Studies on Reflection Hologram Technology Applied Miniature Hologram Types

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Abstract

Miniature holograms are frequently used for exhibition as pyramid shape. But there is a lack of studies on holograms with various shapes. This study aims to learn about the shapes of miniature holograms where reflection floating hologram technologies are applied. By analyzing the floating hologram types, it aims to verify that the reflection type of floating hologram is suitable for miniature hologram implementation and study suitable types of reflection miniature holograms that are not pyramid shapes. Apart from the pyramid shape hologram frequently used for exhibition, the author studies cone, semi sphere and cylindrical shape holograms and forms them in a vertical structure to support expansion of the screen showing the image. Reflection type f hologram posed light scattering problems in the past, but by attaching a polarization filter to the screen, the effect of light scattering is minimized. A vertical type of hologram causes distortion of image depending on the visual angle of the viewer. In the future, if it is possible to minimize the image distortions, it would be possible to implement expanded shapes.

Keywords

Hologram, Floating Hologram, Miniature Hologram, Reflection Hologram, Polarizing Filter, Scattered Reflection

Introduction

In the ‘40s, hologram was first conceived by a Hungarian scientist named Dennis Gabor(Cabor, 1948). ‘Holo’ in Greek means the whole while ‘gram’ in Greek stands for message or information. In other words, it means a complete photo. Hologram can replay a

3D vision of object. (Polarizing folter, Wikipedia, 2020) As the multi dimensional video technology developed, hologram newly emerged as a next generation technology that can replace the flat squire display for PC, TV and mobile phones and in the near future, hologram will enable us to have a call, video conference, education, products and so on that can give us new option as having a vivid experiences of having speaker next to us. (Hologram, Naver Knowledge Encyclopedia, 2021), (The 'holograms' revolutionizing digital communication, 2019)

3D hologram is concluded as a final technology development of current virtual media. 3D hologram is a new video implementation method that can help us escape from the existing flat square displays now. At present, most frequently used displays are flat square displays but hologram can express 3D video on transparent screens or air screens. Hologram, as introduced in movies frequently, implements an object as if seen by a real human. If virtual media environment can be created, we will no longer have to use flat square displays but experiences more vivid 3D displays. (Realistic Media-Holotram, Naver Knowledge Encyclopedia, 2021)

Hologram is one of technologies frequently used in exhibition, fashion shows, and performance and so on. Everland's 'K-pop hologram', 2010 F1 Korean event ticket launching, SK broadband's hologram speaker, 2018 'Real Fake Show', Motorola's 'motoroy' also used hologram technologies in implementing performance and advertise products. However, miniature holograms are implemented mainly as pyramid shapes so there is a lack of studies on various shapes of miniature holograms. In this study, the author aims to learn about the issues of miniature hologram based on reflecting floating hologram technologies.

Floating Hologram

Floating hologram uses transparent or air screens to project 3D video as hologram so that they can see 3D video floating in the air. (Floating Hologram, IXpatterns, 2021) As in Figure 1, there are two ways to implement floating holograms. First, mirrors and transparent curtains can be used with a projector to display 3D video on the empty space and second, display panel's video is reflected to output the 3D video on the empty space. (Figure 1)

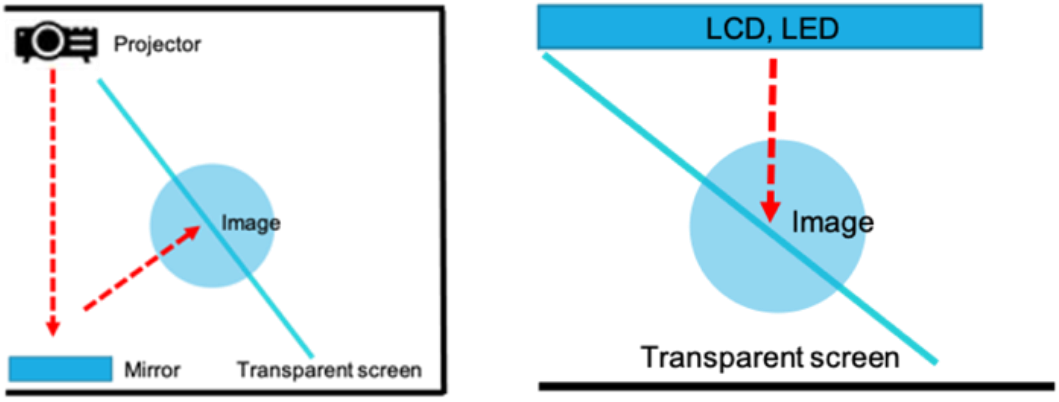


Figure 1. Floating Hologram

Floating hologram uses the projector or display device installed at the top or bottom to project video to the transparent or air screen installed at 45 degrees to create a feel for video floating in the air. Characteristically, it can replay duplicated reality and virtual images be reflecting it to the transparent screen. (Park et al., 2019) Floating hologram creates a special audio visual effect as if the video is created in the empty space. It can create illusion that a virtual object or human exists so hologram technologies are frequently used in performance and exhibitions. (Choi et al., 2019) Floating hologram using projectors is helped with projectors and mirrors so, it is frequently used in actual performance. Display based floating hologram uses a direct projection of video to the transparent plate and it is frequently used in exhibitions. Both methods can create an illusion that 3D images are floating in the air. For successful implementation of miniature hologram, floating hologram should be able to support direct reflections ideally. If a project is used for implementing miniature holograms, installation space required shall be greater than normal cases, and one more reflection process is required. So the holograph size shall be larger which is a major disadvantage. (Choi et al., 2019) On the other hand, if display panels are used then it would be possible to immediately reflect it on the transparent screen, thus the size can be smaller.

Discussion

The phenomenon of cryptocurrency has gained global popularity and become a profitable Generally, miniature holograms are implemented as pyramids and mostly used for exhibitions. Pyramid shape hologram uses multi angles to create four planes where video is projected for 3D effects. (Figure 2)

Figure 2. 'Real Fake' fashion show

As of now, miniature hologram application has been limited to pyramid types. If it is possible to design with direct reflection, it would be possible to implement various shapes of miniature holograms. This study investigates reflection type of miniature hologram.

Table 1: Reflection type of miniature hologram shapes

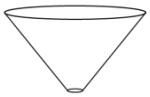
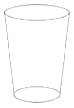
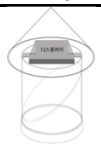
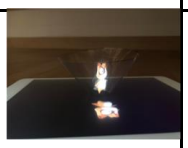
Classification	Transparent cone	Transparent semi sphere	Transparent cylinder	Transparent cylinder/reflection mirror
Shape				
Implemented image				

Table 1 shows cones, semi spheres, cylinders and cylinders and reflection mirrors. Cone, semi sphere and cylinder is installed on the LCD to project video to it. Cylinder and reflection mirror type holograph uses a transparent reflection mirror placed along the diagonal within the cylinder and LCD at the top of cylinder to project video to it. Miniature hologram using cones and cylinders and reflection mirrors provide the best reflection rate, thus leading to good image implementation and sense of engagement. Miniature hologram using cylinders and reflection mirrors yield more problems with light scattering. Miniature hologram directly projected to the cylinder successfully shows image but image seems to be laid down which reduces the sense of 3D.

Table 2: Vertical reflection type of miniature hologram shapes

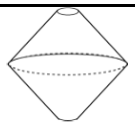
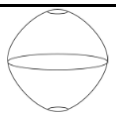
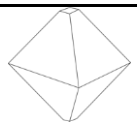
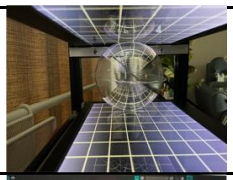
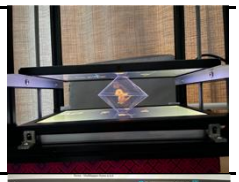
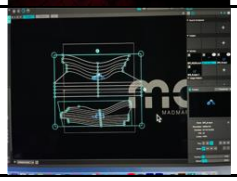
Classification	Cone	Semi sphere	Pyramid
Shape			
Implemented image			
Vertical image integration			

Table 2 shows the design of two sets of each cone, semi sphere and pyramid attached vertically. In this shape, reflection diagrams are attached vertically to expand the hologram screen shown in Table 1. In this structure, LCD is installed at the top and bottom and hologram video is divided in two and projected equally to the top and bottom LCD. Vide is displayed to the LCD at the top and bottom and image distortion in accordance with the vertical structure is supported by the madmapper program. Two images reflected from the top and bottom must be in accordance with the correct location of integration of reflection diagram before it can implement hologram images without distortions. As seen in Table 2, cone and pyramid shapes implement integrated vertical images. Semi sphere shapes, as shown in Table 1, has no problem in image implementation but fails to reflect two images to the location of integrated semi sphere shown in Table 2

How to minimize light scattering appearing in miniature holograms Polarization filters

Polarization filter removes the surface reflection lights. If attached to the lens, it is called polarization lens. Light rays moving in four directions can be filtered out by a polarization filter to only vibrate in one direction. In the polarizing filter, pillars for blocking light are closely arranged in one direction like a comb. (Andy et al., 2020), (Figure 3)

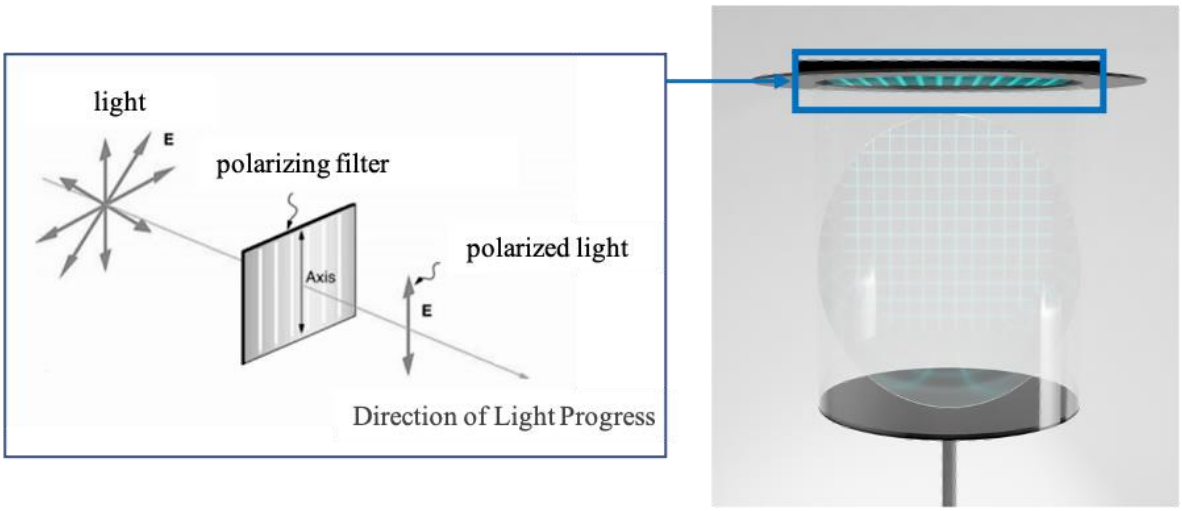


Figure 3. Plotting holograms with polarized filters

Polarization filters

However, these acts were not adopted and became the object of criticism of many In this study, miniature hologram uses a transparent mirror attached to the display to project video. It yields relatively more light scattering effects than other hologram types. Light scattering means that as light is projected on the a small plane with irregular protrusions toward every direction, they are reflected and scattered in many directions. (Figure 4), (Figure 5)

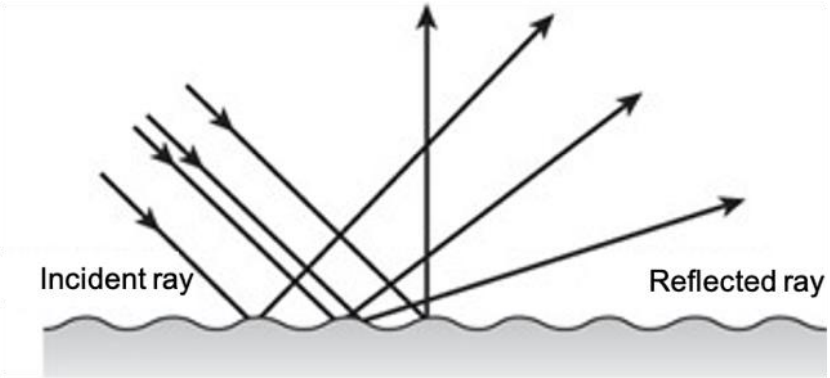


Figure 4. Scattered Reflection

As the light is projected at 178 degrees at the LCD installed in miniature hologram, scattering of lights are found in the reflection mirror and cylinder. The most serious light scattering is found in the cylinder and reflection mirror type of miniature hologram in Table 1. Figure 4 shows that as the lights are scattered from the elliptical reflection mirror to the cylinder that partially reflects the image. To minimize light scattering, a polarization filter can be attached to the LCD to make the light ray vibrate in only one direction. (Figure 5)

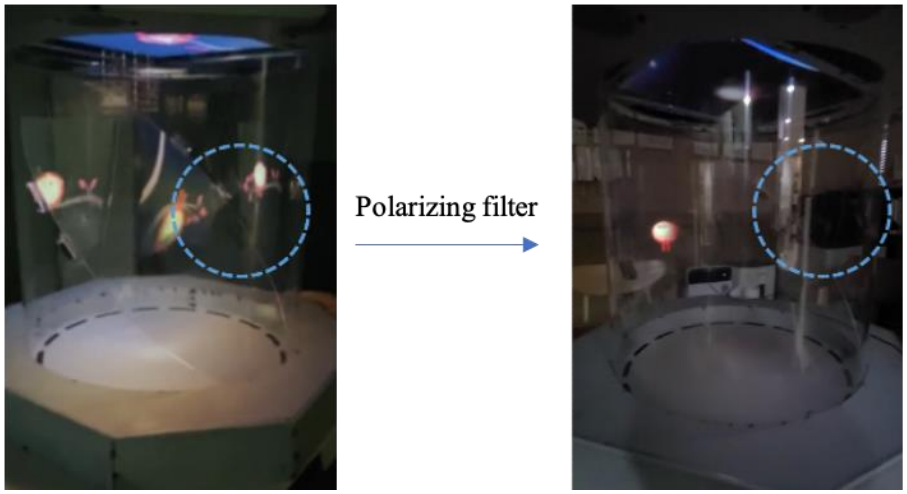


Figure 5. Apply Floating Hologram Polarization Filter

Conclusion

Cryptocurrency, as an economic and legal phenomenon that has gained wide global In this journal, the author studies floating hologram shapes. Based on floating holograms, reflection type of miniature hologram shapes available for implementation is investigated. Reflection type of hologram posed light scattering problems in the past, but by attaching a polarization filter to the screen, the effect of light scattering is minimized. In a hologram shape, straight line reflection plane better reflects lights than the curved one thus leading to clear images and less distortion. In a vertical shape, the straight line reflection plane provides better vertical image integration than the curved one.

A vertical miniature hologram uses a small screen so, if attached in series vertically, it can create a bigger screen. A vertical type of hologram causes distortion of image depending on the visual angle of the viewer. In the future, if it is possible to minimize the image distortions, it would be possible to implement expanded shapes. At present, a hologram is used in many different areas and thus it requires studies on various shapes of hologram and problems inherent to each shape shall be improved.

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