Omnidirectional Display by Use of a Projector

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1. Introduction

An omnidirectional display that surrounds a viewer in all directions gives an immersive sensation by its wide field of view. Aerial imaging by retro-reflection (AIRR) has been proposed to form an aerial information screen with a wide viewing angle [1] and has been utilized for an omnidirectional aerial display [2]. We have conducted experiments to observe the behavior of medaka using our omnidirectional aerial display [3]. In this case, medaka react to the aerial image. However, our omnidirectional aerial display has a small size and there is a problem that the small size may give stress on the medaka used for the experiments. In optomotor reaction experiments, it is required to show a cylindrical image to fish and there is no need to touch the stimulus image directly. In this situation, we can use a screen that surrounds a cylindrical water tank. This paper proposes an optics to realize omnidirectional display by use of a projector and a cone-shape mirror.

2. Principle

The structure of our omnidirectional display is shown in Fig. 1. A cylindrical transmissive screen is installed inside a cone mirror. The principle to form the omnidirectional image use of a projector is shown in Fig. 2. The bottom of the cylindrical water tank is shaded to block light from the projector. Light emitted from the projector is reflected by the mirror and forms an image on the cylindrical screen.



Fig 1. Structure of our omnidirectional display.



Fig 2. A cross-section of our system.

3. Experiments

The projected image in the experiments is shown in Fig. 3. The viewed images are taken from the locations of A and B shown in Fig. 3. In order to observe the omnidirectional image, we used an omnidirectional camera (Ricoh Theta Spherical Digital Camera, THETA SC, RICOH, 2016.10, 910740). We used an OHP film and PP film as a transmissive screen. As shown in Fig.4 and Fig. 5, it was confirmed that the omnidirectional image surrounds the <u>central region</u>.



Fig 3. Projected image used in the experiments.



(a) (b) Fig 4. Results using OHP film taken at (a) Position A and (b) Position B.



Fig 5. Results using PP film taken at (a) Position A and (b) Position B.

4. Conclusion

We have realized an omnidirectional display by use of a projector.

References

- [1] H. Yamamto, et al., Opt. Exp. 22, 26919 (2014).
- [2] S. Onose and H. Yamamoto, Proc. DHIP2016, P20-34 (2016).
- [3] E. Abe, et al., Proc. IDW'17, 3Dp2-3 (2017).