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ReVo 2017: Laval Virtual ReVolution 2017
"Transhumanism++"

ARSuikawARi

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ABSTRACT

This system enables the user to experience *Suika-wari* play in augmented reality world. *Suika-wari* is a Japanese popular play commonly played by the seaside in summer. The main player tries to hit a watermelon (*suika*) with a stick while being blindfolded and surrounding players indicates the position of the watermelon only with the voice.

In this system, the visitors play either roles of the two players. The players share the same augmented reality world where a watermelon is placed. Original play usually uses only one watermelon, but we offer the joy to hit as many watermelons as possible during a certain period.

Categories and Subject Descriptors

Entertainment VR
New Game Systems

General Terms

shared virtual space
augmented reality
optical signal transmission

Keywords

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1. INTRODUCTION

Have you ever heard about the play "Suika-wari" in Japan? *Suika-wari* is a Japanese popular play commonly played on the beach in summer (Fig.1). There are two groups of players. The main player (crusher) tries to hit a watermelon (*suika*) with a stick while being blindfolded and surrounding players (guiders) indicates the position of the watermelon only with their voice.

In this system, the visitors can play either of two roles. If there are not enough players, we will play the other role.

In our system, the watermelon is placed in the augmented reality (AR) world. The crusher does not wear any visual devices to show the image of the watermelon. The guiders hold a tablet that shows the watermelon in AR world. While the crusher cannot see the watermelon, he is still blindfolded so that the guiders cannot point the position with hands. They should lead the crusher only with their voice.

Original play usually uses only one watermelon, but we offer the joy to hit as many watermelons as possible during a certain period.

It is fun to play Suika-wari, but actual play requires a wide space, the cost to get the watermelons and to clean up the place after crushing. Within the AR world, you can easily enjoy the play without such troubles.

2. Concept

The AR world is shared with the crusher and the guiders. Nevertheless, the information is asymmetry. The crusher detects the position of the watermelon only with the vibration in his hand, while the guiders are able to observe the watermelon and the communication method is limited to the oral expressions. They should achieve the mission to hit the watermelon in the AR world within the limitation.

Similar situation is expected to realise in the near future when users are trying to collaborate in an AR world with asymmetrical information. We try to simulate such situation with the system.

Fig.1: Suika-wari[1]

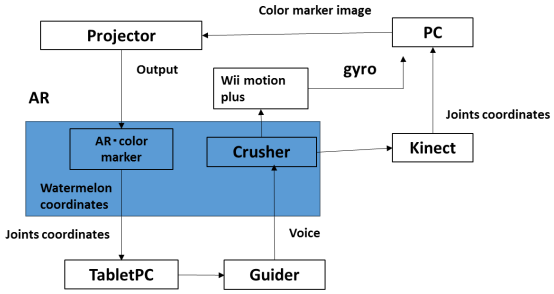

Fig.2 System Overview

3. Experience of Players

There are two roles of players: crusher and guiders.

The crusher is blindfolded and holds a Wii controller. The controller represents a stick to hit the watermelon.

The guiders hold a tablet PC. On the screen, the image from the camera of the tablet is displayed. When the tablet recognizes the markers, the stick and the watermelon are displayed at the corresponding place on the screen (Fig.3).

The crusher does not know the position of the watermelon, so the guiders should lead them to the position. When the crusher swings the Wii controller and it hits the watermelon, the controller vibrates and the watermelon is crushed. Afterwards, another watermelon falls from the sky at random place.

The play will terminate when a certain period of time has passed.

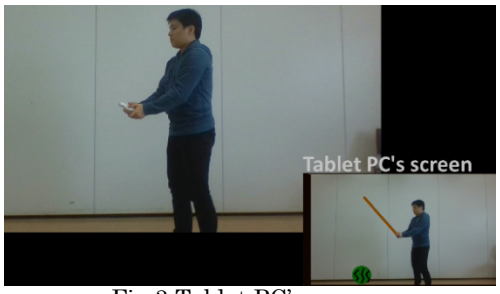

Fig.3 Tablet PC's screen

4. ARColorMarker

We have implemented an optical data transmission system: ARColorMarker. This is similar to typical AR marker, except for the colored area surrounding the marker, and it is possible to encode values to the colored area.

Typical markers are able to transmit a static data with good precision such that two dimensional marker represents long string of an URL. Nevertheless, it is not capable of transmitting dynamic data such as the coordinates of moving objects. The encoded marker changes so rapid that it is impossible to capture with the camera.

With ARColorMarer, the precision is not good as typical markers, but it is robust to the rapid change of value and it could be used to transmit dynamic data. Two areas are used to calibrate the projectors and the surface of the projection.

When the marker is recognized by a receiving device, the positions of the colored areas are determined and the values are decoded from the image.

There are three process of accuracy degradation of the values. When encoding to the color, the value should be truncated to the range of 0 to 255. The linearity of the brightness of projector and

the camera output are not accurate. Furthermore, when the receiving device captures the image, it does not have the range of 0 to 255, but certain range that is far narrow from the original.

We have been experimenting and improving the system, and currently achieved about 5% of accuracy, which means 5cm accuracy within the range of 1m area.

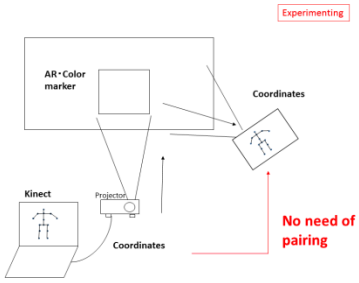

Fig.4 Transmission System

5. System Components

There are four main components in this system.

The position and movement of the crusher is detected with KinectV2. Simultaneously, the detected joints of the crusher are used to determine the coarse position and orientation of the stick.

The orientation of the stick is refined with the information from the Wii controller. The controller is connected to the main computer via bluetooth. It is also used to provide vibrations when the stick hits the watermelon. The acceleration of the swing of the stick is calculated from the Wii controller, because Kinect is found to be incapable of acquiring the movement correctly.

The main computer gathers information from Kinect and Wii controller. The system is implemented on Unity[2] in C#. The bluetooth connections are also achieved in C#. The position of the watermelon and the position and orientation of the stick is encoded to the ARColorMarker and projected onto the wall.

The tablet PCs recognise the ARColorMaker from the camera image and decodes the information. Based on the information, the stick and watermelon are displayed on the camera image and the AR image is constructed. The system is implemented on Unity, and the marker is detected with Vuforia[3] library.

References

[1] Summer Event of Japan Suikawari, https://en.wikipedia.org/wiki/File:Summer_Event_of_Japan_Suikawari.jpg (Wikipedia, the free encyclopedia)
[2] Unity - Game Engine, https://unity3d.com/jp/
[3] Vuforia | Augmented Reality, https://www.vuforia.com/