

Realization of a see-through head mounted display providing an adaptive augmented reality by using an LCD panel and a dot polarizer array

Minyoung Park, Jaehee Seo, and Hee-Jin Choi*

Dept. of physics, Sejong University, 209 Neungdong-Ro, Gwangjin-Gu, Seoul 143-747, Korea

Tel.:82-2-3408-3208, *E-mail: hjchoi@sejong.ac.kr

The see-through augmented reality(AR) display is a device to make the observer recognize both the real object and a virtual image to be projected from the display device at the same time. However, current see-through AR devices such as a head up display(HUD) and a see-through head mounted display(HMD) are using optical elements to project virtual images at fixed distance. Therefore, if the projected images are away from the real environment, the observer will perceive a blurred virtual image and this situation can be a cause of visual discomfort from mismatches between different accommodation cues[1-2]. In order to resolve that problem, in this paper, we propose a see-through HMD by using a dot polarizer array which can provide an adaptive AR image whose position is not fixed.

Generally, a liquid crystal display(LCD) panel is composed of liquid crystal cells to be located between two panes of glass with polarizer films attached at each outer side[3]. Using an LCD panel with the dot polarizer array which replaces the rear side polarizer, most of the ambient light rays passes through only the front side polarizer and does not deliver image information displayed at LCD panel. Therefore, the observer can see the real object as like he/she sees through an almost transparent plate.

On the other hand, the light rays pass through the dot polarizer can construct an adaptive AR image to be generated by the principle of a lightfield display[4]. Since the location of the adaptive AR images can be adjusted to be at the position of the real object as shown in Fig. 1(a) and (b), it is possible to minimize a visual discomfort due to the mismatches between accommodation cues.

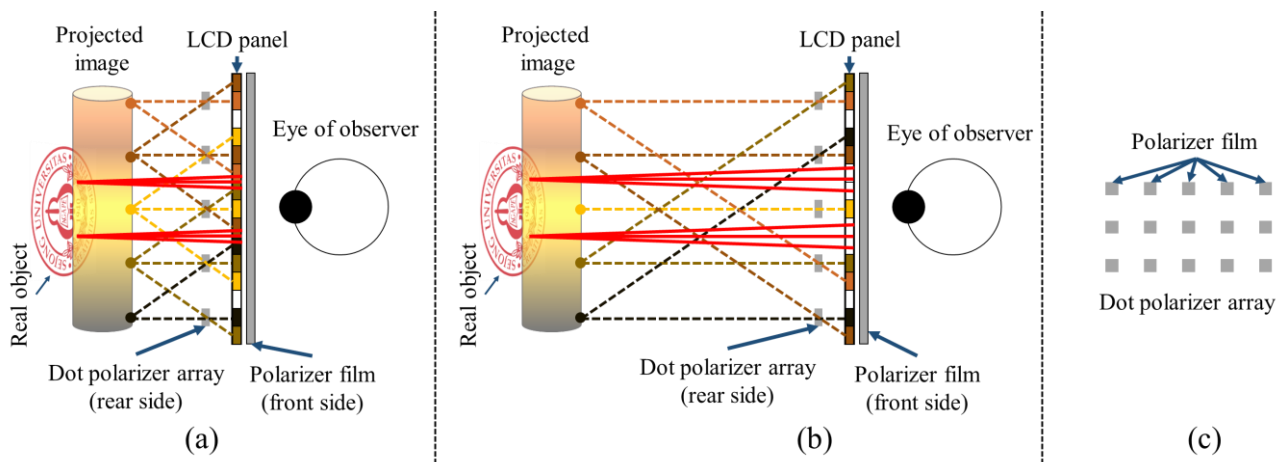


Fig. 1. Principles of the proposed see-through adaptive AR HMD: (a) with real object at near distance, (b) with real object at far distance, and (c) the structure of the dot polarizer array

Acknowledgment

This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Science, ICT & Future Planning(NRF-2014R1A1A1005458)

References

1. H. Hua and B. Javidi, *Opt. Express*, 22(11), pp. 13484-13491(2014).
2. D.-W. K, S.-K. Yoon, and S.-K. Kim, *J. Bro. Engineering*, 11(4), pp. 441-447(2006).
3. P. Yeh and C. Gu, *Optics of Liquid Crystal Displays* (John Wiley & Sons, 2010).
4. H. Choi, S.-W Cho, J. Kim, and B. Lee, *Opt. Express*, 14(12), pp. 5183-5190(2006).