

Contrast ratio between aerial image and ambient light at varying ambient illuminance in an optical system with a mirror as the interface

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Perceptual visibility of an aerial image is affected by the ambient light, especially on an aerial mirror interface that shows aerial image on a mirror. This paper reports experimental results of the contrast ratio between the luminance of the aerial image and the mirrored image of an ambient environment.

In recent years, aerial display technology such as AIRR (aerial imaging by retro-reflection) is attracting attention as an output destination for the metaverse or so, as the interface between cyberspace and real space. In our previous research, we have proposed an optical system that forms a light-field 3D aerial image between an observer and a mirror by using retro-reflector slits and a polarization modulation optical system. Since the contrast ratio is considered to have a significant effect on the visibility of aerial images, we attempted to identify the optimal design that maximizes the luminance contrast of aerial images relative to the reflection by using the reflectance, transmittance, and absorptance of the mirror as parameters.

This measurement experiment was performed under the same ambient light conditions with the expectation that the contrast ratio values would change in response to changes in the optical characteristics of the beam splitter. The optical system consists of a light source, a beam splitter, a magic mirror, and a retro-reflector. In constructing the optical system, three optical patterns were prepared using beam splitters with reflectance of 30%, 40%, and 50%, respectively. The contrast ratio between the aerial image by the AIRR and the mirror image by the magic mirror was measured in each of the eight ambient light patterns. The contrast ratio was derived as the value of the luminance of the ambient light relative to the luminance of the aerial image by measuring the luminance of the aerial image and the mirror image, respectively.

The measurement experiments showed that the optical characteristics of the beam splitter have little effect on the contrast ratio, and that the intensity of ambient light has a significant effect.

Short biography:



Kyoya Hino is a graduate student in Master's Course in Graduate School of Regional Development and Creativity at Utsunomiya University. He graduated Department of Mathematical Science and Electrical-Electronic-Computer Engineering, Faculty of Engineering Science, Akita University in 2023. He is working on about study of Augmented Reality (AR) Display without Glasses Using Aerial Imaging by Retroreflective Reflection (AIRR).