high speed.

Also, since it is difficult for a projector using a single light source to expand the dynamic range by local brightness control, we have considered a dynamic range expansion method with reference to the dynamic range adjustment in the human visual system.

First, the brightness control method which operates at high speed is described in detail. In brightness control by external control using RS232C or LAN, it is difficult to synchronize with control and video signal in frame (tens of milliseconds) because it passes through a microcomputer for transceiver. Therefore, by embedding a brightness control signal into the video signal and directly decoding it by the signal processing units of projector, it is possible to perform direct control synchronized with the video signal. As a result, high-speed control in tens of milliseconds are made possible.

Next, the dynamic range expansion method is described in detail. The dynamic range adjustment in the human visual system is realized by changing the pupil diameter corresponding to the light intensity of ambient light. Therefore, by replacing the ambient light with the average luminance of the simulation image or the environmental condition (time, weather, material, etc.) of the simulated image to be output and by processing the change amount of the brightness of the light source and the optimization of the video signal according to the change amount of the pupil diameter, it is possible to expand the dynamic range.

In this paper, we provide two technologies (methods) to make HDR content in simulator field. With this we can experience a more realistic world and enhance the training experience.

BIO

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Ryosuke Nakagoshi joined the Development Department of Engineering Operation on April 2016. In the group, Nakagoshi is in charge of DSP design and development. Nakagoshi started his career in JVC as an optical researcher for ILA device and product at Kurihama. Then he turned to a DSP engineer for projector development. He joined JVC in 2005. He earned a master's degree in Physics from Osaka University. He lives in Kamakura, Kanagawa with his wife, son and daughter.