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A Study of Immersive Game Contents System Design and Modeling for Virtual Reality Technology

Jung-Yoon Kim[1] and SangHun Nam[2]

[1]*Graduate School of Advanced Imaging Science, Multimedia & Film, Chung-Ang University*
[2]*Center of Human-centered Interaction for Coexistence*
kjyoon79@gmail.com, sanghunnam@gmail.com

Abstract

The Virtual Reality (VR) technique based on computer graphics has been rapidly evolving over the years. VR has emerged to set a trend for developing applications and virtual environments. This paper introduces the trend and features through case studies about the game contents system for immersive interaction among these virtual reality techniques. The proposed methodology utilizes the Unified Modeling Language (UML) for immersive systems intended for future games using a virtual reality technique. The modeling of the design has been compared with using the flowchart methodology to verify its significance.

Keywords: *VR (Virtual Reality), AR (Augmented Reality), Game System Design, Game System Modeling, Immersive Game, Game Telepresence, Unified Modeling Language (UML)*

1. Introduction

Recently, the Virtual Reality (VR) technique is rapidly developing as it used in various media such as novels, movies, and games. Virtual Reality, also known as immersive multimedia, refers to a computer simulated environment which is capable of simulating the physical presence of users in the real or imaginary worlds. The user can be immersed actively, feeing their existence, and acting the real virtual reality which was brought by the development of the Augmented Reality (AR) technology [1].

As an example, the Head Mounted Display (HMD) and Data Glove (DG) can make users feel their presence in the real world. HMDs are like eye glasses worn on the head and the DGs are on their hand to express actions using their bare hands. These devices can allow them to recreate sensory experiences with the aid of a technique control program that includes olfactory sense and taste over visual, auditory and touch sensation, smell, sound, etc. that interacts with them in a real time realm [2, 3].

This paper aims to design the user experience to be actively immersed to the virtual world in the immersive game contents for virtual reality technology. The virtual world in this kind of game needs to be designed and implemented in such a way that the user need to create, arrange and perform the works freely in expanded 3D virtual work space. Thus, it is observed that designing and defining a complicated system is necessarily an important issue when implementing a virtual reality based on game contents. In order to address these issues, this paper has proposed a design methodology based on the Unified Modeling Language (UML).

The rest of this paper is organized as follows: Section 2 discusses the related studies; Section 3 outlines the immersive virtual reality game contents modeling using flowchart; using UML for the design modeling of immersive virtual reality game contents is provided in

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Section 4; the comparison of the methodologies for the design modeling is discussed in Section 5; and the concluding remarks in Section 6.

2. Related Works

Virtual reality aims to allow the users to experience telepresence in the real or imaginary worlds. The term presence here means "a sense of being in some environment", thus, telepresence could mean to experience an existence in some environment using a communication media. Currently, virtual reality environments are mostly visual experiences, but some of the simulations include sensory experiences, such as sound, taste, smell, etc. However, advanced haptic systems includes tactile feedback technology that recreates the senses of touch, vibrations, or motions to the user which are popular in medical, gaming, and military applications [9,10,11].

There are six identified features that is needed to experience virtual reality: (1) the social richness that the user can feel socially and intimacy whenever interacting with the media; (2) the reality of how much the media expresses the existence of an object, incident, or people; (3) the transportation that can give the users a feeling like they exist in some other places; (4) the immersion that gives a feeling like falling in a virtual environment through the media; (5) the existence of a social actor within the medium wherein the user can feel in the situation like a character or object in the interactions; and (6) a situation where the medium acts as the social actor. The medium itself can be a performer and the user can feel the presence when interacts with the other users.

The fundamental task of virtual reality is how to combine communication medium and the human body. The complete combination of technology and human body, namely embodiment, refers to the virtual reality, and to move forward is the purpose of the communication technology [4, 5, 6]. The remote communication environments could provide virtual presence for the users using the concepts of telepresence or telexistence through the use of input devices such as HMDs and DGs.

Thus, the real worlds can be immersed with the simulated environment to create a lifelike experience such as in the virtual reality games as proposed in this paper. High fidelity virtual reality experience can be very difficult to achieve due to the limitations on the image resolutions, communication bandwidth, processing power, etc. However, the development of CAD application programs, accelerated graphics hardware, HMDs, DGs, and other advanced technologies have helped overcome the such limitations with cost effectiveness. The virtual reality applications are usually related to immersive, highly visual, 3D environments.

3. Virtual Reality Game Contents Modeling using Flow Chart

This paper proposes a virtual game modeling using the immersive user interface that connects the user's movements to the virtual workspace. The expectation space composition of the immersive user is depicted in Figure 1 wherein the design offers a related service from the real world.

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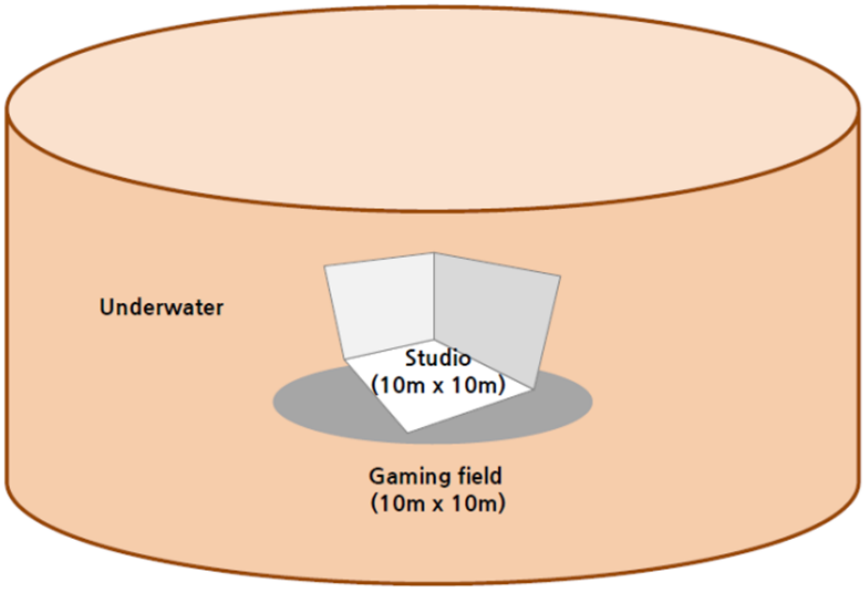
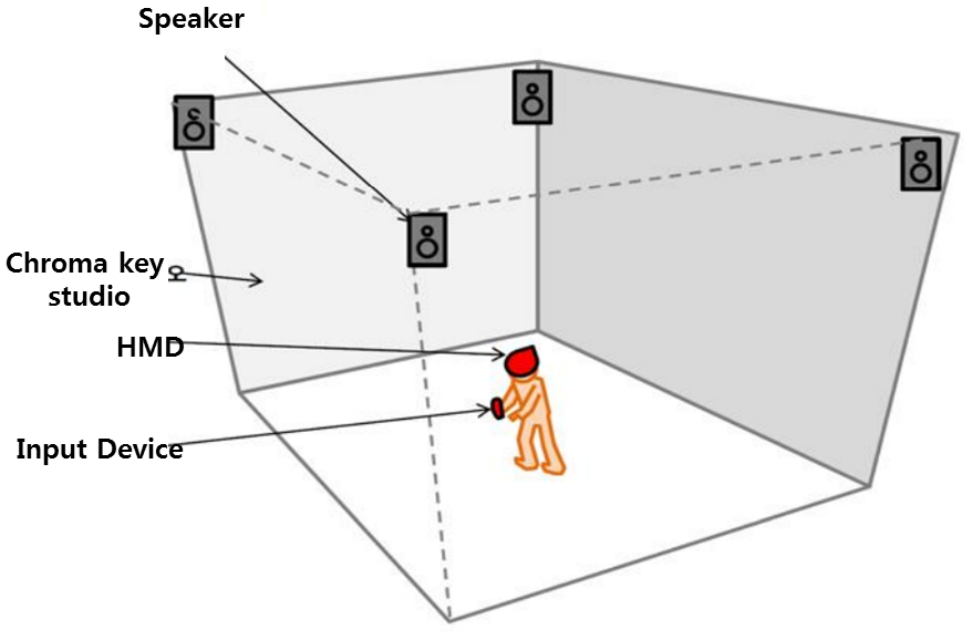


(1) Immersive Virtual Reality Game Studio Conceptual



(2) Immersive Virtual Reality Game Studio Hardware

Figure 1. Immersive Virtual Reality Game Studio

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The scenario that is depicted in Figure 1 shows the user's experiencing the immersed virtual environment as he is in the virtual environment. This scenario will be designed using flowcharts for immersive virtual reality game contents modeling. Flowcharts are types of diagrams that can represent the game flow represented by an algorithm, workflow or process, and showing the steps connected by arrows which could illustrate the game flow model.

The immersive virtual reality game contents flow is outlined in Figure 2. The use of wearable immersive user interfaces was indicated, such as HMD, in order to receive video output and generate 3D virtual spaces and through the gesture modeling for data input process. Figure 2 shows flowchart for the virtual work space module modeling that indicates all possible functions and applications [7, 8, 11].

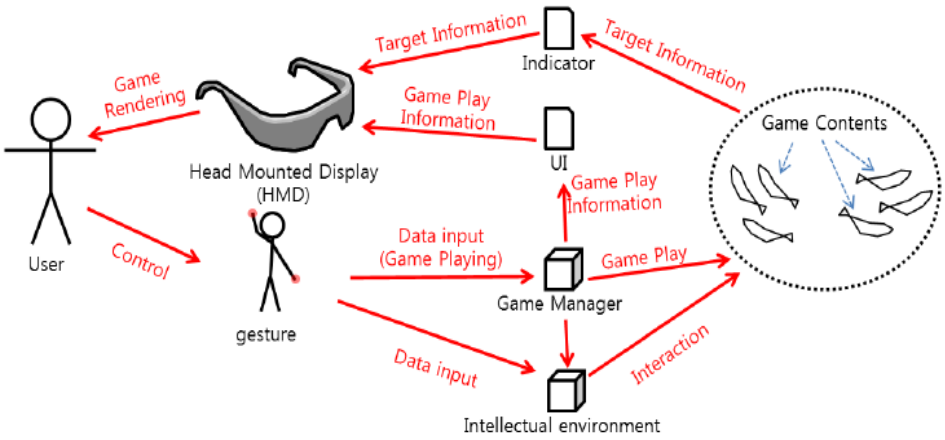

Figure 2. Immersive Virtual Reality Flow Chart

The game flowchart for the immersive virtual reality game contents is depicted in Figure 3. Based on the user commands from the game user, the input/output modeling will be formed accordingly based on the environment and contents rules [7, 8, 13].

Figure 3. Immersive Virtual Reality Game Play Flow Chart

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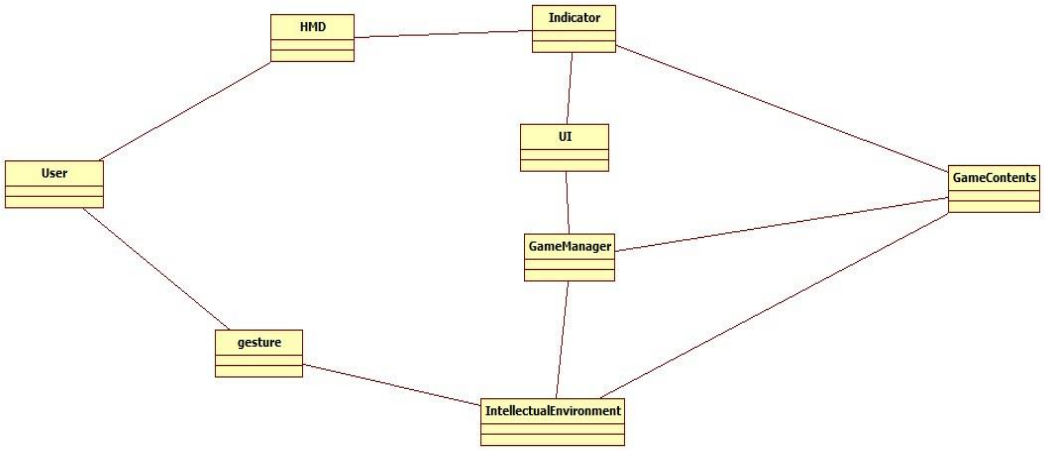
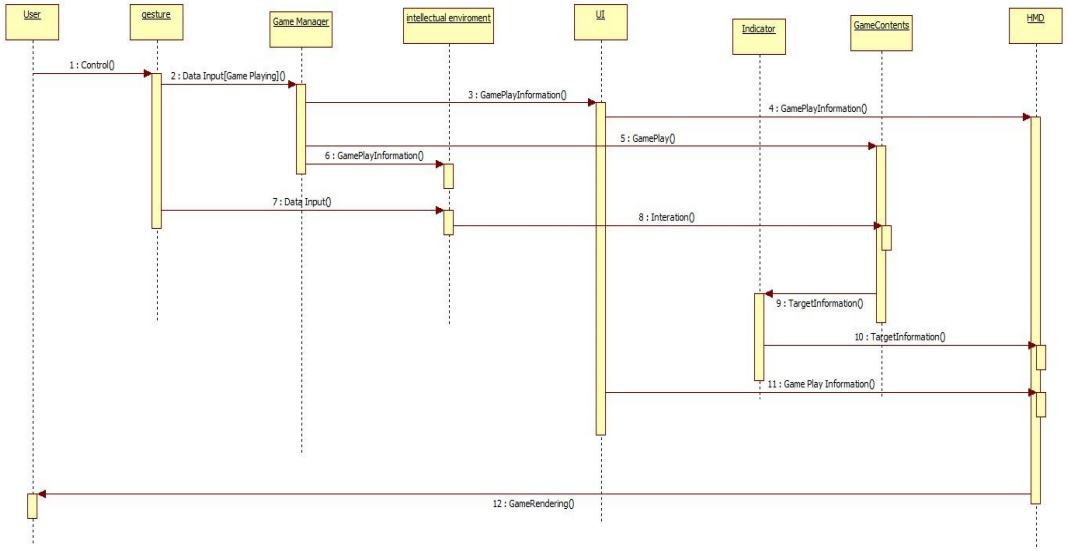
4. Immersive Virtual Reality Game Contents Design Modeling using UML

The general game contents modeling method of immersive virtual reality game contents using UML will be presented in this Section. Figure 4 and Figure 5 shows the modeling of the immersive virtual reality game contents using Unified Modeling Language (UML) class diagrams and sequence diagrams.



(a) Immersive Virtual Reality Class Diagram



(b) Immersive Virtual Reality Sequence Diagram

Figure 4. Immersive virtual reality using UML

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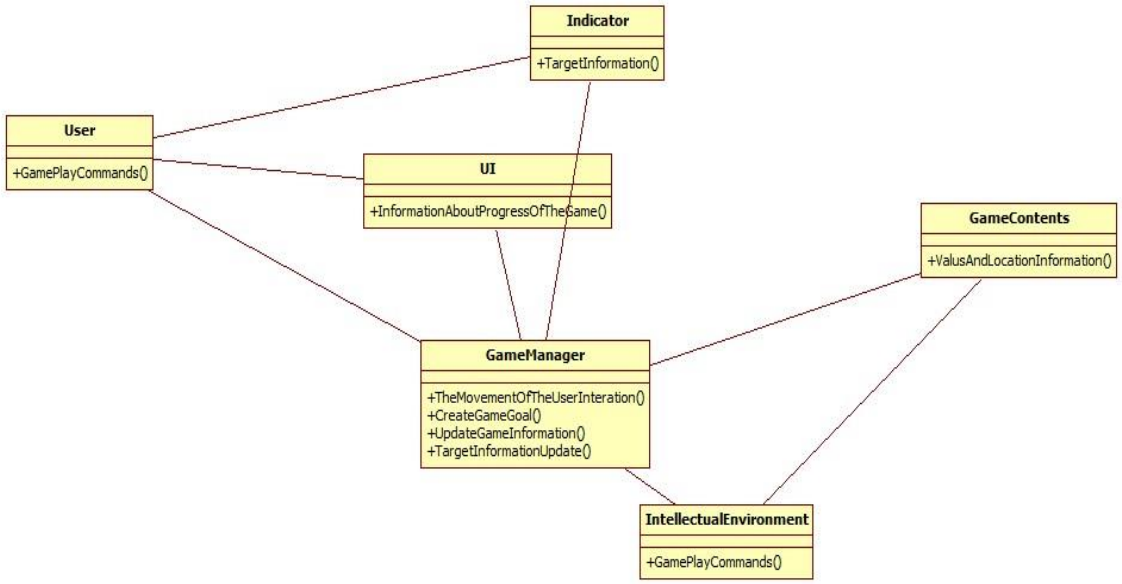
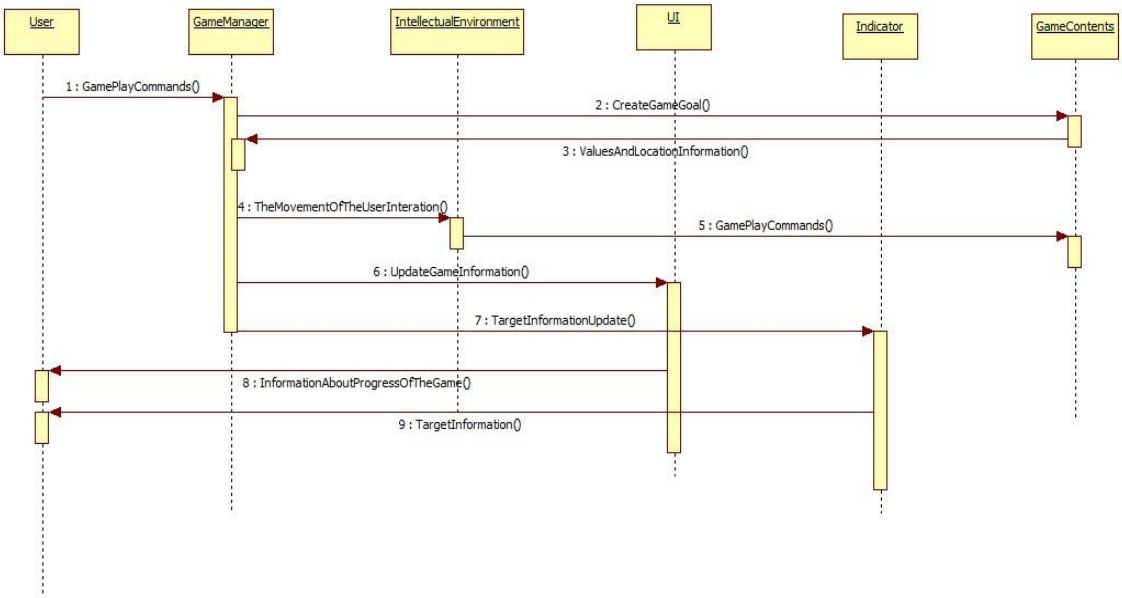


(a) Immersive virtual reality game design Class Diagram



(b) Immersive virtual reality game design Sequence Diagram

Figure 5. Immersive Virtual Reality Game Design Using UML

As depicted in Figure 4 and Figure 5, the visual and logical expressions can be provided when using the UML in order to check the more detailed design method form as compared to that of using flowcharts. The UML as a general-purpose modeling language in game contents provide a standard way in visualizing the design of the immersive virtual reality game contents system.

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5. Discussion of the Comparison and Analysis

The proposed design methodology is compared and analyzed with the exiting general flowchart methodology in systems design. Table 1 shows the capabilities of visual expressions and logical expressions using UML as compared to the existing general design methodology using flowcharts.

Table 1. Flow Chart Design Methodology and Comparison and Analysis of UML

	Flow Chart Design	UML
Expression of Visual	Advantages: Possible to express visual. Disadvantages: Larger-scale complication.	Advantages: Possible to express visual with class diagram and sequence diagram. Disadvantages: UML need to understand
Expression of Logical	Advantages: A simple visual expression. Disadvantages: Possible to express visual but can check complication.	Advantages: Based on object-oriented language, complicated data is able to express logically. Disadvantages: UML need to understand
Result	Hard to express when gaining system. Highly use then simple design.	Possible for visual expression, complicated data is possible to express logically.

Based on the results given in Table 1, it is indicated that using UML for modeling the immersive virtual reality game contents can be more efficient as compared to using the general flowcharts. Both of the methods include decision points, actions, and action blocks, however, flowchart does not include “and” states and its operations cannot receive events as inputs. The understanding can be shared by using UML in a standardized way while flowcharts are limited in sequential process modeling only.

6. Conclusions

This paper designed the immersive game contents model using UML based on virtual reality technology. UML has been used to design immersive user interfaces, recognize movements through HMD and gesture recognition, design virtual reality based on game contents system through 3D virtual spaces and modeling. The proposed design methodology using UML was found to be more efficient and standardized in terms of using visual expressions and logical expressions capability as compared to that of the general flowchart methods.

In the future, the implementation of the immersive game contents based on design methodology using UML will be evaluated and more realistic virtual reality based on game contents will be studied.

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Authors

Jung-Yoon Kim, he received the B.S and M.S. degree in Game engineering from Hoseo University. He received Ph.D. degree in Game engineering from graduate school of advanced imaging science, multimedia & film in Chung-Ang University. His research area includes Game Design, Game ART and Game AI, Virtual Reality Technology.

SangHun Nam, he received the B.S degree in mechanical design from Chung-Ang University. He received M.S and Ph. D degree in Image science from graduate school of advanced imaging science, multimedia & film in Chung-Ang University. His major is computer graphics & virtual environments. He completed a post-doctoral course at virtual environment Lab in Chung-Ang University from 2012 to 2013. His research area includes virtual environments, spatial sketch and interaction, interactive media art.

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