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A Study on the plane of Light Embodiment Method using the Laser

Byungkyu Kim

Media Artist, 10-401 Daerim Apt, Sanddo-2dong, Dongjak-ku, Seoul, 156-716, Korea
camacart@daum.net

Abstract. AT Field_Paralyzed Sense is an interactive media art completed with the participation of viewers. This piece has visualized the light unavailable of embodiment into two dimensional plane of light through laser, polygon mirror motor, and mirror structure and was produced as the light cube through the visualization method in order to create a visual structure where viewers are trapped into the light space. This study examines a technique to visualize the light into two dimensional plane of light and a visualization technique which can produce a light cube by using the structure of mirror. With the use of such a simple light visualization technique, a variety of light art pieces or light embodiment structures can be created using the light.

Keywords: Media art, Immersive environment, Laser, Polygon Mirror Motor

1 Introduction

'AT Field_Paralyzed Sense' is an interactive installation piece. By using the planes of light created with the light, it produces a light cube and creates an immersive environment where the interaction is achieved with the participation of viewers. When a viewer seats on the chair placed within cubical frame, a light space that surrounds the viewer is created. General light has the trait of diffraction. Due to the diffraction of light, we can light the space to a certain degree. However, the laser has trait of limiting the diffraction. Therefore, the wavelength of light does not disperse within the space but presents visual trait of clearly stretching out in a straight line. The purpose of this study is to examine the technique which embodies the light within the space into two dimensional plane using the laser's trait of limiting the diffraction and can create three dimensional cubical light space using the light embodied as the plane.

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Fig. 1. AT Field_Paralyzed Sense

2 Plane of Light_Polygon Mirror Motor

As the light of laser has the trait of no diffraction and stretching in a straight line, the light has a visual trait of being seen as a line within the space. In addition, the laser also has the trait of being reflected by the reflector such as a mirror. When above two traits of laser are used, the laser can be embodied into two dimensional plane of light. Therefore, when a method to continuously project the line of laser light to the mirror along two dimensional plane is used, the light of laser is shaped into two dimensional plane. In general, a polygon mirror motor is used to shape the light of laser into the plane. The polygon mirror motor is a component of laser scanner or laser printer and it is in shape of regular polygon. In addition, the side projected with the laser is made of mirrors. Therefore, when the laser is projected vertical to the side of polygon mirror fixed vertical to the axis of motor, the light of laser forms two dimensional plane due to the high speed rotation of motor.

Fig. 2. Structure of general polygon mirror motor and sample of industrial use

There are two reasons why the polygon mirror motor was custom-manufactured instead of using commercialized one. First, the polygon mirror motor purchased in general is produced in small size thus the thickness of reflecting surface which can reflect the light is thin about 5mm. However, RGB laser used in AT Field_Paralyzed Sense presented the thickness of 5mm, 7mm, and 12mm respectively in its light source thus it was necessary to manufacture a polygon mirror motor with thick reflecting plane. Second, the polygon mirror motor with thick reflecting surface is used in medical devices and sold at about dozens of million won thus it was inadequate considering the limited budget for the production of AT Field_Paralyzed Sense.

The most important manufacturing technology of polygon mirror motor is to adjust all surface angles of mirror attached to each reflecting plane to have the same angle. It is due to the fact that it cannot be visualized as constant and even plane of light if there is a minute distortion in even one reflecting plane. Therefore, as a method to adjust the angle of each plane of manufactured polygon mirror, it shall be manufactured so that the angle can be adjusted by modifying reflecting planes diverted from the axis and horizontal direction of central body. The wire cutting technology was used in order to satisfy above conditions. Each plane separated with the wire cutting is widened and retracted against the axis by two bolts (When the first bolt fixed only to the widened reflecting plane is fastened, the reflecting plane is widened as it pushes away the reflecting plane diverted from central body. When the second bolt connected to central body in penetration of the reflecting plane is fastened, the plane retracts toward central body direction).

The projection angle of laser can precisely be controlled as the angle of reflecting plane can be adjusted through above procedure and it enables the creation of constant plane of laser light.

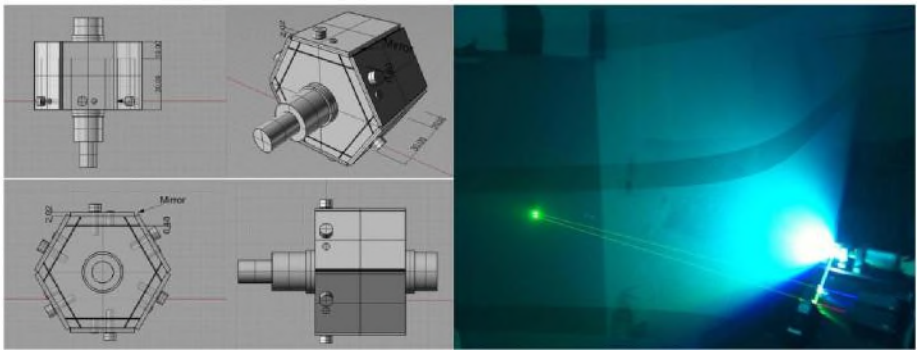

Fig. 3. Design structure of manufactured polygon mirror and its test sight

3 Light Cube

In order to create a two dimensional plane of light using the polygon mirror motor and embody a three dimensional light cube using that plane of light again, a reflecting frame that can trap the laser light must be designed. It is simple to embody a single

plane of light. Just attach a mirror to inner plane of frame after manufacturing a rectangular frame. When the light of laser is projected from a corner of frame after enabling four mirrors to face one another in parallel, the light source of laser is reflected in repetition to plane of four mirrors in sequence. (refer to Fig. 4)

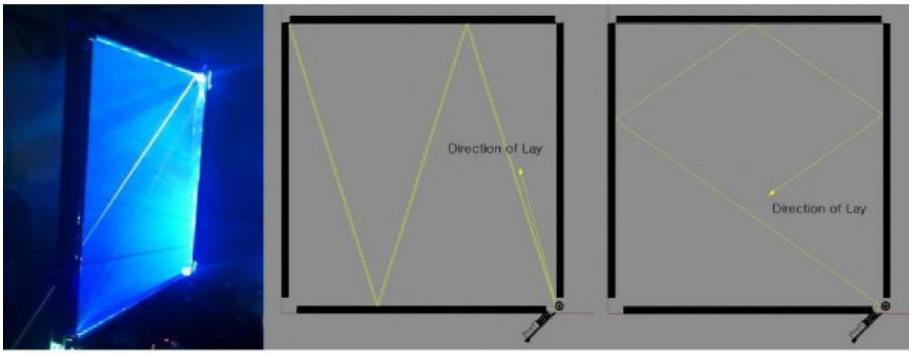

Fig. 4. Direction of laser light reflected by the angle of polygon mirror and light source trapped within two dimensional plane frame

When four rectangular frames and four lasers are used as illustrated above in order to enable them to face one another, a rectangular shaped laser cube is created excluding the floor and ceiling. Although the floor can be disregarded in a light cube as it is the part where the viewers step on, it is necessary to block the part above the head of viewers with the light. Therefore, when the angle is set to enable four reflecting planes on the top of cube frame to reflect the light source of laser in 90˚, even the top part can be covered with the plane of laser light. (refer to Fig. 5)

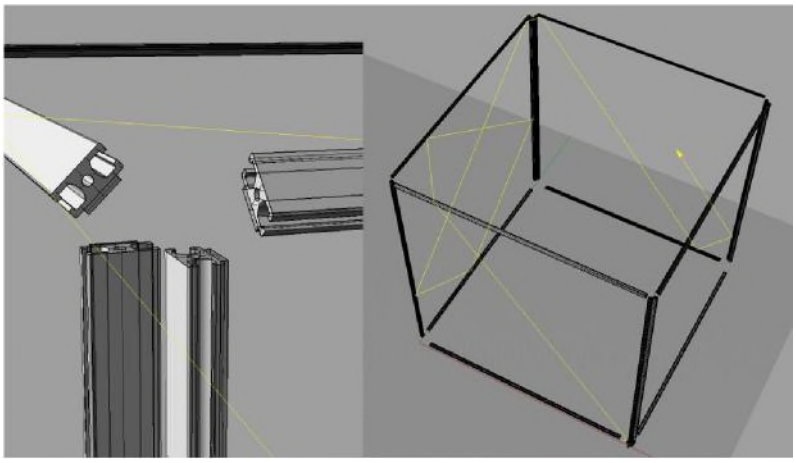

Fig. 5. Structure of three dimensional reflecting frame and straight direction of light

4 Conclusion

AT Field_Paralyzed Sense is applied of technique which can visualize and shape the light into the plane. Also, through the plane of light embodiment, it visualized three dimensional light structure. Although numerous artists have promoted the embodiment work using the light in the past, it has not reached the quality of physical visualization implemented in AT Field_Paralyzed Sense. Therefore, AT Field-Paralyzed Sense can be considered as an artwork which achieved physical embodiment so substantial to enable viewers to be under the illusion that the light is a tangible matter. It is suggested that there is a necessity for follow-up studies on new light artworks applying above technique with the use of an attractive substance that is the light.

References

1. http://terms.naver.com/entry.nhn?docId=1155955&cid=40942&categoryId=32238.
2. von Wiese S.: Kunst Licht Kunst; The Artificial Light Spaces by Gruppo T and Zero for Eindhoven. pp. 448-465, (2006).
3. Jeong-Yeon S.: A Study on Design Characteristics of Artistic Space Effedted by Light in 'Light and Space Art'. Korean Institute of Interior Design, vol. 14, no. 4, pp. 37-38, (2005).
4. Paul C., Digital Art, Thames & Hudson Ltd. pp. 71-72, (2003).

