VIRTUAL KEYBOARD ADAPTATION

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Abstract: The manipulation with a mobile phone touchscreen can be unpleasant and difficult sometimes, especially for handicapped people. That is why we decided to customize the manipulation with mobile phone touchscreen for little finger ankle. The customizing consists in the increase of accessible areas of touch because little finger ankle needs larger surface of contact for accuracy. The aim is to make a finger-friendly interface for handicapped people.

Keywords: Touchscreen, Android, keyboard

1. INTRODUCTION

Touchscreen technology has come a long way in last few years. Since the display is a device for information presentation, the output information is limited by the size of the display. The comfort of manipulation is connected with the size of the control elements displayed on the screen. The sizes of the control elements do not therefore satisfy all users. For example disabled people have problem with the touch control. The main problem is in decreased finger coordination or even the inability to use fingers to touch. That is why the knucklebones are used. The use of knucklebones needs larger area of contact between the user and the device. This is related with increasing typing errors. The solution is in the expansion of the icons of control elements. This work brings three concepts of new different keyboards enabling comfortable control: zoom, volcano and T12. The T12 proposal is picked as the best solution for next research. This proposal was programmed and implemented.

Android operating system was chosen due to an open-source software stack. With devices built on the Android Platform, users are able to optimize the phone to their interests. Android provides access to a wide range of useful libraries and tools that can be used to build new applications. The Android SDK (Software Development Kit) was used for application development. Android SDK is a software development kit that enables developers to create applications for the Android platform. The applications are written using the Java programming language and run on Dalvik virval machine [2, 3].

The following criteria are taken into account:

- comfort,
- speed,
- intuitiveness,
- lucidity,

- addiction.

It is important to mention two major types of touchscreens: capacitive and resistive. The capacitive touchscreen displays rely on the electrical condition of the human body. A small electrical charge from the finger is used for position detection. The resistive displays use two very thin layers below the glass that are pressed together when the screen is touched. It means that the resistive screen can be touched with any objects, like stylus [1].

2. PROPOSALS OF THREE NEW KEYBORADS

This chapter describes three new concepts of virtual keyboards for mobile devices with touch-screen: zoom, volcano and T12. The goal was to find a new solution for comfortable control of mobile device. These proposals have several advantages and disadvantages.

2.1. ZOOM SOLUTION

The first solution "zoom" seems to be quite simple. The idea is zooming letters or symbols on the keyboard. The proposal of zoom keyboard is shown in Figure 1. It can be seen that the letters or symbols are easy to touch without any typing errors. The problem is that only a small number of letters can be placed on the screen. In this case only eight letters are available and the rest (arrows and other control buttons) is mentioned for shifting to the other group of letters. Consequently, the disadvantage is in often switching of the screens.

Figure 1: The proposal of zoom keyboard

2.2. VOLCANO SOLUTION

The "volcano" solution enables the presentation of all needed letters and some support symbols like full-stop, comma, question mark, etc. Figure 2 shows that the letter "h" is about to be touched by the user and become maximized. The size of letters surrounding "h" is also larger and with increasing distance from "h" the size of letters is fluently decreasing. This feature causes a volcano effect.

In the case of horizontal layout, the length of the whole keyboard is $W_c=11$ and the length of one letter is $W_k=1$. If the pressed letter ("h") is 1.6 times larger than the W_k , the neighbors of the pressed letter ("y", "g", "b", "j") are 1.2 times larger than the W_k and the size of their neighbors ("u", "t", "f", "v" , "n" , "k") remain W_k , then the size of the rest letters is W_o according to (1):

$$W_o = \frac{11W_k - 1{,}6W_k - 2 \cdot 1{,}2W_k - 2W_k}{6} = \frac{5W_k}{6} = 0{,}8\bar{3}W_k \qquad (1)$$

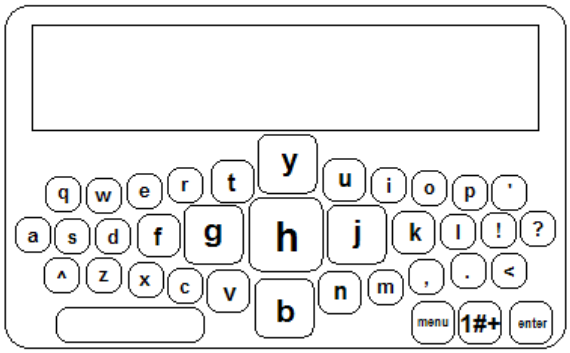


Figure 2: The proposal of volcano keyboard

2.3. T12 SOLUTION

The last solution is very similar to the ordinary hardware mobile phone keyboard. Figure 3 depicts the layout of letters and other needed buttons. It means ten basic buttons for numbers 0-9 and two buttons for symbols "*" and "#" and four or more special buttons. The principle follows ordinary mobile phone keyboard. After one touch, the first letter is chosen and after second touch, the second letter is chosen, and so on.

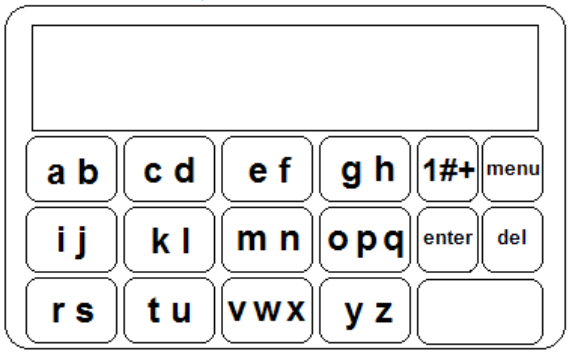


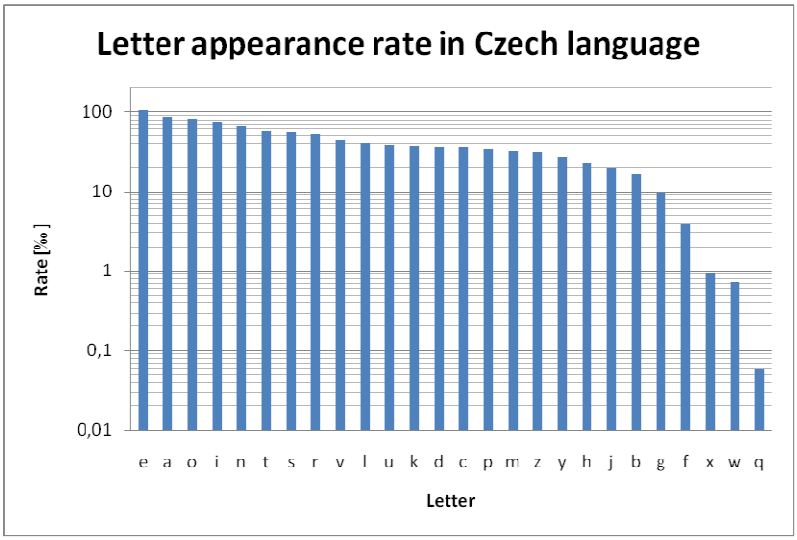
Figure 3: The proposal of T12 keyboard

3. FINAL SOLUTION AND IMPLEMENTATION

The T12 proposal was chosen for the final implementation because it offers the most suitable solution. This solution brings more advantages then the others. For example, the whole keyboard is displayed on the screen (not in the case of zoom keyboard). The program is based on a "Soft Keyboard" application. This application contains fully-functional virtual keyboard for Android operating system. The Soft Keyboard for Android is shown in Figure 4.

Figure 4: The Soft Keyboard application

It is also important to take into account the letter appearance rate in Czech language. Graph 1 shows the frequency of letter appearance. The most frequent letters are “e”, “a”, “o”, “i” and so on. The statistic was introduced by the linguistic department. The letters need to be easy to write in order of appearance; the letter with more frequent appearance is connected to the letter with less frequent appearance. According to this statistic, the letters layout is improved and changed as shown in Figure 5.



Graph 1: Letter appearance rate in Czech language without punctuation [4]

Figure 5 and Figure 6 show the final design of new keyboard in horizontal and vertical layout. New keybord contain all letters and additive symbols. Also the pressed letter or symbol is highlighted above as shown in Figure 6.

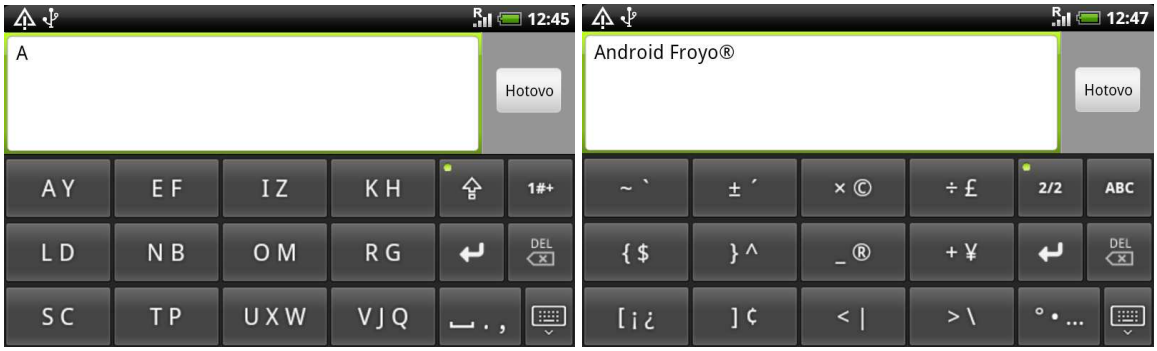


Figure 5: T12 keyboard for horizontal layout (letters and symbols)

Figure 6: T12 keyboard for vertical layout (letters and numbers)

4. CONCLUSION

This article introdouces three new proposals of virtual keyboards. The T12 concept was chosen as the best solution for the next implementation. The goal of T12 virtual keyboard is to make manipulation for handicapped people with mobile phone easier. The layout of new keybord is designed with respect to handicapped people. The letters on the buttons are placed according to the letter appearance rate in Czech language.

Next step is to test this new keybord on a number of users and then upload the virtual keyborad to Android Market. This application will be distributed for free.

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