Diversification of a novel tap operation interface for people with visual impairment

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I. Introduction

PCs and cell phones have physical buttons such as a keyboard and call buttons, but a touch screen device usually does not. Since there are no tactile marks such as braille, it is difficult to operate through a capacitive touch screen without seeing and just after a quick look at the screen. We have proposed a new operation method called inverse tap (iTap) for capacitive touch panels [1]. iTap is judged as a tap operation when the finger leaves the screen and touches it again. User can find the point of operation by the tactile marks without looking at the screen, and perform operation equivalent to tapping. In this paper, we propose a new additional method called "two-finger inverse tap", and attempt to diversify the operation options for a single operation point.

II. Two finger iTap

When the following operations are performed, they are judged as two finger iTap operations.

1) Touch a screen with two or more fingers
2) Move fingers to find the point to operate while touching
3) Release one finger from the screen at the point
4) Release the other finger within a certain distance
5) Touch one finger the same point within a certain time
6) Touch another finger the same point within a certain time

The above 3 , 4 and 5 , 6 are proceeded almost simultaneously. The order of the two fingers (positions) when releasing and touching is not important. In this method, both following two states are considered as no-operation states: one is the state when a finger is away from a screen, and another is the state when it is touching a screen too. Of course normal tap and swipe operations are disabled. In addition, a physical marks such as braille will be placed on the touch screen.

III. Experiment and Conclusion

We conducted a comparison experiment between a normal tap and a two finger iTap with a blind-folds. The subjects repeat following steps in one minute: take an operation task (ex. turn-up temperature), and then execute the task, and report. We record the number of times of correct and wrong operation (Fig. 1). The number of successful and unsuccessful button presses are shown in Table I and Table II. Note that the
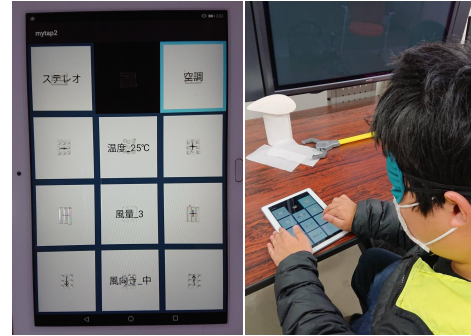

Fig. 1: An experiment

TABLE I: Noraml tap

subject	A	B	C	D	E	F	G	average
unsuccess	0	1	3	4	4	5	5	3.12
successful	8	10	9	10	10	6	7	8.57

TABLE II: Two finger iTap

subject	A	B	C	D	E	F	G	average
unsuccess	0	0	0	0	0	0	0	0
successful	9	11	10	13	10	10	11	10.57
two finger	6	9	8	12	10	9	8	8.86
one finger	3	2	2	1	0	1	3	1.71

number of successful in Table II includes not only two finger iTap, but also one finger iTap. There were many operations at the wrong buttons for normal tap operations. On the other hand, there was no operation at the wrong button position for iTap operations. Then the number of successful iTap was examined. About 15% of them were judged as one finger iTap. The subjects may not have been accustomed to the two finger iTap operation. However since more than 80% of the operations were performed correctly by the two finger iTap, it is expected to improve easily. In the future, we would like to consider the new method such as equivalent to swipe that makes easier operation in the blind condition.

References

[1] Kenji Funahashi. Hayato Maki. Yuji Iwahori "Novel tap operation on capasitive touch screen for people with visual impairment", ICAT-EGVE 2020 Posters and Demos, pp. 3–4, December 2020.