

# A Web Browsing Method on Handheld Touch Screen Devices for Preventing from Tapping Unintended Links

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**Abstract.** In recent years, it is common thing to browse Web pages with mobile devices, such as smart phones. However, users sometimes tap the wrong link when they scroll or zoom web pages because of the relatively small display area of mobile device and sensitivity of touch screen. In such case, it is necessary to stop of loading the page or back to the previous page after the page changed. It seems that above unintended operation might increase the total browsing time and user's frustration. In this study, we aimed to prevent users from tapping unintended links for effectively web browsing with touch-screen mobile devices. The proposed method has two kind of operation mode. They are a tapping mode and non-tapping mode. With the tapping mode, users can tap the link and change the mode only. On the other hand, with the non-tapping mode, users can do swipe, pinch, and mode change operation but they cannot tap any links. Furthermore, mode change operation, we adopt the Bezel Swipe operation, is intuitive and efficient.

The results of the experimental evaluation showed that the rate of tapping the unintended links with the proposed method was lower than that with conventional method. However, the task completion time with proposed method is longer than that with conventional method.

**Keywords:** Mobile interaction, web browsing, unintentional tap, Bezel Swipe.

## 1 Introduction

In recent years, it is common thing to browse web pages with touch screen mobile devices, such as smart phones. However, users sometimes tap the wrong link when they scroll or zoom in or out web pages because of the small screen area of mobile device and sensitivity of touch screen. In such case, it is necessary to stop of loading the page or back to the previous page after the page changed. These unintended operations might increase the total browsing time and user's frustration.

Matero and Colley analyzed accidental touches on capacitive touch screen based mobile telephones in a user test [2]. In the study, patterns that are characteristic of unintentional touches were identified and layout guide lines to reduce the amount of them were presented.

In this study, we aimed to prevent users from tapping unintended links for efficiently web browsing with touch screen mobile devices.

## 2 Proposed Method

The proposed method has two kinds of operation mode. They are a tapping mode and a control mode. With the tapping mode, users can tap the link and change the mode only. On the other hand, with the control mode, users can do scroll, zoom in or out, and mode change operation but they cannot tap any links. Furthermore, mode change operation, we adopt the Bezel Swipe operation [1], is intuitive and efficient. As shown in Fig. 1, the Bezel Swipe is done by sliding of the thumb or finger, starting from a bezel zone to a screen zone of the device.

When users want to change the mode from tapping to control, they can do that with just swipe in their finger from the outside of the screen. In order to change the mode from control to tapping, users can do that with just tapping on the screen.

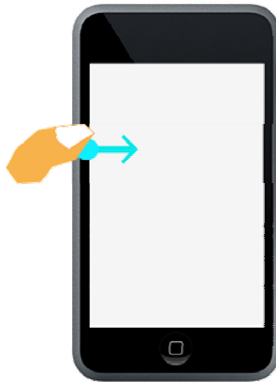
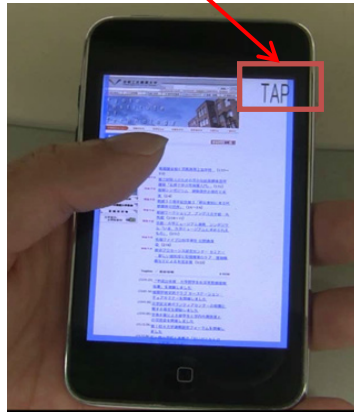


Fig. 1. Bezel Swipe

In order to distinguish the tapping mode from control mode, there is a visual feedback on the top right of screen. As shown in Fig. 2, a word “TAP” is displayed at there in the tapping mode or a word “CTRL” is displayed in the control mode.

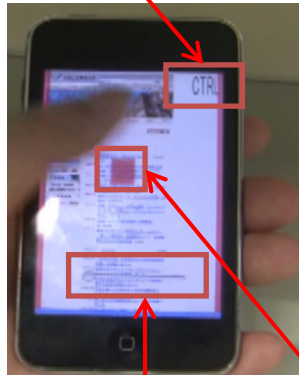
In control mode, two kinds of operation method are proposed for zooming in this paper. One is called as “double-tap method” and another is called as “slider method”. In double-tap method, users can zoom in or out by double tapping on the screen. The number of zooming level is two, so a double tapping toggles the zooming level between zoom-in status and zoom-out status. In zoom-in status, the width of tapped area is adjusted to the screen width as the common web browser’s zoom-in manner.

A visual feedback of tap mode



(a) tapping mode

A visual feedback of control mode



A finger take-off point

A slider for zooming

(b) control mode (slider method)

**Fig. 2.** Two kinds of mode in proposed method

While the zooming level is discrete in double-tap method, users can set the zooming level continuously with the slider method. In the slider method, there is a slider at the bottom of the screen and users can slide the tab of it to set the zooming level as they want.

Furthermore, in slider method, in order to make the operation efficient, there are two kinds of operation manner depends on the bezel swipe direction to change the mode. When users swipe in their finger from the bottom of the screen, the mode is immediately set the control mode and they can scroll the page with swipe action without finger taking off. On the other hand, when users swipe in their finger from either side of the screen, the mode is set the control mode and the point where they take off their finger is the center for zooming in or out operation. It is expected that they will take off their finger where they want to see in detail. Then they can set the zooming level with the slider as they want.

### 3 Experimental Evaluation

In the experiment, three kinds of web browsing method on handheld touch screen devices are compared. They are a conventional method, the double-tap method, and the slider method. The conventional method is a commonly used modeless method on handheld touch screen devices. Users can scroll pages with swipe, zoom in or out with double tapping, and change a page with tapping a link.

Our proposed method is compared with this conventional method experimentally. Both proposed and conventional methods are implemented on the Apple's iPod touch. A repeated measurements within-subject design is used for the experiment.

The purpose of the experiment is to examine following hypotheses:

- H1: Both proposed method, they are the double-tap method and the slider method, decrease the rate of unintended tapping compared with conventional method.
- H2: Both proposed method slightly but not significantly increase the operation time compared with conventional method because there is additional operation, which is mode change operation.

#### 3.1 Web Pages for Task

For the experiment, we prepared top pages of the Yahoo! JAPAN web site for PC, the Wikipedia Japan web site, and our university's web site. From each web page, ten different web pages are made with making different link's string to be red. There were total thirty pages were prepared for the experiment. An example web page the experiment is shown in Fig. 3.



Fig. 3. An example web page of the experiment

### 3.2 Procedure

Ten participants were recruited from our university. In the experiment, each participant was asked to hold the mobile device with their one hand and to operate it with the same hand thumb.

Each participant was asked to do following procedure to complete the task for each method:

1. Do practice until enough for operation.
2. Touch the start button on the screen. Then a web page is displayed.
3. Touch the link with red string. Then a new web page is displayed.
4. After all designated web page is touched, and then the “task completed” message is displayed.

Error rate was calculated with dividing the number of web page which had unintended user’s touch by the number of total web page for the experiment. Task completion time, the elapsed time from pressing the start button to displaying the “task completed” message, was also measured. Furthermore, subjective evaluation was done with a questionnaire after each task.

### 3.3 Results and Discussion

The results of the experimental evaluation showed that there was a main effect of the method on the error rate ( $F(1,553)=11.824, p<0.05$ ). The error rate of tapping the unintended links with the double-tap method was 3.33[%] and that with the slider

method was 1.67[%]. There was no significant difference between them but both error rate was significantly lower than that of conventional method (9.17[%],  $p < 0.01$ ). This result supports our hypothesis H1.

On the other hand, there was a main effect of the method on the task completion time. The time with the double-tap method was 210.89[sec] and that with the slider method was 227.83[sec]. There was also no significant difference between them but both task completion time was significantly longer than that of conventional method (157.12[sec],  $p < 0.05$ ). This result does not support our hypothesis H2.

Results of the subjective evaluation showed that participants viewed the proposed method very positively. Compared with the conventional method, the proposed method got the same or nearly the same score about the easiness to learn the usage and the easiness of operation.

## 4 Conclusion

In this paper, a web browsing method on handheld touch screen devices for preventing from tapping unintended links is proposed and evaluated experimentally. From the experiment, it is found that the proposed method is decrease the rate of unintended tapping compared with the conventional method. However, it is not so efficient for operation on mobile devices. From the subjective evaluation, it is also found that the proposed method is viewed very positively.

## References

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