BloNo: Mobile device accessibility for the Blind

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Resumo

We present a new mobile text-entry method that relies on alphabet navigation and dismisses memorizing, offering visually impaired individuals an easy writing mechanism. Current mobile text-entry interfaces are not suitable for blind users and special braille devices are too heavy, large and cumbersome to be used in a mobile context. With the enormous growth of mobile communications and applications it was urgent to offer visually impaired individuals the ability to operate this kind of devices. Evaluation studies were carried and validated the navigation method as a new mobile text-entry interface for the target population.

Palavras-Chave

Mobile, Visually Impaired, Text-Entry, Accessibility, SMS.

1. INTRODUCTION

Nowadays, mobile phone text-entry is a common and easy task for the majority of the population. However, for visually impaired individuals this is very hard to accomplish. Traditional mobile devices are not equipped with keyboards adapted to those users' needs nor do they provide any kind of feedback for their actions.

Alternative devices were developed to overcome the difficulties arising from visual impairments. Some are based around a braille keyboard as is the case of Braillino or Alva Mobile Phone Organizer. However, while those devices make text-entry easier, they are too expensive, heavy and cumbersome. Other alternatives are based on screen readers (i.e., Nuance Talks), offering visually impaired individuals the opportunity to operate with regular mobile devices. The problem with this approach is that the users need to remember the keyboard disposition as feedback is only given after each letter/word is written. Although experienced users can eventually operate this kind of solution, unexperienced users often give up as mistakes recurrently occur.

We present an interface that relies on alphabet navigation and dismisses memorizing, offering visually impaired individuals an easy writing mechanism. Moreover, menu navigation was also implemented and several practical tasks were evaluated with the target population.

2. OUR APPROACH

Based on user needs, capabilities, and available devices we decided that our method should be compatible with regular mobile phones and, therefore, with the regular 12-key keyboard layout (Figure 1) requiring no-extra hardware (i.e. expensive braille keyboards). It should also require no memorization or difficult adaptation stages.

Figura 1. Regular Mobile Phone Keyboard

Vowel Navigation Method To accomplish our goals, a new text-entry system was developed. The alphabet was divided into five parts, each starting with a different vowel, as these are easy to remember unlike other arbitrarily chosen letters. Those parts were then used to create a character matrix (Figure 2). We use the keyboard keys as a joystick to navigate that matrix. Keys '2' and '8' allow the user to navigate vertically through the vowels, while keys '4' and '6' will allow navigation through the rest of the alphabet horizontally (Figure 2). Both the horizontal and the vertical navigations are cyclical, which means that the user can go, for instance, from the letter 'z' to the letter 'a', and from the vowel 'u' to 'a' (Figure 3).

Using all directions will allow the user to reduce the number of key presses needed to reach to a certain letter. Comparing the approaches followed in Figure 2 and 3 we

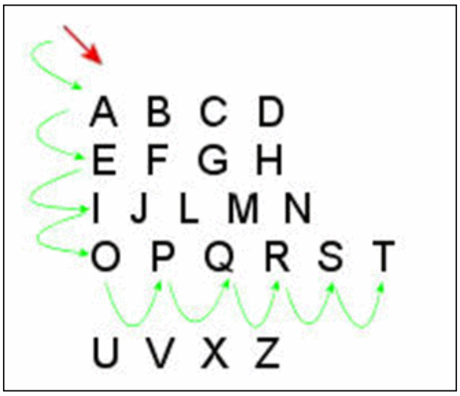

Figura 2. Navigation using two directions

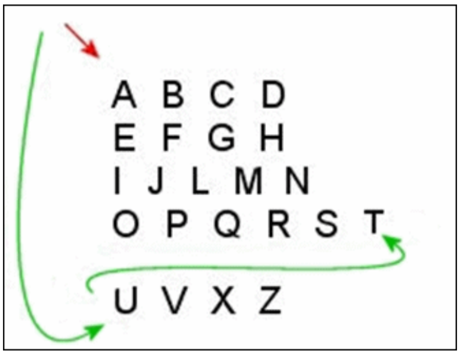

Figura 3. Navigation using four directions

can state that, by using all the directions, the user needs only two strokes to reach the letter 't', instead of nine strokes (using only two directions). Also, the user receives voice feedback before accepting any letter (automatically after a configurable timeout), therefore reducing entry mistakes. The method requires little memorizing and even with low alphabet mental mapping the users can still, in a worst case scenario, navigate forward until they get to the desired letter (there are no wrong buttons, just shorter paths). This is a major issue for the visually impaired as they can totally rely on audio feedback before accepting any letter, increasing the text-entry task success and the motivation to improve the writing skills.

Automatic Word Finishing - AWF

To optimize user performance while introducing text, we developed a system that suggests (on user demand, by pressing the '9' key) a list of possible words that start with the prefix the user has entered. The user accepts the word by pressing the '5' key once. Punctuation characters can be selected by continuously pressing the '5' key.

Task-aware Dictionaries

To enhance AWF performance we developed task-aware dictionaries. These are focused on the specific task being performed by the user and their goal is to reduce the spectrum of words suggested by the AWF. As an example, when entering a name on the contact list, the only words the user will need are names and surnames. In the same way, when entering an address, the user will only need street names.

3 EVALUATION

Tests were made with five totally blind users assessing the new text entry interface as well as the techniques used to improve it, in a set of tasks including message writing and contact manipulation 4. The text entry interface was well understood by all users with a mean of 2 words/minute ratio, after a brief 5 minutes training session.

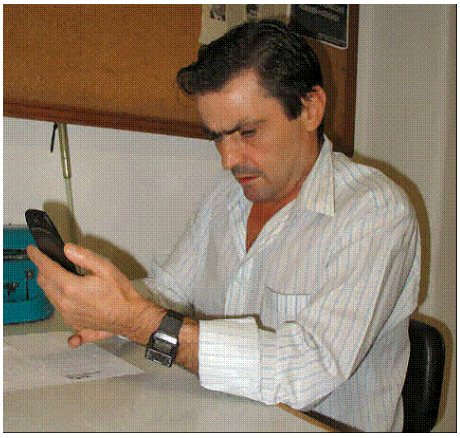

Figura 4. Blind user testing the system

The AWF mechanism reduced the number of keystrokes per character (KSPC) in 13,9% and the time to accomplish the tasks in 9,9%. Adding a contact was tested in 3 different conditions: without AWF, with AWF and with AWF and task-aware dictionaries (names only). AWF mechanism improved the total time in 32,4% and task-aware dictionaries improved it by 14,5%, with a total time reduction of 42,2%. All users were satisfied with the system and showed great improvements in their performance across the evaluation process (reduced in 45% the number of words/second, and reduced KSPC in 21%).

4 CONCLUSIONS

The new text-entry interface presented needs no memorizing and no extra hardware making possible for any visually impaired individual to use a regular mobile device, accomplishing even the most difficult tasks like writing a message or managing contacts. Target population evaluation validated the approach. As future work, we will study other text-entry interfaces as well as shortcut mechanisms that ease menu navigation, like accelerometers, RFID tags or voice recognition.

5. ACKNOWLEDGEMENTS

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