

Applications of Technology Inheritance with a Mixed Reality Headset

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ABSTRACT

As multiple metaverse applications that superimpose virtual information on the real world, we have developed applications such as "TechniCapture," which can spatially record the fingers and the gazes of a skilled worker at work and project them over the real work environment.

1 Introduction

In recent years, it has become increasingly important to pass on skills from skilled workers to novices in industry. For example, according to the white paper on manufacturing [1] by the ministry of health, labor and welfare in Japan, the number of young workers in the manufacturing industry has decreased by 1.21 million over the past 20 years, while the number of elderly workers has increased by 330,000 over the same period. Furthermore, the concept of metaverse is attracting great attentions, then applications and services for technical succession in virtual reality have been developed and researched. However, in order to reproduce the work environment only in virtual reality, it is necessary to create object models or capture the work environment. In addition, the reality of the environment is considered to be lost in the process.

In contrast, Mixed Reality System, which overlays spatially virtual information on the real world, is another important for realizing a metaverse. One of a mixed reality system in technological transfer is a system that reproduces the work of a skilled person in the real world environment virtually and provides supplementary information to novice users. If the work of a skilled person can be reproduced superimposed on the actual environment, the novice learner will be able to learn the work of a skilled person without losing the authenticity of the environment.

Therefore, as shown in Fig. 1, we developed "TechniCapture" [2] an application that can spatially record and play back information about the human hands, fingers, and eye gaze with a mixed reality headset which is able to obtain these data. Moreover, as shown in Fig. 2, we developed "Tebanashi Manual" [3] which places a manual in space and can be easily operated by simply tilting the head. In addition, we have developed a prototype

experimental assistance application by modularizing each function in the TechniCapture and incorporating it into the Tebanashi -Manual.



Fig. 1 TechniCapture



Fig. 2 Tebanashi-Manual

2 TechniCapture

TechniCapture is an application which can spatially record and play back information about the human hands, fingers, and gaze.

2.1 Record Function

First, the origin of the space can be specified with AR Marker recognition. By specifying the spatial point as origin, these hands or gaze information can be superimposed according to the real environment. In contrast, If the spatial origin is not specified, the spatial origin depends on the device. For example, In the case of a HoloLens 2 device, the spatial origin is the start position of the Application. Second, the recording function is described. The TechniCapture is able to

record three-dimensional positions and rotations information of 25 joints of one hand by the hand tracking function, the origin and direction of gaze, and voice by the microphone.

2.2 Play Function

Third, we describe about the function of Playing the data recorded. The application loads the data recorded, these information of the data applied to an avatar as shown in the Fig. 1 The elbow position of the avatar, which is not originally recorded, is pseudo-reproduced by inverse kinematics based on the posture of the fingers. Then, as shown in Fig. 3, as interface of the play function, A slider user interface has been implemented that allows time specification. Additionally, the application has a function of export the data to csv (Comma Separated Values) file.

Finally, we describe that the function to persist gaze information in the space. By persisting gaze information in space, it is possible to analyze gaze information like a heat map to see where the user focused on for a long time during work.

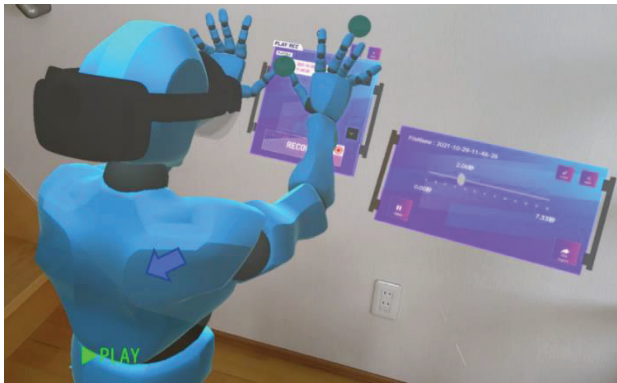


Fig. 3 Play Scene in TechniCapture

3 Tebanashi-Manual

Tebanashi-Manual is an application that displays manuals consisting of text, images, and videos in space to assist in working.

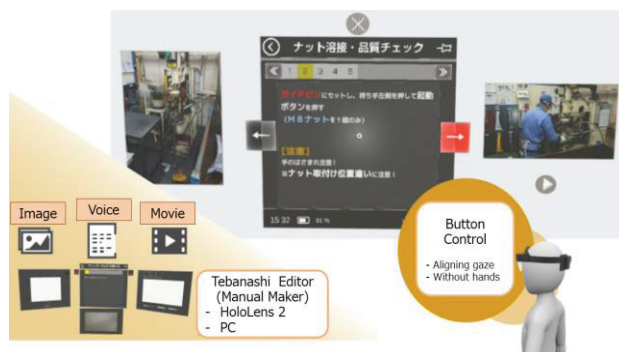


Fig. 4 Features of Tebanashi-Manual

3.1 Manual Editor

Firstly, one way to create manuals is to use excel format. It is possible to create scenarios required for manuals, adding not only text but also images or movies. In addition, as shown in Fig. 4, we also designed a dedicated software, "Tebanashi Editor for PC", and "Tebanashi Editor for HoloLens" which allows manual creation to be performed with a computer or an MR device.

3.2 Display a Manual spatially

Then, Tebanashi-Manual is able to display the spatial manual with text, images and movies. The panel displaying the manual is able to choose to be placed in space or follow the head. This allows the user to work while referring to the manual both when moving or when working in a fixed location. Additionally, it is possible to manipulate the scenario display without using hands, assuming one is working with two hands.

4 Example of an applied application

As one example of an applied application, we designed an experiment assistance application that combines TechniCapture and a Tebanashi-manual. The Tebanashi-manual allows the operator to learn what work is to be performed, and the operator's fingers and gaze can then be smoothly recorded by the functions of TechniCapture. In the present, the experimenter had to provide a pre-experiment briefing and then launch a application to record the results. However, this application allows the same application to explain and record experiments. Therefore, we expect that the efficiency of experimental data collection can be improved.

5 Conclusions

In this study, as metaverse applications, we developed TechniCapture and Tebanashi-Manual. TechniCapture is a mixed reality application that allows workers to record and playback spatially. On the other hand, Tebanashi-Manual allows manuals to be placed in space for easy operation. Furthermore, by incorporating each function of TechniCapture into Tebanashi-Manual, we developed a prototype application to assist in experiments. In the future, as mixed reality headsets evolve, it will become possible to record and play back workers spatially with greater precision. Furthermore, TechniCapture will equip with a function to analyze the data using artificial intelligence.

References

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