An Accessible Keyboard for Android Devices as a Means for Promoting Braille Literacy

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Abstract—BrailleOne is a mobile application designed to provide blind and visually-impaired Braille readers with an accessible keyboard for manual text input on their Android smartphones or tablets. Its purpose is to make use of adolescents and young adults’ excitement for technology in order to facilitate Braille learning and daily practice. The results of a pilot evaluation study suggest that BrailleOne could contribute to the overcoming of accessibility barriers in the field of text entry.

Index Terms—Braille, Android, keyboard, mobile application, accessibility, blindness, visual impairment.

I. INTRODUCTION

Braille is a tactile reading and writing code used by individuals with blindness or other forms of visual impairment. In Grade 1 Braille, most written characters can be represented by a “cell”. Cells consist of 6 dots arranged in two columns of three dots each. Different combinations of 1–5 dots in a cell are used to represent letters and other symbols.

The proportion of visually-impaired individuals who are proficient in Braille is gradually decreasing, even though blind or visually-impaired Braille readers are more likely to engage in higher education, to be employed and to enjoy a better quality of life [1, 2]. One possible explanation is that digital techniques, such as screen readers, are becoming increasingly popular.

BrailleOne is a mobile learning application that aims to enable users to type text on a touch screen using Braille code. It serves a dual purpose: firstly, it is an accessible keyboard for sending messages and emails; and secondly, it is a means for efficient and enjoyable Braille learning and practice. BrailleOne could help blind and visually-impaired people benefit from the long-term effects of Braille literacy.

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II. RELATED WORK

Towards mobile keyboard accessibility, initial ideas include a gesture-driven software button [3] and an isometric joystick [4]. Other options used a mobile keypad to navigate through the visual alphabet or matching specific keys to the 6 Braille dots [5]. More recently, a multi-touch text input method was introduced [6] and Braille input approaches with one [7] or multiple fingers [8] were employed. Another suggestion is that for Braille input purposes, each cell should be decomposed into 2-dot subsymbols [9]. The application in References [10, 11] requires users to hold their smartphones in an irregular position in order to produce Braille code on a touch screen. Finally, a Braille keyboard comparable to BrailleOne has recently been presented, but it runs on iOS devices only [12].

III. DESIGN AND DEVELOPMENT PROCESS

BrailleOne consists of one main scene (Fig. 1). Braille text input can be effected with one hand; it takes two moves to type a character. The middle and lower part of the screen is divided into three vertical sectors and is used as a one-hand keyboard. These three sectors represent Braille dots 1, 2 and 3 at first touch and secondly, dots 4, 5 and 6.

On BrailleOne, first column dots (i.e. 1, 2 and 3) are typed first and appear in blue. The remaining three dots (i.e. 4, 5 and 6) follow and appear in red. For example, “m” is represented by dots 1, 3 and 4 in Braille code. To write “m”, a user must first touch sectors 1 and 3 simultaneously (Fig. 2), and then touch sector 1 again for dot 4 (Fig. 3).

All letter characters, numbers and some punctuation marks are included in the current version of the application. Apart from Braille typing, the following functions are available: Delete character (swipe left), Leave space (swipe right), Repeat character (swipe down), Copy to clipboard (swipe up).

Voice output is used so that progress could be monitored at all times.

IV. QUALITATIVE RESULTS OF A PRELIMINARY EVALUATION

After developing BrailleOne, we carried out a pilot usability test. We visited a school for blind students in Thessaloniki, Greece, and asked four young Braille readers to evaluate our application. Their feedback included ideas regarding swipe left/right functions and the need for more languages made available. All four interviewees agreed that an accessible Braille keyboard would be of value for blind and visually-impaired individuals who wish to use an Android smartphone or tablet. An 18-year-old blind boy, who had never used a smartphone before, managed to write his name on BrailleOne after a 10-min demonstration session. However, two of the interviewees admitted that they have purchased iOS devices and use a voice input method in order to avoid the existing accessibility barriers.
V. CONCLUSIONS AND FUTURE WORK

BrailleOne is an accessible mobile keyboard for blind and visually-impaired individuals. It was designed to combine effective characteristics of previous applications and to overcome any further difficulties that have emerged.

Furthermore, BrailleOne is ideal for those who would rather avoid a standard mobile keyboard or voice input in noisy environments. Above all, adolescents and young adults with blindness or other forms of visual impairment are likely to benefit from this application, as it utilizes a popular technological device to practice and enhance their Braille typing skills. BrailleOne would be appealing to this latter age group, as it can eventually be used for writing text messages or keeping notes with no special equipment, no need for assistance and without attracting their peers’ attention. In addition, this mobile learning application could facilitate and motivate Braille literacy and enable users with blindness or visual impairment improve their spelling skills. Concluding, the technological and educational features of BrailleOne are expected to be beneficial for people with such a disability.

There are further steps that should be taken before the potential of BrailleOne is fully used. A thorough usability investigation should be implemented. A training course on the use of BrailleOne would need to be developed and the average typing speed (words per minute) calculated for both blind and visually-impaired users with either proficient or elementary Braille knowledge, such that BrailleOne might be compared to other applications of its kind with regard to this specific aspect.

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