Adaptive Parallax Autostereoscopic LED Display

Kouta Minamizawa
Keio University
Yokohama, Japan
kouta@tachilab.org

Keitaro Shimizu
Keio University
Yokohama Japan
k-taro@kmd.keio.ac.jp

Masahiko Inami
Keio University
Yokohama, Japan
inami@kmd.keio.ac.jp

Naohisa Ohta
Keio University
Yokohama, Japan
naohisa@kmd.keio.ac.jp

Susumu Tachi
Keio University
Yokohama, Japan
tachi@tachilab.org

Shigeto Yoshida
Sharp Corporation
Osaka, Japan
yoshida.shigeto@sharp.co.jp

Noriaki Yamaguchi
Sharp Corporation
Osaka, Japan
yamaguchi.noriaki@sharp.co.jp

Shigeki Imai
Sharp Corporation
Osaka, Japan
imai.shigeki@sharp.co.jp

Figure 1. *The 38-inch adaptive parallax autostereoscopic LED display*

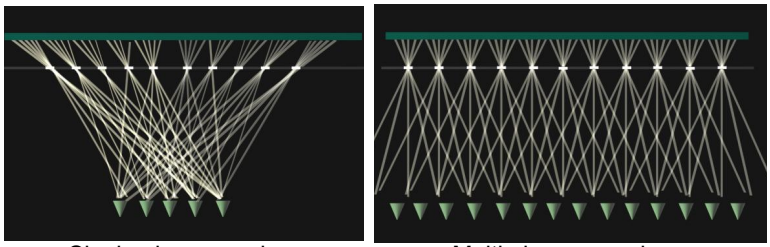

Figure 2. *Reconstruction method of the 3D image. (Left) In single-viewer mode, the light fields are gathered around the viewer's head. (Right) In multi-viewers mode, the light fields are distributed in front of the display.*

Introduction

Autostereoscopic 3D displays using static parallax barrier or lenticular lens are commercially available in these days. In these methods, however, the number of viewpoints is fixed at the time of manufacturing. Active parallax barrier [Perlin, 2000] and dynamic parallax barrier [Peterka, 2008] have been proposed to improve the resolution and number of viewpoints by moving the position of the parallax barriers. To implement an autostereoscopic display, with dynamic parallax barriers, dual-layered LCD panel is a common approach as is mentioned by [Hirsch, 2010]. And a method of optimizing the parallax barriers [Lanman, 2010] has been proposed to represent more perceptually-acceptable imagery. Remaining limitations of the dual-layered LCD method are the refresh rate and brightness of the LCD panel. Commonly used high-speed LCD has 120Hz in refresh rate and around 500cd/m^2 in brightness so that conventional systems did not have enough quality to be used in public. To solve this problem, we propose an adaptive parallax autostereoscopic display composed of a high-density/high-frequency LED panel and a high-speed/high-contrast LCD panel.

Implementation

We implemented a novel 38inch high-density LED panel that has 240Hz refresh rate and 1500cd/m^2 brightness. More than 160,000 full-color LEDs are arranged on the panel with 1.5mm pitch. A moving image rendered on the basis of a particular parallax barrier pattern is displayed on the LED display, and a 240Hz VA type LCD panel with HD resolution, which works as dynamic parallax barrier, is placed in front of the LED panel. The distance between the LED panel and LCD panel is 45mm and both the images on the LED and the LCD panels are displayed synchronously. Consequently, appropriate rays of light are delivered to each viewpoint as shown in Figure 2. As the barrier pattern can be varies arbitrarily, the number and direction of motion parallax can be flexibly controlled according to the viewer's condition.

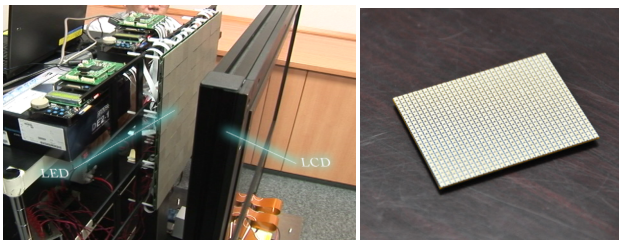

Figure 3. *(Left) Construction of the 3D display using a LED panel as light source and a LCD panel as dynamic parallax barrier. (Right) Our developed high-density LED module*

When a viewer stands in front of the display, the system recognizes the rough position of the viewer's head by a camera, and then the viewpoints are densely arranged around the viewer's head so as to maximize the range of the horizontal motion parallax. When the viewer lies down in front of the display, the parallax would automatically changed to vertical. Further, when there are multiple users in front of the display, the number and angle of horizontal parallax would be changed according to the distribution of the people. This proposed system enhances the viewing style of 3DTV from individual use as gaming to public use as digital signage.

References

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