HaptoMIRAGE- A Multi-user Autostereoscopic Visio-Haptic Display -

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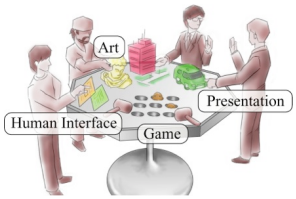

Figure 1: *Concept drawing of the proposed system*

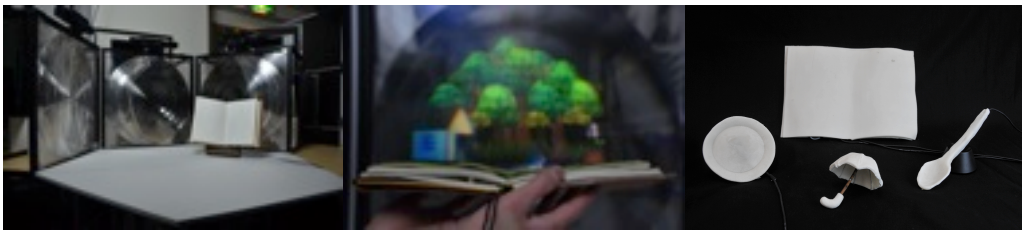

Figure 2: *System appearance*

Figure 3: *3D Real image on a tangible haptic display*

Figure 4: *Content-adjustable tangible haptic display*

Summery

HaptoMIRAGE is a visuo-haptic display that provides a wide-angle autostereoscopic 3D image on the content-adjustable haptic display so that it enables us to have an enchant interaction with the virtual world via tangible object with multi-modal sensation not only by one user but also by multi users.

Our aim is to implement a platform for storytelling, entertainment and creative collaboration by combining 3D vision and haptic sensation in shown Figure 1. Based on our active-shttered real image autostereoscopic technology [Nii et al, 2012], we have developed a 3D image projection technology for multi users that provides autostereoscopic real image in midair with a view of 180 degrees. We have also developed a content-adjustable haptic display based on the simple and realistic record & playback method [Minamizawa et al, 2012], of which we can easily design the shape and the vibrotactile sensation according to the scenario of the content.

Active-shuttered Real Image Autostereosopy

The 180 degrees autostereoscopic display consists of three components such as Figure 2; each component has 60 degrees field of view, and provides an autostereoscopic image for one user. The Fresnel lens makes the real image from the LCD display, and the position of the user is measured by camera-based motion capture system, and the active shutter using transparent LCD panel provides the time-divided rays of the light for left-eye and right-eye. Then the user can see the real image as a floating 3D image in shown Figure 3. In this way the users up to three can see the autostereoscopic image from different viewpoints at the same time.

Content-Adjustable Tangible Haptic Display

The haptic display has multiple vibrators to provide spatially distributed haptic sensation to user. In order that user can fabricate the form of the haptic display, we developed a creation method of haptic display using polymer clay and multiple vibrotactile actuators. The record and play-back method of haptic sensation is based on the method of TECHTILE toolkit [Minamizawa et. al.] and then the creator can design both the shape and applied sensation according to the content such as Figure 4.

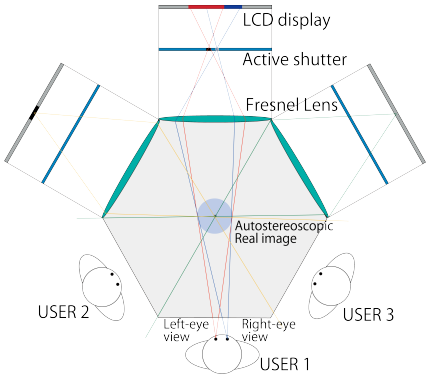

Figure 5: *System construction of the autostereoscopic display*

User Experience

By using Active-Shuttered Real Image Autostereoscopy method and contents adjustable haptic display, we realized that multiple users could experience with 3D contents via using haptic display. The user can sense the vibro-tactile sensation from the feeling of moving or texture of 3D contents. Additionally to this, haptic display can be fabricated various shapes that are contents adjustable. Therefore, the user can experience the story with using the objects that includes the world of story.

Acknowledgment

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References

NII, H., ZHU, K., YOSHIKAWA, H., NYAN, L, H., ROLAND, A., AND NAKATSU, R. 2012. Fuwa-Vision: An auto-stereoscopic floating-image display. In Proceedings of ACM SIGGRAPH Asia 2012 Emerging Technologies Singapore.

MINAMIZAWA, K., KAKEHI, Y., NAKATANI, M., MIHARA, S., AND TACHI, S. 2012. TECHTILE toolkit - A prototyping tool for design and education of haptic media. In Proceedings of ACM VRIC 2012, Laval, France.

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