Seelinder: The Cylindrical Lightfield Display

Tomohiro Yendo *
Nagoya University / JST

Naoki Kawakami †
The University of Tokyo

Susumu Tachi ‡
The University of Tokyo

1 Introduction

The ideal 3D display allows multiple viewers to simultaneously see 3D images without special glasses from a free position and a view that corresponds to there positions. Since the multiplex hologram [Cross 1977] device has these features, it is used in the display of artwork, entertainment, advertisements, and other applications. However, it can only display static images. On the other hand, some volumetric scanning displays [Favalora et al. 1995] are used to display dynamic images that can be seen from free directions; however, their applications are limited because their images are "phantom images," where all objects are see-through. It is difficult to provide a multiview display that can be seen from all horizontal directions with conventional methods, such as using lenticular sheets, due to the limitations of resolution and the shape of the two-dimensional display devices, which include LCD panels. In other approaches, we have proposed a ray-based cylindrical display [Endo et al. 2000] that allows multiple viewers to see 3D images from a 360° horizontal arc. This technique uses a cylindrical parallax barrier and a one-dimensional light source array constructed from such semiconductor light sources as LEDs aligned in a vertical line. The light source array rotates along the inside of the cylindrical parallax barrier, and the intensity of each light is synchronously modulated with the rotation. A prototype display is also demonstrated at Emerging technologies in SIGGRAPH2001 [Endo 2001]. It showed adequate images of each viewer corresponding to his position and movement that smoothly brought changes into view; the images have high presence. But it displayed only monochrome binary still images generated from 3D models.

Now we extend a previous ray-based cylindrical displaying method and develop a new display that can show dynamic colored images. Moreover, we developed a ray control method to display actual objects whose source is a set of photos taken from around an object. In this paper, for the first time we describe the design's details and create image data of the new display.

2 Principles

The basic structure of the proposed display is shown in Figure 2. It has two spinning cylinders, one inside the other. The outer cylinder is a parallax barrier that has a series of vertical slits spinning rapidly while the inner cylinder spins slower in the opposite direction with a series of one-dimensional LED arrays on its surface. If the slit width of the outer cylinder is sufficiently small, the light through the slit becomes a thin flux, whose direction is scanned rapidly by the spinning of the outer cylinder. In this paper we call this angular scanning. By synchronously changing the intensity of each LED in the arrays to the spinning, rays of different direction have different colors with time-multiplexing. Moreover, the inner cylinder also rotates slower, and the LED array's position is a little different when the next slit comes, and so rays are shot to each direction from each position. In this way, a cylindrical light field display is realized.

*e-mail:yendo@nuee.nagoya-u.ac.jp
†e-mail:kawakami@star.t.u-tokyo.ac.jp
‡e-mail:tachi@star.t.u-tokyo.ac.jp

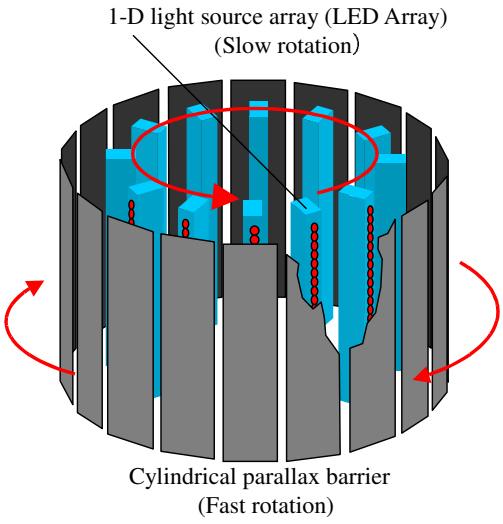

Figure 1: Schematic diagram of basic structure

Figure 2: Photograph of Seelinder

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