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Development of flick input interface in Virtual Reality

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In recent years, with the advent of HMD (Head Mounted Display) such as HTC VIVE, VR (Virtual Reality) has become popular in general. Furthermore, in recent years, as VR development environments such as Unity 3 D and so on are in place, various kinds of contents using VR have been appearing, and it is expected that VR will further spread in the future. With the progress of HMD and its peripheral devices and the development of research related to VR, it is becoming possible to reflect actual movement of fingers in the VR space without attaching a device such as a controller to the hand. Studies have been conducted to input characters in freehand VR environments so far, but few can input characters with operations similar to flick inputs commonly used in smart phones and tablet terminals, There is no character input interface of flick input form including visual feedback. In Japan, there are an increasing number of young people who are not good at keyboard input, and most of them use flick input especially when inputting Japanese on mobile terminals such as smart phones, so even in the VR environment, the flick input format There is constant demand for interfaces that let you enter characters. In this research, we developed a flick input form interface that enables Japanese hiragana input in freehand VR environment using game engine Unity3D and Leap Motion.

When entering characters with the interface created in this research, operate the virtual hand in the VR environment, press the key with the row of the character to be input displayed, move the finger in the direction of the character you want to input After moving the finger to the front of the initial position of the key, the input is confirmed.

In addition, the interface created in this research is roughly divided into three visual feedbacks. The first is a representation of the state where the key is being pressed, using a collision determination with the key, a mechanism is implemented in which the key moves to the depth position of the fingertip that touched the key. Secondly, with the expansion of the key, we implemented a mechanism to arrange and display the keys of the steps around the key of the step by referring to the feedback of the flick input keyboard that is standard on the iOS terminal . The third is a change in the color of the key, a mechanism is implemented to change the color of the key corresponding to the character selected by the user from pressing the key to confirming the input. Besides, as long as one key is operated, it is designed so that the user can visually understand which key is being operated by hiding other keys. In addition, the whole keyboard can be moved by the thumb and index finger

grip operation so that the user can place the interface in a position where the user can easily input. During the movement, the direction of the HMD is acquired, and the interface is designed so as to be perpendicular to the line of sight direction.

Moreover, by comparing the existing character input method to input by pointing the virtual keyboard with the controller, the input speed, and the frequency of erroneous inputs, the effectiveness of the interface created in this research, We verified the effect of visual feedback by preparing the interface excluding only depression of the key from the interface and all the visual feedback excluded and comparing the input speed and the frequency of erroneous input. In the evaluation experiments, Leap Motion was attached to the front of HTC VIVE using Leap Motion VR Developer Mount to track the movements of fingers, and the HTC VIVE controller was used for character input method using existing controller did. For the measurement, we used a typing game in the VR environment created using the Typing Game System For Unity module. In this typing game, words are randomly entered, and if the word is correctly entered up to the end, the next word is repeated for a period of 60 seconds. Since it is rare to input a meaningless character string when actually entering characters, the word to be presented is not a random character string, but any Japanese should know it, the Japanese capital I made it to the prefecture name.

As a result of the experiment, 13 of 18 subjects found that it is possible to perform input more quickly than existing character input method which points with virtual keyboard with controller and input. However, with respect to the frequency of erroneous inputs, the character input using this interface was about 4.6 times the erroneous input frequency of the existing input method and the high frequency of erroneous input was conspicuous. In the evaluation experiment on the effect of visual feedback, there was not much effect on the input speed, but when we conducted a questionnaire survey on the subjects, all 10 subjects changed the color of the key to a visual I felt that feedback was effective, and 9 people felt easy to input by visual feedback that develops keys. Also, visual feedback such as key color change and key expansion had the effect of reducing erroneous input frequency. On the other hand, the visual feedback that expresses depression of the key has the effect of increasing the incorrect input frequency in the subsequent stage, and it turned out to be feedback that leads to deterioration of operability. In conclusion, we confirmed that the interface created in this research can input with input speed equal to or higher than the existing input method. However, the erroneous input frequency is as high as about 4.6 times the existing input method, and there is room for improvement. On the other hand, when we conducted an input experiment using the interface which removed visual feedback from the interface created in this research, it turned out that expression of indentation of key leads to erroneous input. In addition, assistance of input by changing the color of the key and expanding the key has an effect of reducing the erroneous input frequency, and in particular, it is estimated that it is effective for a user who is not so familiar with the flick input.

The future task is to reduce erroneous input frequency. We believe that if we can increase the accuracy of identification of inputs and miniaturize the interface as a whole, it will be a good operability interface with reduced user fatigue.