

# Slit-based Light Field 3D Display

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## 1. Introduction

The principle of glasses-free 3D displays (each eye sees a different image without wearing glasses) can create a fully natural sensation of depth. In conventional principles, lenticular lenses or parallax barriers are placed in front of an image source, such as a liquid crystal display, to allow it to show a stereoscopic image. A disadvantage of the technology is that the resolution of perceived images is limited by the diffraction at the lenticular lenses or parallax barrier. To overcome this limit, we improved the technique by using the human perceptual feature known as slit viewing. When a figure moves behind stationary narrow slits, observers can see the moving figure as an integrated whole, a phenomenon known as slit viewing.

## 2. Slit-Based 3D Display

Our novel 3-D display (slit-based light field display) consists of several one-dimensional light arrays. The series of light arrays are arranged in a row with certain spatial intervals. Each light array is composed from LEDs aligned in a vertical line, and it is bounded laterally by a cylinder, as shown in Fig. 1. The cylinder has a thin slit. Since the slit width is sufficiently small, the light through the slit becomes a ray of the light. In addition, the light array rotates fast with the cylinder, changing its flashing pattern. Accordingly, the rays of different direction show different line images. The multiple lines of light arrays viewed from a position synchronously change the pattern, as if the moving image is obtained through a thin slit. Consequently different slit-viewing pattern can be generated at different position, and different moving images can be shown to the left and right eyes, which can lead to 3-D stereoscopic presentation of moving images.

### 2.1 Characteristics

Although the slit-based light field display cannot present static images, it can be a concise and effective information display in public spaces. We can arrange the size of display easily only by changing the size of LED array, and the resolution of images by changing width of slits.

## 3. Conclusions

Combining the ray-based 3-D display method and the human perceptual feature known as slit viewing, we achieved a novel and concise stereoscopic display, which can simultaneously present moving 3-D images to multiple viewers without special glasses.

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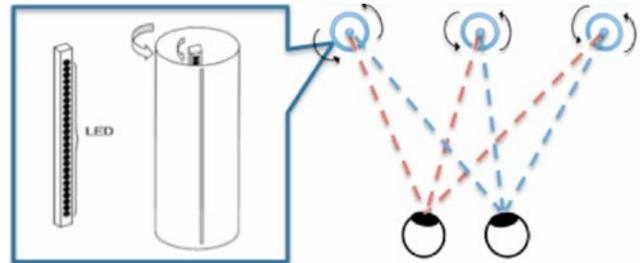


Figure 1. Principle of Slit-based 3D Display.



Figure 2. Slit-based Light Field 3D Display.

## 4. Acknowledgments

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## References

Hideyuki Ando, Yohei Miyazaki, Taro Maeda, Junji Watanabe, Three-Dimensional Perception in Multi-Slit Vision for Public Display, The 2nd International Workshop on Ambient Information Technologies in IEEE VR 2013, 2013.