Title of Project : Systematizing and Consolidating a Technological Basis of Mixed and Diminished Reality Space

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Research Area : Virtual Reality
Keyword : Mixed Reality, 3D Sound, Immersive Display, Diminished Reality

【Purpose and Background of the Research】

MR (Mixed Reality) technologies have recently been expected as innovative IT representation technologies, which are emerged from extensive research efforts for VR (Virtual Reality). In this project, we aim to establish fundamental technologies for constructing MR space with higher quality presence of multi-modal information by pursuing more generalized scheme of conventional MR technologies in the following research directions.

One direction is a simultaneous establishment of both visual and audio MR technologies for constructing multi-modal MR space. The second direction is high quality DR (Diminished Reality), which is a technology for visual removal and hiding of real object in the scene.

【Research Methods】

Research Topic A (MR Experience with High Realistic Sensation in Immersive Audio and Visual Space): By developing our sound image planetarium system [1], the audio and visual integrating MR system can provide the experience of high realistic sensation for users (Fig.1). As an audio technique, we would overcome the following problems: distance of sound image, reverberation, moving sound sources, and multiple concurrent users experiences. As a visual technique, we attempt to develop a new MR display system using both a background display on the dome wall and a video see-through HMD.
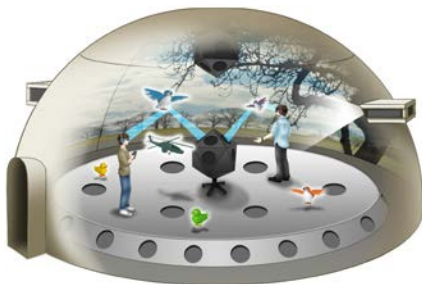

Fig. 1: Sound image planetarium system

Research Topic B (Development of Key Technologies and Establishment of Methodological Scheme for DR): DR is an extended technology from MR with more difficulties. Regarding DR as a superimposing of hidden background images onto the target scene [2], we aim to establish a framework of the methodologies of DR via systematic experiments and component technologies. This topic is categorized into two cases: B-1) Static hidden background, and B-2) Dynamic hidden background. For performing the experiments for this purpose, we will build a video capturing studio with dimmer control and moving camera holding equipment for making practical situations for DR.
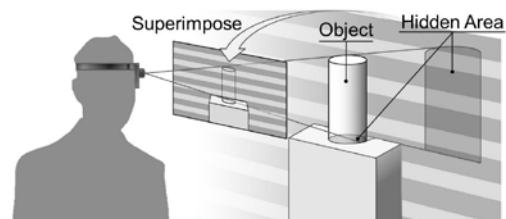

Fig.2 Concept of DR by superimposing hidden area

【Expected Research Achievements and Scientific Significance】

By performing this unique research in the world, the audio and visual integrating MR and the sound image planetarium system can achieve both high-definition sound and practical use. Our hand-made parametric loudspeaker would bring an innovation to new fields with our application which is very unique and may acquire the focus of industry fields.

In the topic B, we plan to publish software and data generated from this project in addition to academic articles, so that this project can lead and stimulate the research activities in this field, which increases the number of researchers and related research projects.

We believe that our DR project will provide clear definition of the problems in MR technologies. After solving such problems during the term of this project, MR application will be extended into various areas, such as art and education, civil engineering, safe and security.

【Publications Relevant to the Project】

[1] Y. Sugibayashi, T. Nishiura et al.: "Three-dimensional acoustic sound field reproduction based on hybrid combination of multiple parametric loudspeakers and electrodynamic sub-woofer," Applied Acoustics, Vol. 73, No. 6 (2012)
[2] S. Mori, R. Ichikari, F. Shibata, A. Kimura, and H. Tamura: "Framework and technical issues of diminished reality," Trans. of VRSJ, Vol. 16, No. 2, pp. 239 - 250 (2011) [in Japanese]

【Term of Project】 FY2012-2016

【Budget Allocation】 166,500 Thousand Yen

【Homepage Address and Other Contact Information】

http://www.rm.is.ritsumei.ac.jp/kiban-s/eng/