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RESEARCH ABOUT CONTACTLESS UI USING GESTURE RECOGNITION IN OMNIDIRECTIONAL CAMERAS

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In recent years, many small autonomous mobility have been developed. Various types of UIs are being considered for these vehicles. In particular, the demand for contactless UI is increasing. This is because people have more hygiene consciousness due to infectious disease. Therefore, we focus on contactless UI using gesture recognition. Gesture recognition is generally performed using a monocular camera. However, we think that an omnidirectional camera is more suitable for use in small mobility devices. The omnidirectional camera has a 360-degree field of view. This is wider than that of a typical monocular camera. Therefore, a system that requires multiple monocular cameras can be supported by a single omnidirectional camera. This advantage is expected to reduce the number of camera sensors installed in small mobility systems with space limitations. Recognizing gestures with an omnidirectional camera using a conventional monocular camera method results in a decrease accuracy. Therefore, the purpose of this research is to improve the recognition accuracy with an omnidirectional camera to the same level as that with a monocular camera.

The cause of the inaccuracy of gesture recognition with an omnidirectional camera was the distortion of the omnidirectional image. The omnidirectional image has distortion as shown in Fig. 1. This distortion caused the skeleton of the finger to be incorrectly estimated. We reduced this distortion by converting the omnidirectional image to a panoramic image. The distortion of the converted image is reduced in the lower part of the image. By using this for gesture recognition, we were able to estimate the finger skeleton with a less distorted image. Procrustes analysis was used as the gesture recognition condition. Procrustes analysis is a method used to compare shapes of two or more figures. Using Procrustes analysis, a plausible gesture can be determined even if the fingers are misaligned due to hand misdetection. Therefore, gesture recognition is robust to oscillations and false positives of the predicted position of the fingers that occur when a hand is detected. For these reasons, the author hypothesizes that the use of Procrustes analysis will improve recognition accuracy. Procrustes analysis removes the element of rotation. As a result, some gestures are considered as rotated versions of other gestures. Therefore, as shown in Fig. 2, some gestures were misrecognized as different from the original hand shape. Therefore, the author proposes a solution to this problem by incorporating finger direction information into the Procrustes analysis.

The experimental results in Table.1 show that the proposed method improves the accuracy when used with an omnidirectional camera. The accuracy of gesture recognition by the omnidirectional camera improved to the same level as that by the monocular camera.

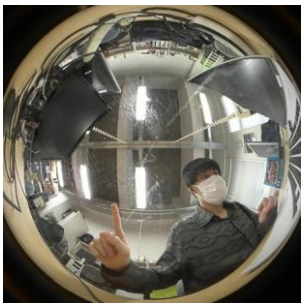

Fig.1 Image of omnidirectional camera

Procrustes analysis　　Procrustes analysis + fingers direction data

Fig.2 Comparison each gesture recognition result

Table.1 Comparison of each method

	Accuracy of conventional method[%]	Accuracy of procrustes analysis method[%]	Accuracy of procrustes analysis + fingers direction data[%]
Left	100	100	100
Right	94.4	100	100
Up	80.8	93.4	99.6
Down	98.6	80.0	98.4
Rock	87.6	99.4	99.8
Scissors	88.0	100	100
Paper	85.2	100	100