

A Wearable Mixed Reality with an On-board Projector

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Abstract

One of methods achieving Mixed Reality (MR) displays is the texture projection method using projectors. Another kind of emerging information environments is a wearable information device, which realizes ubiquitous computing. It is very promising to integrate these technologies. Using this kind of fusion system, two or more users can get the same MR environments without using HMD at the same moment. In this demonstration, we propose a wearable MR system with an on-board projector and introduce some applications with this system

1. Introduction

Mixed Reality (MR) is one of advanced technologies for enhancing or augmenting a person's view of the real world with computer generated graphics. There have already been some methods of Mixed Reality display integrating virtual reality with real world (e.g. optical see-through or video see-through with head mounted display (HMD)). One of promising approach in displaying of MR has been proposed the texture projection method objects using projectors [1]. Meanwhile, wearable computing has been emerged rapidly. It is very useful to have both functions in the same time, anywhere [2]. This is because a wearable MR computing advances an innovative form of personal computing, which is brought by continuously worn, intelligent assistants with augmented memory, intellect and creative communication in physical senses. We have proposed a "wearable MR" system with an on-board projector and introducing some applications with this system.

2. Wearable MR and Projection Method

The Projection method is to superimpose texture information that a computer generates in real-time optically on real objects using projectors. If this system is realized in wearable environment without HMD, the system can presents the personalized information on the nearby projective targets for user. This system has some advantage points as compared to HMD-based systems. The first point is the assuagement of user's burden by wearing HMD. The second point, as well as the user wearing this system, the others nearby the user can get the same MR augmentation without wearing it at the same

moment. The last point is that the user can get higher 3D feeling of quality because of projecting the object directly.

3. Prototype System

The prototype system consists of a wearable system and projection targets. The wearable system has an infrared-ray light module, a camera, a small notebook PC and a compact projector (Figure 1, 2).



Figure 1. Overview of the prototype system.

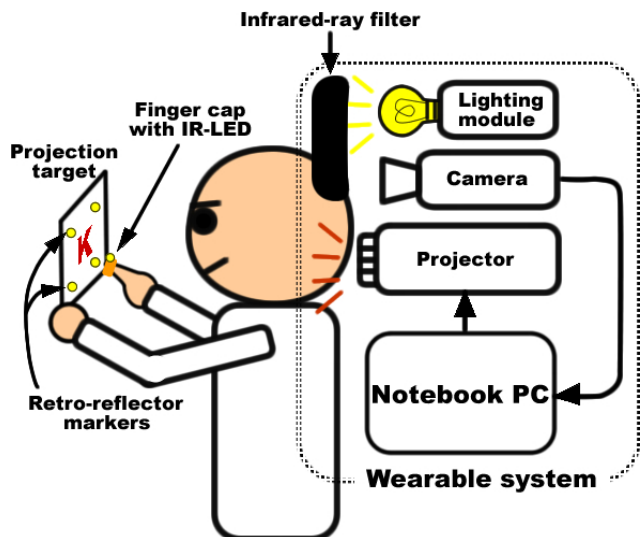


Figure 2. Configuration of the prototype.

The projection targets made of retro-reflective sheet are located onto a paper book. The system processes as follows.

Step 1: Infrared (IR) ray is irradiated from the IR light module.

Step 2: The camera with IR filter catches reflected light from the retro-reflective markers.

Step 3: The system extracts the marker in the image and obtains the 2D position and ID of the target in front of the user, by analyzing positional arrangement of the markers.

Step 4: The system projects textural graphics according to the extracted coordinates in real-time.

4. Wearable MR applications

MR-manual is an application to presenting complementary texts, images and animations on a paper manual, which a user holds in the hand (Figure 3). This application realizes the manual having both advantages of paper and electronic instruction. By specifying a page from the discernment of marker arrangement, a system can present the information corresponding to each page.

Personalized MR-BBS utilizes fixed projection targets like a billboard (Figure 4). When the user equipping the system stands in front of the MR billboard, the system projects the personalized information for the user automatically.



Figure 3. "MR-manual".



Figure 4. "Personalized MR-BBS".

5. Interaction with Finger Action

To give an interactive function to the system, in addition to the markers, which manage the ID and position of pages, we append an interactive virtual object managing the user's interaction. There are two types of markers: button type and slide bar type (Figure 5). The interaction of a free-hand is realized by equipping with the finger cap mounted a small IR-LED. It becomes possible to change presented information or to make it change continuously by a user's intention.

6. Conclusion

We have proposed a wearable MR system with an on-board projector and realized some MR applications. Adapting the texture projection method, we can confirm the feasibility of MR environment without HMD that may spoil the workability in wearable environment. In the demonstration in the conference, we will bring the entire wearable MR system with "MR-manual" application.

7. Reference

- [1] Inami, Kawakami, Sekiguchi, Yanagida, Maeda and Tachi : "Visuo-Haptic Display Using Head-Mounted Projector", IEEE VR 2000, pp. 233-240 (2000).
- [2] B. Thomas, et. al., First person indoor/outdoor augmented reality application: ARQuake, Personal and Ubiquitous Computing, Vol. 6, No. 1, pp. 75-86 (2002).

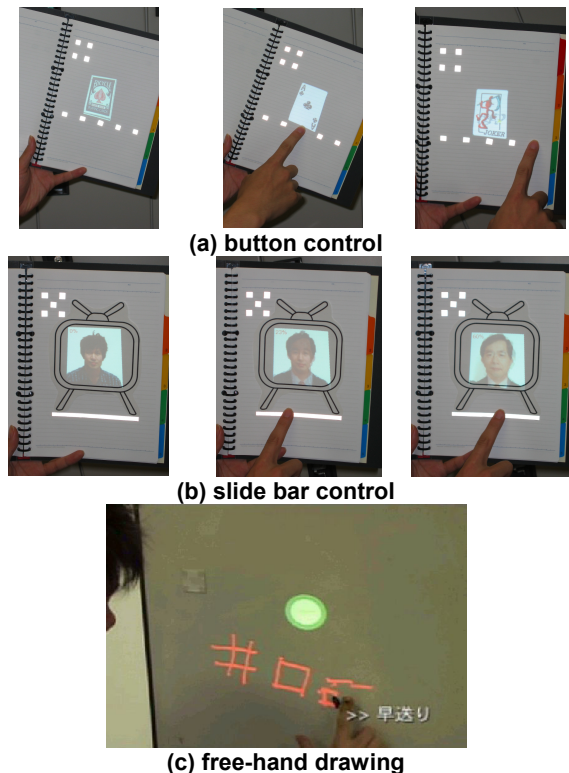


Figure 5. Interaction with system.