Moving Slit Light Field Display

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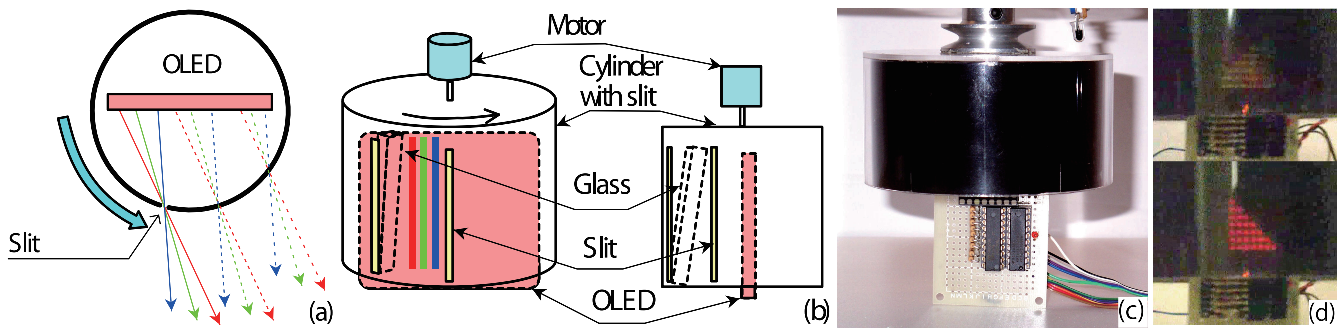

Figure 1: *(a) The slit is moving around the Organic Light Emitting Diodes(OLED) and the light from OLED pass this slit to the viewer's eye(Looking from top side), (b) Configuration of display(Looking from side), (c) Prototype display, (d) Left(red) and Right(green) Images*

1 Introduction

This paper describes the design of a parallax based Moving Slit Light Field Display(MSLFD). A MSLFD shows multi parallax images, by using vertical slits in an opaque cylinder surrounding multiple static flat panel displays. It allows viewers looking towards the cylinder to see an image from any position. Currently, various forms of 3D display have been developed and flat panel 3D display has been in practical use for some time. But commercial 3D displays only show a stereogram. On the other hand, Light Field Displays have been developed for displaying the dense ray information of the space, [Endo et al. 2005; Jones et al. 2007]. These displays use a "Parallax barrier" to control the ray direction to the observer. It shows parallax images without the use of an eye glass. We describe a system to reduce the size of the display by using two dimensional Organic Light- Emitting Diodes (OLED) and a rounding slit. OLEDs can act as the dense light source array and it can be controlled line by line. This system proposes a method to synchronize the movement of OLED's line and movement of slits. It can show many images in multi orientation (Figure 1(a)). In this paper we explain the principal method of design and how to expand the resolution and views of a MSLFD.

2 System Description

Our system configuration is as shown in Figure 1(b). The controlled line of OLEDs follows the slit position. When the positional relation is the desired orientation, the light ray pass through this slit to viewer's eye. The OLED can flash a specified line immediately making the system a light field display. As mentioned, the slit type 3D display which MSLFD is based on can show images with restricted resolution.

- **How to expand the horizontal view:** Resolution is dependent on the slit movement speed and LED display flicker rate. The basic system flashes once per pixel movement of the slit. The system can be programmed to flash up to two times per pixel movement to increase its resolution.

- **How to expand the vertical view:**We expand the vertical view by shifting the light ray direction by varying sub-pixel amounts. This is done by adding different angled glasses behind the slits as shown in Figure 1(b). A normal slit shows the original image to the viewer's eye. By adding the angled glass behind the slit, we show the image shifted by a number of sub-pixels in relation to the eye.

- **How to have multiple view points:** We use normal 2D displays, but drawing a single line at any time, moving according to position of slit relative to the line of sight of the viewer.

We developed a proof of concept prototype display by using a dot matrix LED array unit (8 by 8 resolution, red and green) and 100mm diameter cylinder with 10 slits (Figure 1(c)). This LED unit is driven the same way as an OLED line by line. The signal is generated by the CPU board (XC-1 by XMOS). The display shows two images at the same time and each image resolution is 16 by 16 and refresh rate is over 30Hz (Figure 1(d)).

3 Conclusion

The main contribution of this system is to demonstrate a relatively simple system using 2D LED array to reconstruct 3D images without using an eye glass. Compared to previous systems, this system only has 2D LED and moving slits. It can achieve high display resolution despite using relatively low resolution LED arrays and by displaying only two lines to a viewer at any time. Also, by using moving slits, combined with high resolution OLED panel, we can achieve real MSLFD system.

References

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