

INTRODUCTION

Visual effects (VFX), which composite computer-generated imagery (CGI) onto real scenes in a feature film, usually require a sequence of images that is manually generated in the post-production process. In an alternative approach, mixed reality (MR) merges the real and virtual worlds to achieve real-time interaction between users and MR space^{1,2}. In this sense, MR creates real-time VFX seen from an observer's viewpoint. These two fields, which used to be considered independent, will rapidly affect one another. VFX techniques, especially photometric registration, are useful in MR systems. On the other hand, MR technology can be utilized in film production. This sketch introduces the first MR system that is specially implemented for filmmaking.

ADVANTAGES OF MR IN FILMMAKING

The system uses the latest and highest level of MR technology. It calculates depth of objects that move around the real world in real-time so as to realize the dynamic mutual occlusion between the real and virtual objects. The MR system has the following advantages compared to virtual studio systems that are currently used in TV studios:

- No chroma-key technology. Blue or green backgrounds are no longer required. Computer-generated objects are placed not only in front of the real scene but also at any depth in the scene.
- Real-time composition of CGI and the real scene can be observed from an actor's viewpoint with a head mounted display (HMD) and from a cinematographer's viewpoint with a monitor.

These advantages can be applied to filmmaking in two ways:

1. In rehearsal, actors can view virtual characters in HMDs.
2. Depth data acquired in rehearsal can be used in the highly precise post-production process.

SYSTEM CONFIGURATION

The system is based on a video-see-through MR system as shown in Figure 1.

- Using the Optotrak system, it tracks movements of a video camera and an HMD worn by the actor.
- Zooming is digitally encoded and transferred to a computer.
- Using a computer-vision method, a five-camera depth-detection system dynamically determines the depth of real objects in the scene.

“2001: AN MR-SPACE ODYSSEY”

Using this system, we reproduced a few cuts taken from a short film produced by the film director Takashi Yamazaki, in which an actress interacts with a computer-generated creature in our MR studio as shown in Figure 2. Figure 3 shows a frame from the

movie, and Figure 4 shows a real-time frame. The director and the audience see the panning and zooming operations of the camera in real-time. The system also allows the actress to change actions and positions as many times as necessary. Through her video-see-through HMD, the actress can see and fight with a virtual creature. This makes trial-and-error experimentation in the movie making much easier, and it allows audiences to see scenes seen from the actress's viewpoint.

CONCLUSION

It may take a little while to practically apply this system to actual filmmaking. However, it may soon be utilized as a new type of entertainment in which a viewer can participate as an actor or actress.

References

1. Ohta, Y. & Tamura, H., Eds. (1999). *Mixed reality - Merging real and virtual worlds*, Ohm-sha & Springer-Verlag.
2. Feiner S., et al. (1999). Mixed reality: Where real and virtual worlds meet, in *SIGGRAPH 99 Conference Abstracts and Applications*, 156-158.

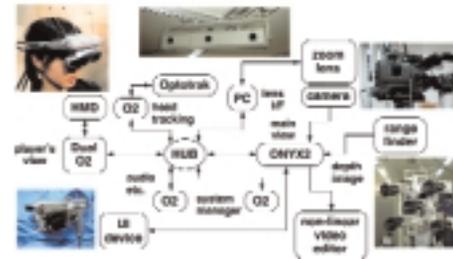


Figure 1. System configuration



Figure 2. Demonstration of the MR system



Figure 3. A frame from the VFX movie



Figure 4. A real time frame