

User study of VR basic controller and data glove as hand gesture inputs in VR games

Seokwon Lee, Kihong Park, Junyeop Lee, Kibum Kim

Department of Game and Mobile Engineering,

Keimyung University

Daegu, Republic of Korea

kalee7878@gmail.com, epzmfhs@naver.com, dlwnsduq111@naver.com, kibumkim@kmu.ac.kr

Abstract—This paper reports work-in progress for the usability study of VR basic controller, an HTC vive controller and a handmade data glove in the context of VR games. We compared the effectiveness of those two input hardware as hand gesture inputs in VR game.

Keywords—VR, On-air inputs, Controller, Data gloves, Hand Gesture, Game

I. INTRODUCTION

It is not exaggerated to say that the majority of virtual reality-based industries are game industries. As a result, more and more people are interested in VR games. To answer these demands, the industries quickly responses by making many different VR products such as Oculus Rift, HTC Vive and Sony PlayStation VR. Currently available basic commercial VR sets are composed with an HMD (Head Mounted Display), two basic controllers, and base stations which track the positions of an HMD and controllers. As gamers, we started to wonder whether these basic controllers are the ideal input device for VR games. We thought about the alternative input devices for VR games. The various general input devices for computers are mouse, keyboard, joy stick and nowadays even hand gestures for natural user interfaces. Among these inputs, we paid attentions on hand gestures because using hand gestures might support more immersive feeling than using a mouse, a keyboard, or a joystick. Therefore, in this study, we investigate the usability of two different input devices as supporting hand gestures in VR games, which are basic controllers and data gloves.

II. RELATED WORKS

The paper ‘Comparative Study on the Interface for Manipulating 3D Objects in a Virtual Reality Environment’[1], measure the usability of three different virtual reality environment, a desk with a keyboard and mouse, a desktop with a leap-motion and HMD with hand geusture. However, since this experiment only measures the process of manipulating a few of 3D objects, it is very different from the game environment where various situations are given, and we expect that unexpected results may occur when various situations are given. The other

paper ‘Swordplay: Innovating Game Development through VR’ [2] produces a test game whose the major is drawing certain patterns with hands, and therefore user can use ‘spells’ to change skills or weapons. We replace the spell-based method in a different way, taking into account the fact that drawing pattern’s may not be recognizable or memorable in the actual game.

III. EXPERIMENT DESIGN

A. Purpose of experiment

The most important thing of the virtual reality game is immersion. Virtual reality has a property called ‘transparent immediacy’ [3] which allows users to forget the existence of media and believe that they are in the virtual world. However, in the case of a virtual reality game, it is matter to do actual manipulation rather than just viewing the game, so if the interface becomes less relevant to the actual motions that users are currently posing, it will interfere with the immersion. Therefore, we use HTC’s VIVE basic controllers which is already popular around the world and data gloves for hand gestures to find out which one of them is more immersive to VR games than the other one.

B. Equipment

We compare VIVE controller(Figure1) and data glove(Figure2) to find out which one is a better interaction device. The VIVE controller is one of the popular VR controllers, and it is comfortable to use and has shown great performance. our data gloves are focusing on two functions. Bending sensors are used to examine which fingers are bending or not, and the "MPU6050 6-axis sensor(Figure3, Figure4)" are used to detect the rotation and movement of the hand. The data glove is examined to determine whether the user can easily understand how to use it , and whether the gesture is useful to attack a target in the range..



Figure 1. HTC VIVE [4]



Figure 2. Data glove for hand gesture

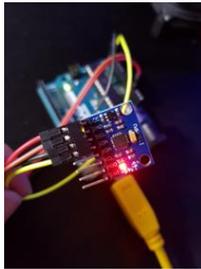


Figure 3. Six axes sensor - MPU6050



Figure 4. MPU6050 Test

C. Game Production

The basic form of our game is similar to the game 'Vanishing Realms(Figure5)' [5]. The genre that can call high tension and immersion in a short time with virtual reality device is action genre. Among many existing action games we decided to refer a game named "Vanishing Realms", that is capable of interlocking with two devices.



Figure 5 Vanishing Realms [6]

D. Game Conception

The overall scenario of the game is the similar to "Vanishing Realms" and we develop not only the basic controller of HTC VIVE but also the data glove. The key point in game developing is to recognize the motion of the general attack (i.e., swing controllers) and open the skill menu in virtual space to select and use skills.

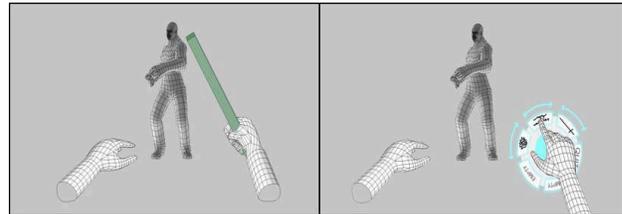


Figure 6 Game conception

While playing the game, the trigger button on the basic controller will be held down to wield the sword. In case of data gloves, when the hand is clenched, the sword will be attached to the hand. As for the method of opening the skill menu, the trigger button on the basic controller should be released, then menu GUI is create around the right hand and then the skill can be selected through the trackpad. When using the data glove, the menu GUI will be created when all fingers are unfolded, and the skills can be selected through the rotation of the hand.

E. Experiment Procedure

The experiment procedure is as follows. The experiment will be run for a total of three minutes. Within the game, three situations are given to participants at one minute interval, and the participant will play the same game with two different interfaces. After the test is over, we will hand over the questionnaire to participants to fill out for usability evaluation of both devices.

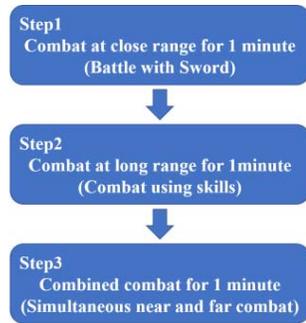


Figure 7 Flowchart of game

F. Survey for evaluation

The questionnaire for evaluation is based on the following criteria: responsiveness (“Did the interface respond well as user intended?”), Accuracy (“Did the interface perform well during the operation”), understandability (“Was the interface easy to understand?”), user preemptiveness (“Was the interface adjusted as the user desired?”).

IV. CONCLUSION

We are currently working on prototype of VR game after finishing experiment planning and game design. We expect that the users will prefer to use the data gloves as hand gesture interface more than to use the controller. Through this study, we will explore whether our expectation will be right or not, and we will find out why and what causes the result.

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