

Implementation of 3D Drawing to Interactive Display System

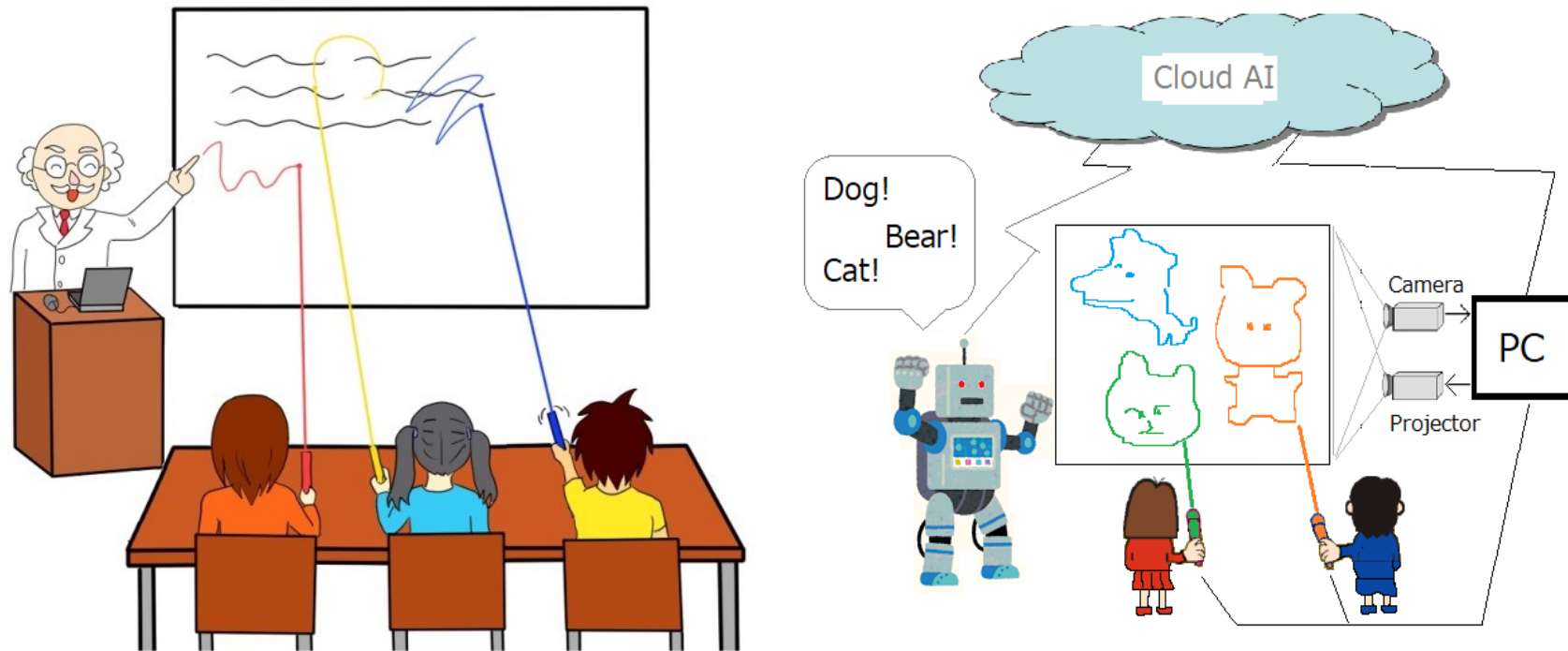
National Institute of Technology, Nara College, Department of Electrical Engineering

Taiki Kato

Shigeki Doi

Introduction

In recent years, the application of new information technologies such as AR (augmented reality), gamification and image processing in the amusement field is progressing. Our laboratory has developed "light crayon system" based on the image processing technology.

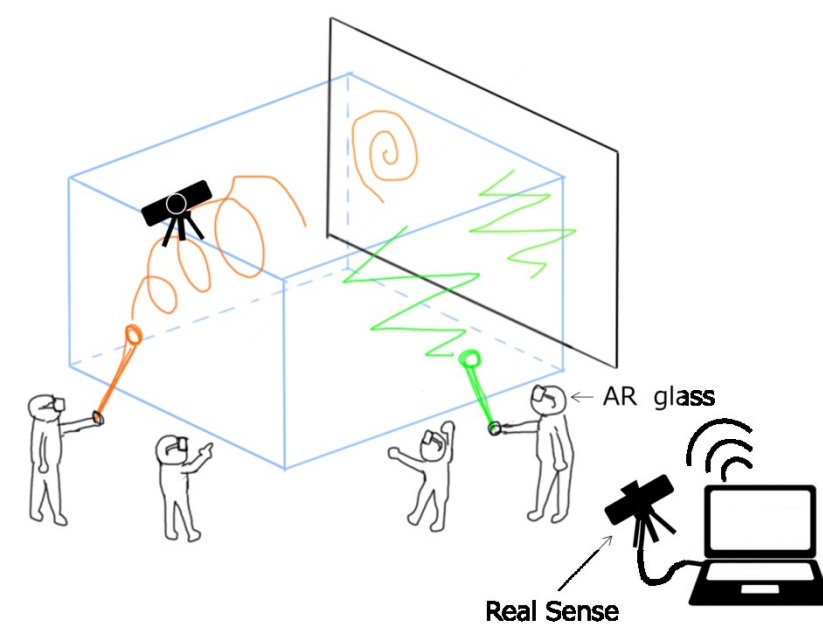


Constitution

This system mainly consists of light pointer, PC, camera, projector, and screen. The light pointer is a device using as a brush. By holding this light pointer in front of the screen, you can draw lines freely. This system is not merely tracking the trajectory of the optical pointer and the drawing with the projector.

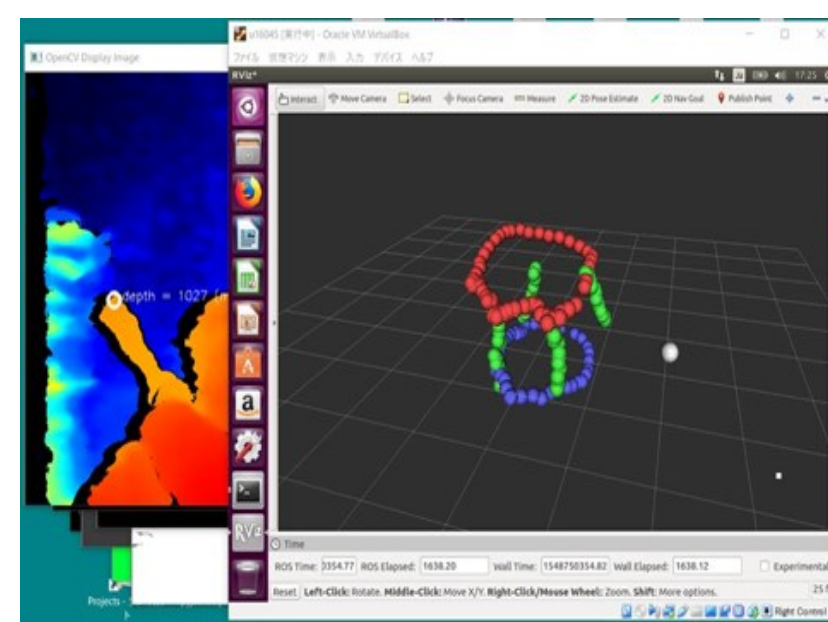
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And also, VR(Virtual Reality), AR(Augmented Reality) and MR(Mixed Reality) technologies have attracted attention, and many systems have been developed. We tried to develop a system that can be drawn around us or in the air without any restrictions, using MR technology for the addition of new entertainment features. This system is called "3D light crayon".



Preliminary experiment

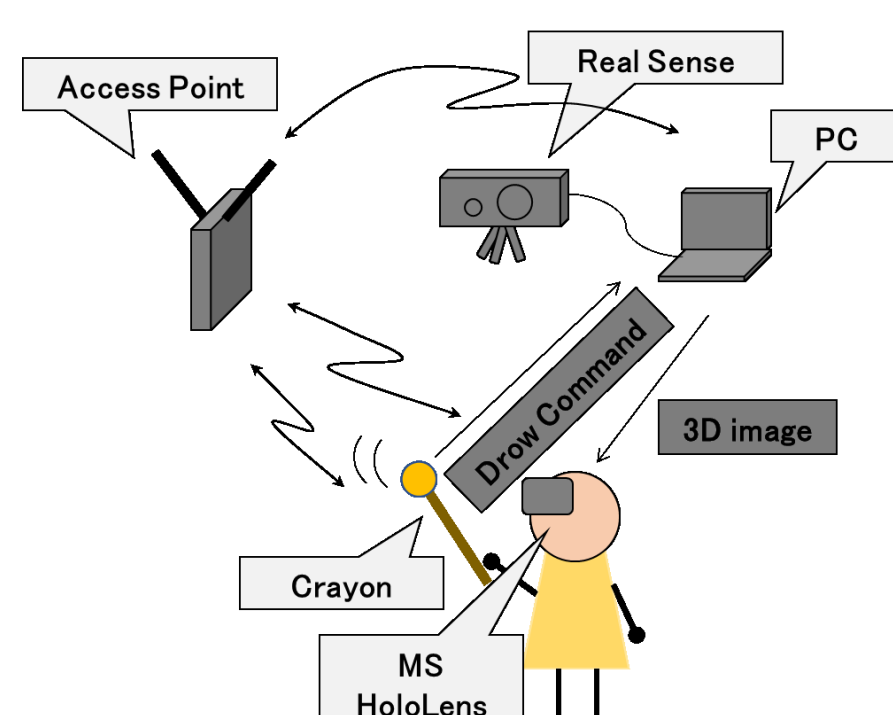
The prototype 3D light crayon in preliminary experiment captures the 3D data of the orbit drawn in space by the light crayon to PC using the depth sensor Intel RealSense and visualize the drawn orbit with Rviz of the 3D display tool from the ROS(Robot Operating System).



Development of the 3D light crayon

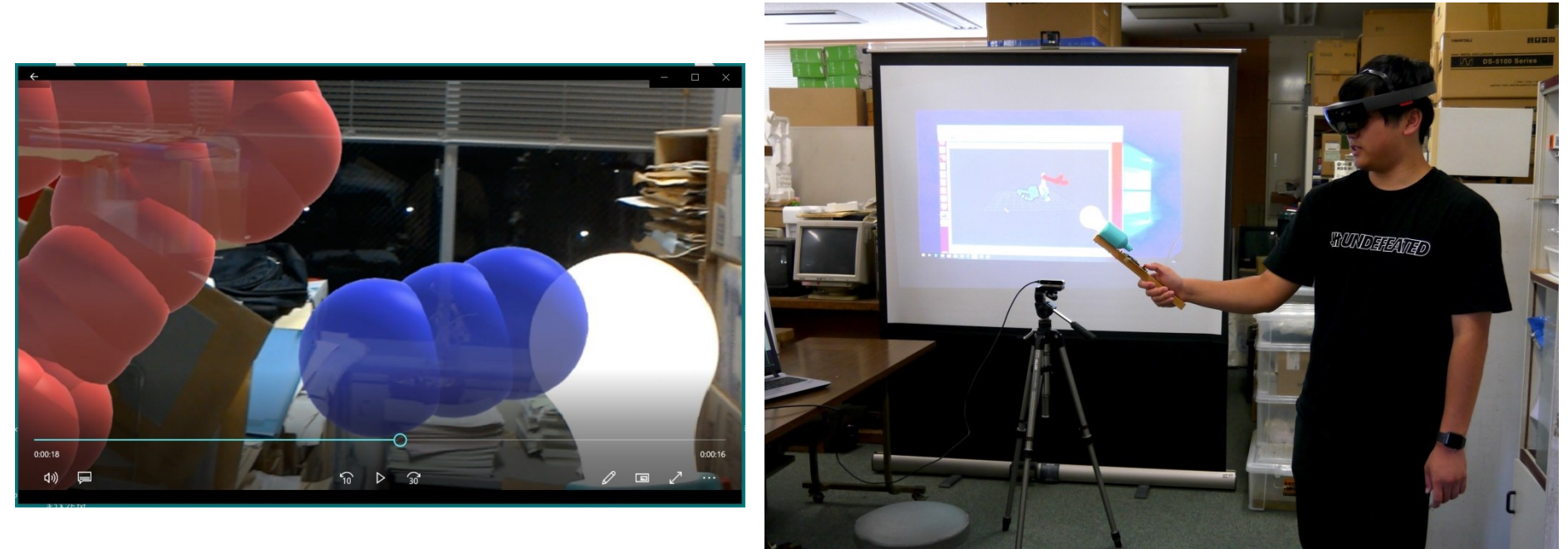
We tried to make the 3D light crayon system using Microsoft HoloLens which is one of AR glasses as 3D output device. The system consists of three functional steps.

- ①The trajectory of the light crayon is complemented in 3D. Therefore, a sensor that measures the distance of the light crayon pointer is required.
- ②On the unity game development platform provided by Unity Technologies, it generates 3D graphics on the PC with the captured trajectory.
- ③This 3D image is output to the participant as a light crayon trajectory in three dimensions.



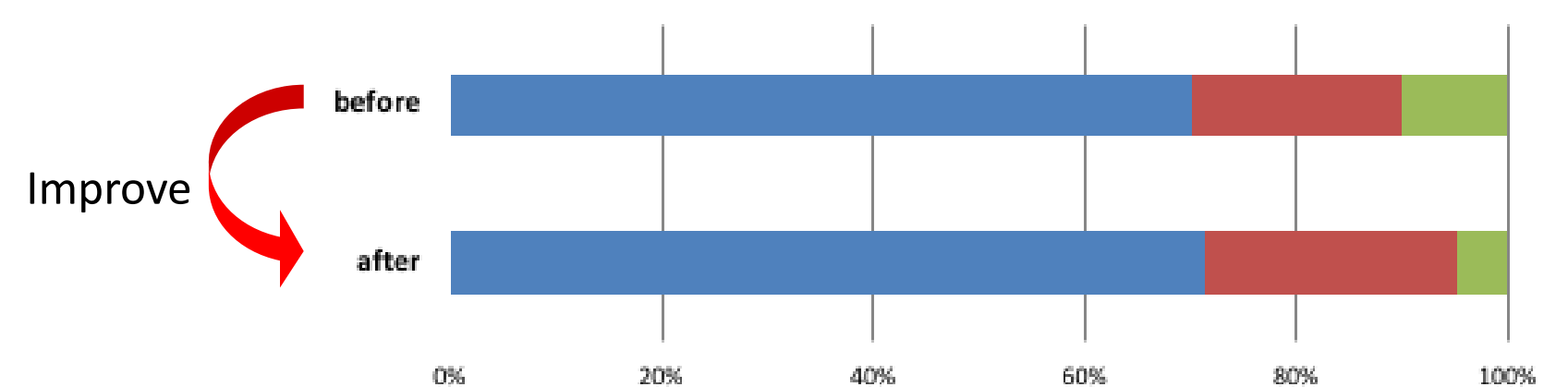
Results

●This output uses HoloLens provided by Microsoft. HoloLens is generally referred to as AR glasses, and it is possible to arrange 3D images superimposed in the space of everyday life. The result of the images operator will see and operator's appearance are shown below.

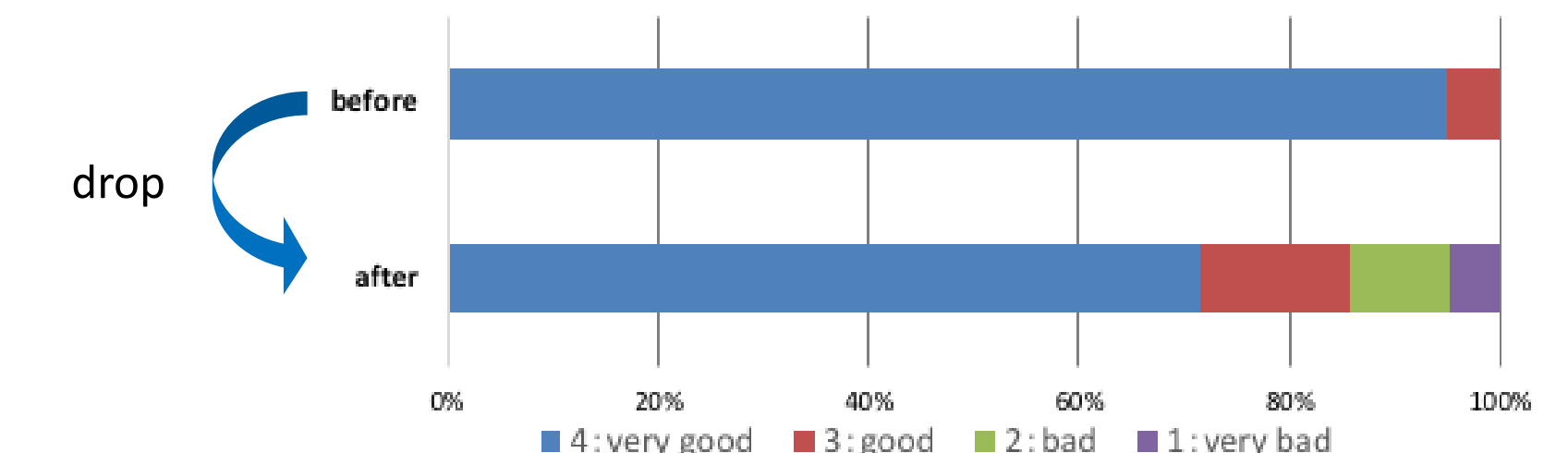


●Actually field test was carried out and evaluation about entertainment value was obtained. In Science event the Tenri Science-Experience Festival, a questionnaire was conducted from 21 players. The item "after" in the questionnaire is the result of implementing the 3D drawing function with AR glasses for the first time. Compared with traditional 3D light crayons without AR glasses, dominant results was obtained in terms of "Creative mind is inspired". And, the result was not good in term of "Interested in 3D light crayon".

Creative mind is inspired



Interested in 3D light crayon



Conclusions

- In this study, the depth sensor and the AR glasses were used to construct a system that allows operators to draw pictures around themselves. However, some problems were found doing actual construction and operation. With Microsoft HoloLens, an AR glasses used in this study, it is only possible to share the situation with the person who is wearing the glasses and drawing the picture.
- With future development, we are considering a system that draws pictures with the figure of hands using AI image recognition technology. The flow of this system is shown below.
- ①The camera shoot the user's hand and to send them to the PC.
 - ②It is to recognize the image by using AI to determine the shape and coordinates of the user's hand.
 - ③ The user is able to draw a picture by connecting the coordinates of the hands' movement. Moreover the hands' gesture will change the color of the lines shown on the screen.

