Multi-Viewpoint Interactive Fog Display

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Abstract

We propose a 360-degree observable fog display which provides different images according to observers' position. The proposed display utilizes directional light scattering of fog so that multiple images which are projected from different directions on one cylindrical fog screen can be transmitted to appropriate observers. The fog display brings motion parallax to observers that can recognize a 3D structure of the presented objects.

Keywords: fog display, Mie scattering, multiple projection, motion parallax

1 Introduction

Fog displays are one of immaterial display systems. Foregoing systems (e.g. [1]) provide only 2D images on a flat screen. We propose a novel fog display system which uses multiple projectors can bring observers recognition of 3D shape of the presented object by motion parallax. 360-degrees viewable 3D displays which utilize projection of multiple images, such as Hitachi's Transpost[2] and Sony's RayModeler[3], have been developed. The advantage of the proposed fog display is that the proposed display enables direct operation to the virtual objects by hands.

2 Methods

The proposed display projects multiple images of a virtual object from different viewpoints onto one cylindrical fog screen (fig. 1). Since the water drops constituting the fog screen show the Mie scattering that is a strong forward directional scattering of lights, observers see only one image projected from the frontal projector at a time. In this way, the 3D shape of the object can be recognized from the motion parallax when the observer walks around the cylindrical fog screen.

Most of 3D displays cannot realize to touch and to grasp the virtual object because the projection system is covered and sometimes dangerous. One of the advantages of the fog display is that the observer can interact with the presented virtual objects by his or her hands. The proposed 3D fog display utilizes an infrared LED illumination and an infrared camera to detect the motion of observer's hand around the fog screen. This infrared vision system enables observers to handle the virtual object directly without any markers.

3 Results

Figure 2 shows the prototype system of the proposed fog display. A diameter of the cylindrical fog screen is 80 mm. We used three projectors and projected three slightly different images. The resolution of each image is 800×600. The projected images from projectors and the images on the fog screen are shown in figure 3. The result reveals that the projected images are not mixed and observers can see the virtual object as it were inside the fog.

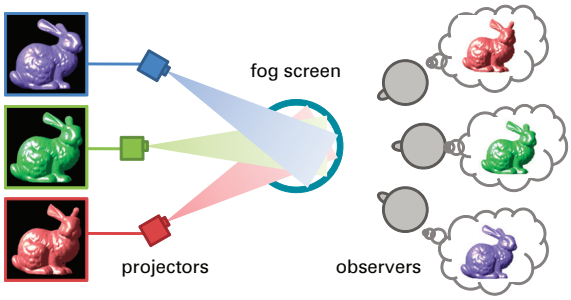

Figure 1: Concept of the display.

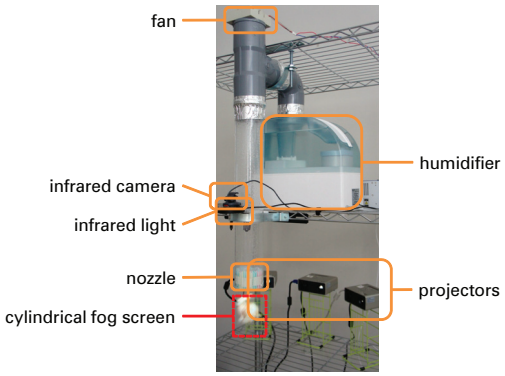

Figure 2: Prototype system.

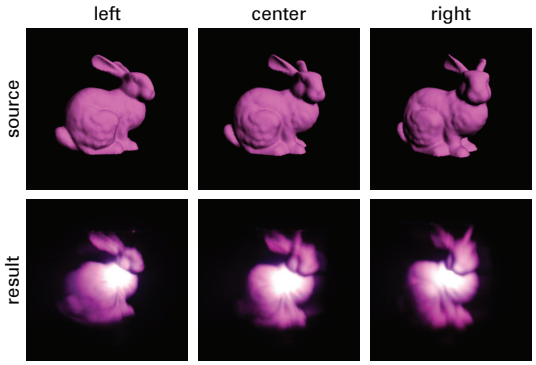

Figure 3: Results of projection onto fog screen.

References

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