

Virtual Interior Design System based on Mixed Reality Technology

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Abstract. A virtual interior design system based on mixed reality technology is proposed in this paper. The mixed reality technology is a concept covering augmented reality that shows graphic objects integrated to a real environment. This paper describes design of a virtual interior design system that can change and display building inside interior design using mixed reality technologies in a ubiquitous computing environment. The virtual interior design system proposed in this study consists of a hardware platform that can receive and process data from various sensors and a virtual interior design application that displays interior design based on the processed information. The system proposed in this paper will develop into services to the extent which can be directly used in the field if subsequent studies are carried out.

Keywords: Mixed Reality, Virtual System, Interior Design, Ubiquitous Computing Environment

1 Introduction

Ubiquitous computing is a concept proposed first by Mark Weiser at Xerox Palo Alto Research Center in 1988, referring to an environment in which users can have services of seamless computing anytime and anywhere. For this, all objects should be connected to a network, and an interface with which anyone can easily use devices without any difficulties should be provided [1].

Also, with the sensor technologies and communication technology, as the accuracy of information recognition gradually gets higher, the method of showing the information attracts more attention. In this environment, as a method of displaying information, augmented reality (AR) technology is much in use. Augmented reality is a technology that shows virtual objects in the real world that a user sees [2]. In contrast, the technology that projects the contents of the real world to a virtual environment is called augmented virtuality (AV). Paul Milgram and Fumio Kishino proposed mixed reality (MR) as a concept that covers both augmented reality and augmented virtuality [3]. The integration of these two concepts is defined as mixed reality. Fig. 1 shows this concept. This paper describes a virtual interior design system

in which users can change and view building inside interior design using mixed reality technologies in ubiquitous computing environment.

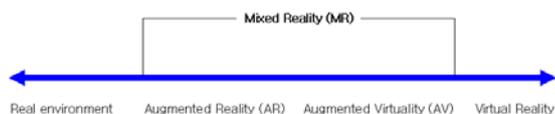


Fig. 1. Mixed Reality Spectrum

2 Hardware of Virtual Interior Design System

GPS Global Positioning System is used sometimes instead of markers. However, GPS was manufactured for outdoors, it is inappropriate to use it in an interior environment. This paper measures the distance to the terminal using terrestrial magnetism sensors and supersonic sensors, based on which it describes the method of registering actual environment and virtual objects. And to change interior design in the actual environment, it describes interior design applications that can change wallpaper materials, lighting and visual points, etc. The existing virtual interior design systems have not been used in interior design with important sense of realism as they used three-dimensional graphic spaces only, so did not reduce the gap with the reality. Also, in apartment model houses or exhibition spaces for remodeling, by providing only one kind of interior design in one place, various interior designs have not been provided in interior design services. The virtual interior design system described in this paper supplements these weaknesses using mixed reality.

The virtual interior design system in this study is to allow users to simulate drawing interior designs and changing various environmental factors immediately at the sites with one smart terminal without needing another device. Interior design businesses can provide clients limitless interior design factors such as wallpaper, tile, windows and furniture, etc. and the clients of interior design can simulate various interior designs in advance, so their satisfaction can be promoted after the completion.

The hardware system grasps the position, direction and acceleration of a smart terminal provided with services. Recent smart terminals are equipped with a terrestrial magnetism sensor that finds directions and an acceleration sensor that finds the position and acceleration of the terminals. So, through these sensors, accurate information from the camera built in the smart terminal is obtained and positioned to the same space as the objects in the three-dimensional virtual space to match the three-dimensional virtual space with the actual space. To realize the best sense of reality and service various interior designs, it is essential to obtain the accurate position information of the camera.

However, since general phones do not have a built-in sensor that can measure distances, this paper designs and uses an embedded system. In designing the embedded system, among AVR family of ATMEL Company, AVR ATmeda128 [4] that is often used for practices in the field with the highest performance was used. Along with this micro controller, supersonic sensors, acceleration sensors and terrestrial magnetism sensors are used and through an analog digital converter (ADC), data were obtained.

3 Virtual Interior Design Application System

If the actual camera's three-dimensional position coordinate and slope, direction and screen information are found through the hardware system, an application that can display building inside interior design using this information is necessary. Since in this paper, the virtual interior design application uses sensor data in the ubiquitous computing environment in which these functions are carried out, this is called u-interior design application. The following Fig. 2 shows the screen of the application.

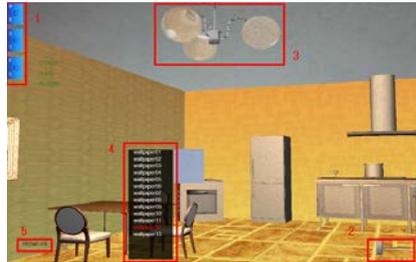


Fig. 2. The screen of the application

4 Conclusion

With the development of mixed reality technologies, new services emerge in ubiquitous environments. This study implemented a system that can display and check interior designs in the ubiquitous environment using the mixed reality technology. In the mixed reality, the problem of registering actual space and virtual space is very important, and this paper used supersonic sensors, terrestrial magnetism sensors and acceleration sensors instead of makers to improve weaknesses of using them. The proposed mixed reality based interior design system in this study will develop services that can be directly used in the field if subsequent studies are carried out further, and it is expected that its blending with sensor technology will have a great potential of development.

References

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