Augmented reality system using holographic mirror and concave half-mirror

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1. Introduction

Recently, augmented reality (AR) systems using holographic optical elements (HOEs) are getting the limelight [1,2]. In this study, we propose the AR system using holographic mirror and concave half-mirror. The proposed system provides the image with relatively high field of view (FOV) without increasing the form factor of the system. There is a trade-off between the system form factor and the reconstruction efficiency of holographic mirror. The optimal condition of the system is determined with experiments and analysis.

2. Results and Discussion

Figure 1 shows the schematic diagram of the proposed system. The system consists of a display part, a holographic mirror, and a concave half mirror. Light rays from the display part are reflected on the surface of the holographic mirror and projected to concave half-mirror. Then, the light rays are focused into observer's eye providing the virtual image. Since both holographic mirror and concave half-mirror are transparent to light rays from real world scene, the observer can perceive augmented reality through the proposed system.

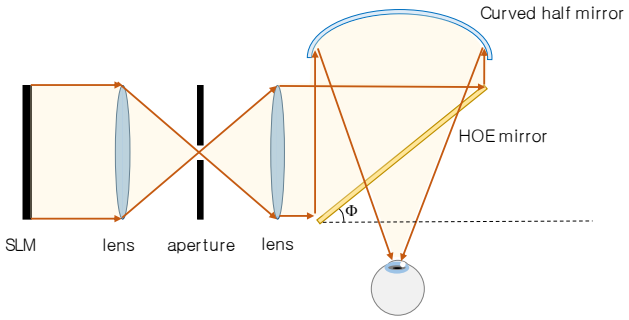
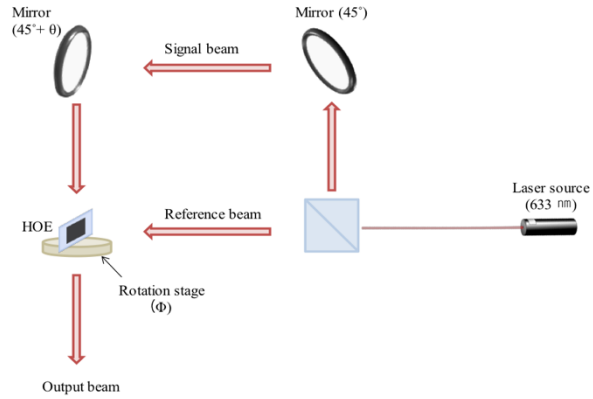


Figure 1. Configuration of the proposed system. Light rays from the display part are projected to observer's eye after they are reflected from holographic mirror and projected to concave half-mirror.

The tilted angle of holographic mirror is related to the form factor of the system and reflection efficiency. As the tilted angle of the holographic mirror decreases, the total system form factor decreases but the reflection efficiency gets worse. We set the tilted angle to 20 degrees and tried to find the recording condition that brings the maximum reflection efficiency. Figure 2(a) shows the schematic diagram of recording process of holographic mirror and Fig 2(b) shows the measured intensity of the beam spot for various recording conditions. The maximum intensity is achieved when the rotation angle of photopolymer is 1 degree and the rotation angle of signal beam is 19 degrees.



(a)

Recording condition		Measurement result	
θ (degree)	Φ (degree)	Reconstruction Φ (degree)	Maximum intensity
1	17	18	2280
1	18	19	2520
1	19	20	4460
2	15	18	630
2	16	19	1318
2	17	20	1430
3	13	18	530
3	14	19	2023
3	15	20	217

Figure 2. (a) configuration of the recording process and (b) measurement intensity of beam spot.

3. Conclusions

We propose the AR system using holographic mirror and concave half-mirror. The tilted angle of holographic mirror is related to the system form factor and the reflection efficiency. The total system will be built in the further research.

Acknowledgments

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References

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