Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 84 (2016) 137 – 141

Procedia Computer Science

7th International conference on Intelligent Human Computer Interaction, IHCI 2015

ETAO Keyboard: Text Input Technique on Smartwatches

Rajkumar Darbar[a,*], Punyashlok Dash[a], Debasis Samanta[a]

[a]*School of Information Technology, IIT Kharagpur, West Bengal, India*

Abstract

In the present day context of wearable computing, smartwatches augment our mobile experience even further by providing information at our wrists. What they fail to do is to provide a comprehensive text entry solution for interacting with the various app notifications they display. In this paper we present ETAO keyboard, a full-fledged keyboard for smartwatches, where a user can input the most frequent English alphabets with a single tap. Other keys which include numbers and symbols are entered by a double tap. We conducted a user study that involved sitting and walking scenarios for our experiments and after a very short training session, we achieved an average words per minute (WPM) of 12.46 and 9.36 respectively. We expect that our proposed keyboard will be a viable option for text entry on smartwatches.

Peer-review under responsibility of the Organizing Committee of IHCI 2015

Keywords: Text entry; smartwatch; mobile usability

1. Introduction

Over the past few years, the world has seen a rapid growth in wearable computing and a demand for wearable products. In recent-times, smartwatches have gained a lot of public attention as one of the most popular wearable device. In 2001, IBM introduced WatchPad[1] which was the first prototype of today's commercially successful smartwatches like Samsung Galaxy Gear S, LG G Watch, Motorola Moto 360, Apple Watch and so on. Smartwatches allows users to access several applications (messaging, email, calendar, maps etc.) running on smartphones, without the need to use their phones. Although applications are instantly accessible on the watch, users face difficulties to immediately reply as there is normally no text entry method on the same device.

Text input is an integrated part of our daily digital activities. While Qwerty keyboard has become the dominant text input modality for mobile devices but it is difficult to fit on tiny wearable devices. Most present day smartwatches either do not offer a virtual keyboard as a text entry mechanism or provide methods like short-hand gestures which take lengthy user training sessions to get accustomed to. The 'speech to text' mode is supported by most modern smartwatches which run on Android Wear[11], Tizen[12] etc, but there are certain limitations of voice typing such as privacy, noise in crowd and pronunciation.

* Corresponding author. Tel.: +91-9635118040;
E-mail address: rajdarbar.r@gmail.com

Peer-review under responsibility of the Organizing Committee of IHCI 2015
doi:10.1016/j.procs.2016.04.078

Here, we present ETAO keyboard, a technique that supports faster and less erroneous text input on ultra-small interfaces of smartwatches. It supports all English alphabets, numbers and most symbols that we use on a daily basis. Using our proposed keyboard user-interface (UI), a user can select most frequent characters (i.e. E, T, A, O, I, N, S and R) with a single tap and remaining characters, numbers and symbols with two taps. It supports faster typing with minimum key strokes per character (KSPC). We use two swipe gestures for delete and space. Here, we consider 'tap' as the prime input method because it is really easy to perform when walking in a street. Moreover this layout easily eliminates 'fat-finger problem'[2] by providing keys with bigger buttons. We conducted a user study to demonstrate the effectiveness of our proposed prototype. The user evaluation shows that a novice user takes only a few minutes to learn the keyboard and can achieve a relatively high typing speed while sitting or while walking.

2. Related Work

Text-input in wearables can be done through various methods like speech, bluetooth keyboard etc. However as soft-keyboards are popular methods of text-input in most mobile devices, we are interested to see their performance on wearables like smartwatches. S.Oney et al. proposed ZoomBoard[4], that uses a miniaturized version of the conventional Qwerty with multiple zoom levels set. Although this mechanism seems favorable to the user because of the familiar layout, it still requires two or more careful taps to zoom and select a key. The Swipeboard[5] divides the traditional Qwerty keyboard into nine regions and to enter any character, user requires two swipes. Using first swipe, user specifies the desired character's region and the second swipe selects the particular character within that region. H. Cho et al. developed DragKey[6] for text entry on wrist-worn watches with tiny touchscreen. It allows a user to input letters using drag directions regardless of carefully touched locations. The user needs lot of time to learn the layout and making drag gestures while walking is also slower than tapping.

M. Dunlop et al.[7] proposed alphabetic ambiguous-key approach to text entry. Here, they used tapping and few swipe gestures as input method. Overall, it is a nice concept, but a user may face difficulties while trying to enter password and urls. Moreover, commercially available prediction based text input techniques like Minuum[13], Swipe[14], and Fleksy[15] also suffer from similar kind of problems. M. Funk et al.[8] developed linear and multi-tap touch-sensitive wristband for text input. But, it demands external hardware which is not available in the existing commercial smartwatches. D. Y. Huang et al.[9] presented TouchSense which provides additional touchscreen input vocabulary by distinguishing the areas of users finger pads contacting the touchscreen. They showed its applicability in a calculator and a text editor application, but not in text input purpose. Recently, Jonggi Hong et al. developed SplitBoard[10] where Qwerty layout is split into a few layers. The user sees one layer of keys and has to swipe left or right to press keys present in other layers. It is intuitive to use as it doesn't require a steep learning curve. But, the key-size of SplitBoard is not large enough to avoid 'fat-finger' problem.

Most of the earlier research-works related to text entry on smartwatches tried to fit traditional Qwerty soft-keyboard in an intelligent way and also used touch sensitive wristband for typing. The existing virtual keyboards, which provide good typing accuracy, are slow in nature and keyboards which support faster typing, are error-prone. Our aim in this work is to develop a keyboard which will try to establish a trade-off between typing speed and error rate.

3. ETAO Keyboard Prototype

3.1. Design

The area provided by a smartwatch is really small (1.65" screen diagonal) hence, in our proposed ETAO keyboard, we apply the concept of key layering where certain keys appear in one layer and the rest appear in other layers. With the exception of the two middle keys in the first row, the size of each key has been set at 40 dp. This size has been chosen after many trial and error tests so that the keys are not too small or too large to hamper the layout.

ETAO keyboard supports all English alphabets, numbers and most symbols that we use on a daily basis. The design layout consists of two-layers of input modes where a user can access most frequent letters (i.e. E, T, A, O, I, N, S and R) with a single tap and remaining characters with two taps. The first layer i.e. main-screen is divided into two regions. The top most region has a text field where typed characters will appear. The bottom region has four 'grid keys' and eight individual buttons.