Chapter 11

THREE-DIMENSIONAL PROJECTION DISPLAY SYSTEM

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Abstract: In this chapter, a current state of the art of 3D projection displays will be addressed. This begins with a review on conventional and three-dimensional projection display systems. And, some discussions on stereoscopic projection displays such as the polarization-based, the LC shutter-based and the ZScreen-based will be followed. Then, time-sequential multiview projection display and projection integral-imaging display will be discussed. Finally real 3D projection displays such as the Fresnel lens-based and the hologram-based will be reviewed.

Key words: 3D Display, Projection

1. INTRODUCTION

1.1 Overview of projection displays

In general, an electronic display is defined as a device or system that converts electronic signal information representing video, graphic or text to a viewable image of this information. Displays can be largely classified into direct-view or projection. Direct-view displays produce their images on the surface being viewed. On the other hand, the images from projection displays are formed on auxiliary surfaces, which are physically separated from the image-generating component. The direct-view technologies include cathode-ray tubes(CRTs) in televisions and computer monitors as well as plat-panel displays, such as liquid crystal displays(LCDs), plasma display
panels (PDPs), and organic light emitting diode displays (OLEDs) in various information terminals. All these displays have their own capabilities of high-resolution and satisfactory luminance. But, it is difficult and expensive to make a large-scale direct-view display enough to accommodate several viewers simultaneously.

Human visual system is known to have an angular resolution of approximately 1 minute of arc. In case an viewer would watch the HDTV (high-definition television) at a distance of 2 meters from the television as shown in Figure 11-1, the TV size must be as large as ~70" in diagonal to fully resolve the TV video images with a resolution of high definition, which is shown in 1920 X 1080, ~0.6mm, full-color pixels [1].

![Figure 11-1. Display geometry for viewing direct-view HDTV](image)

It is a surely expensive and challenging problem to implement a direct-view display of this size at present even though several prototypes of LCDs and PDPs of this size were being demonstrated very recently [2, 3].

Alternatives to the large-scale direct-view displays, Many types of projection displays have been devised [4]. Projection displays make use of an optical imaging system to magnify a small picture created either by conventional direct-view technologies, such as CRTs, or by modulating the light from an illumination system with a device called a panel. Projection displays produce larger images from electronic signals than is normally achieved by direct-view technologies. Figure 11-2 shows where projection displays are located in the display market with regard to resolution and screen size [1, 4].