Smart Wristband: Pressure-Sensitive Wristband as a Scrolling and Selecting Input Method for a Smartwatch

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# ABSTRACT

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## ACM Classification Keywords

H.5.2. Information interfaces and presentation: User Interfaces – *input devices and strategies*.

# Introduction

The main input methods for traditional smartwatches on the market are display touch screens and physical buttons. However, it is difficult to carry out complex tasks on smartwatches due to the limited number of physical buttons and inadequate area of touch interaction. The limited display screen size of smartwatch can be easily blocked by user’s finger when using. Furthermore, the selection process of objects, especially the fine ones, on the screen can be not accurate due to the size of the user’s finger in relation to the size of the touchscreen. Our research aims to enhance users experience with smartwatches and increase efficiency and accuracy of scrolling and selection through extending interaction surface of smartwatch to include the wristband as an input tool.

We propose placing different types of touch sensors on the smartwatch wristband and use these sensors to identify scrolling and selection input. To scrolls up and down, a user can move their finger along the long edge of the band. Alternatively, the user can move his/her finger along the short edge of the band (where it meets the watch) to scroll left and right. For long scrolls, a user can do multiple rolling strokes over and over. Furthermore, moving a finger on the wristband will be mapped on the display screen using selection arrow. Once the selection arrow is on the desired object, the user can tap his/her finger on the band to select. Our research question is: Is placing touch input on the back of a smartwatch wristband more convenient to users and will it lead to faster and more accurate object selection compared to using finger selection on smartwatch touchscreen? We argue that our input method can deliver more selection accuracy and freedom because the finger will be moving along bigger interaction space. Moreover, moving the touch interaction off the screen will allow the user to not block the display screen while interacting with the device.

While no other input method beyond smartwatch touchscreens and physical buttons has been implemented commercially, there are several studies that researched the possibility of extending interaction surfaces beyond these two methods such as using air-magnet-pen and hand gestures. There are few studies that used the wristband as an input method, but they either focused on developing the strap only for text entry or the wristband was only sensitive on the edges where the wristband touches the watch. We are studying the possibility of making the entire wristband sensitive so we can use the whole wristband as an input surface. This has the potential of performing multiple and complex tasks and can increase the selection accuracy.

# Related work

BandSense [1] explored pressure-sensitive multi-touch interactions with a smartwatch wristband. Their device had pressure-sensitive touch sensors on the wristband on either side of the smartwatch screen. The sensors could detect tapping and flicking motions, as well as pressure input on part of the band that can be used a directional input. The device could also interpret flicking up and down motions as commands for copying and pasting. They demonstrated that this kind of device could be useful for many different tasks, although they did not conduct a user study to test the effectiveness of this device.

Funk et al. [2] experimented with two text entry methods on a touch-sensitive smartwatch wristband: sliding and multi-tapping. Both text entry layouts were a vertical arrangement of letters positioned to the sides of the watch display. The first had a narrow key for each character, and the user could slide their finger until the correct character was selected. The second had 3 letters per key, which were selected by multi-tap. They concluded that the multi-tap layout was faster in terms of words per minute, and also preferred by the study participants.

Knibbe et al. proposed extending interaction area with smartwatches to include the back of the wearer’s hand and use off-gesture interaction as input method. The proposed prototype supports range of bimanual gestures that translates into commands for the smartwatch. The prototype built for this experiment has infrared proximity sensors on the sides of the watch and the strap to identify different dynamic gestures which are made by the hand wearing the watch and recognize bimanual gestures that are made by the other hand on the back of the wearing hand. There are also piezoelectric sensors positioned underneath the watch to detect taps and when the wearing hand moves or there are actions at the back of the wearing hand by the other hand. By adapting parts of this approach in our research, namely sensors used and adaption algorithm, along the wristband, we can identify tab and figure movement.

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