Challenges of the blind programmers

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Abstract. *Programming today requires one to be able to code textually but it also requires a quite amount of visual design. Both of these have left blind people in very difficult position when talking about programming.*

There has been some effort in general to produce methods and tools that would enable blind persons to use computers but none of them has been specialized to aid the blinds in various programming issues.

In this paper we will discuss the methods that are used to aid blinds to use computers, we will analyze how and in which amount they can be used to help blind persons in programming, we will discuss how applicable they are regarding textual and visual programming work. Finally we will also mention main disadvantages that blind come across and give some ideas for their resolution.

Keywords. blinds, programming, disadvantages, methods, tools

1 Introduction

Since 1950s and 1960s textual programming has gained its sustainable form. In this point programming for the blind was something that was possible and blind programmers could compete with their sighted colleagues. Education and employment of blind programmers was quite successful. There are over 130 registered blind programmers today with American Foundation of the blind programmers which indicates that blind people still take interest in the field of programming [7].

Since 1980s and GUI development it became more and more difficult for the blinds to work as programmers. In the first phases of GUI environments there was a possibility to describe visual elements through text files but as development of these tools advanced this has become virtually impossible [1]. All this has left the blind programmers with a huge problem to deal with.

The tools to aid blinds to programming jobs were based on text recognizing and conversion of text into speech. Unfortunately, these tools haven't advanced as quickly as GUI development and there have been some serious technological problems to upgrade these tools to work with new development environments.

The main disadvantages of blind programmers have become inability to perform design activates and create graphical forms by usage of point and click interface. All this calls for a detail analysis of all available methods and tools to aid blind programmers, to assess the disadvantages that blinds come across and to discuss possible solutions for their resolution.

2 Methods and tools for blind programmers aid

When taking a closer look at all methods and tools for aiding the blinds in working with computers and programming the most number of tools work as convertors from text to speech or sometimes even to Braille.

There are a number of tools on the market and here are some of the most known and mostly used:

- HAL Screen Reader - recognizes text and converts it to speech using standard computer's soundcard. Screen information is also sent to

one of many Braille devices available. HAL recognizes not only texts but also Windows dialogs, icons, menus, buttons and controls.

- JAWS [3] - is the most used and most popular screen information reader in the world. It enables various applications content recognizing as well as Internet support. It uses its own soundcard and internal speech synthesizer. JAWS converts text to audio and also has a support for Braille.

- Virgo4 - enables to choose what screen information will be displayed in Braille and what will be displayed in audio format.

The visual appearance of these tools is shown in the following figures.
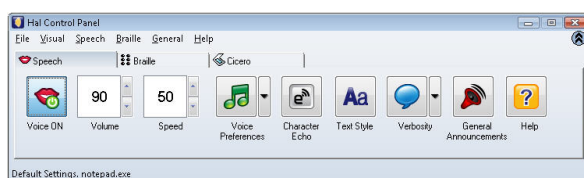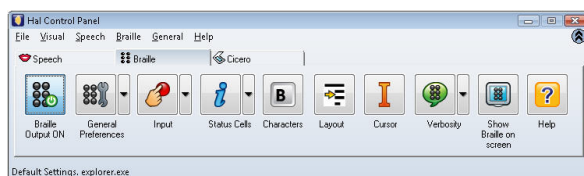
Figure 1: Hal speech options

Figure 2: Hal Braille options

All these tools aim to enable the blind person to hear text on the screen in the form of speech. All tools have to be constantly updated to support new programs. So, the basic process of working for the blind programmer is to hear the text of menus, code lines, etc. and to enter programming code by using the keyboard.

To solve the problem of having to use the keyboard and to aid blinds to program in more natural way another approach is possible. In this approach the use of keyboard is completely omitted and replaced with the usage of voice.

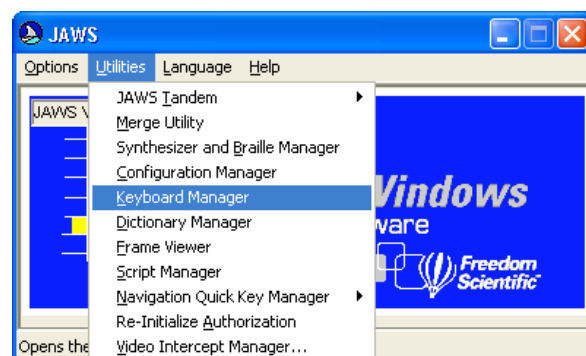Two major difficulties can be found when blind learners use programming languages. First, if they
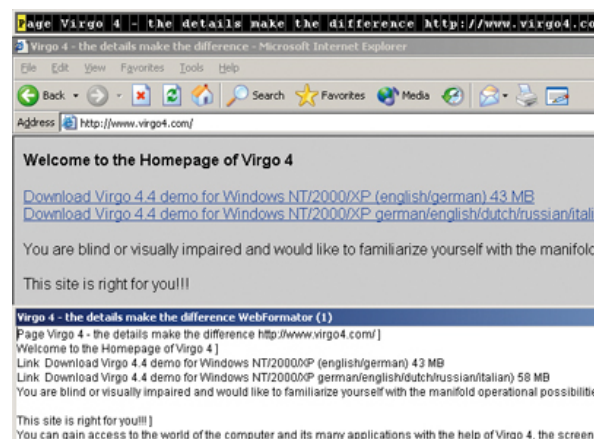
Figure 3: JAWS utilities

Figure 4: Using Virgo4 with Internet Explorer

use a pure language they face the issue of verifying the program consistency and the correct reading of command lines. Second, if they are provided with current tools to support program construction, they deal with graphical user interfaces [4].

The mentioned audio based programming language (APL) [4] is an effort to solve these problems and provide blinds with efficient means of learning programming concepts.

APL consists of two layers: Audio Interface and Programming Logic. Audio Interface consists of Circular command list that contains list of commands (condition, input, variables, etc.) and a Query that defines variables and input/output (audio and optional text). Programming Logic has four states: Run program, End loop or condition, Delete last command, and Save command and Verify next step. All semantic is not visible to the

programmer.

Figure 5: APL layers [4]

Although this concept is good for learning it is too rudimentary for complex wide usage in a professional programming and applications development.

3   Visual design problem

Although the mentioned methods cover all text-based programming which has been sufficient for years, the new technologies require more sophisticated solutions. The main problem that existing tools come across is the problem of visual design. If we look at desktop and web applications development separately then we can come to conclusion that this problem is still not so big when talking about web development. Although there are some visual editors for HTML, the whole interface design as well as background logic when talking about web is still coded line by line in various editors, which makes existing text to speech converters more than sufficient. There are some details that could be discussed like colors pick and other accessibility elements [6] but this is an issue on a lower level.

As for the standard desktop GUI applications and development environments, they are becoming more and more sophisticated and thus less and less appropriate for usage in combination with existing tools and methods for the blind programmers aid. The main problem is that although in the beginning of visual environments, where computer screens or forms where drawn by using a mouse and various controls are created by point and click actions, there was possible to describe the form also

by using a standard text file [5] and that feature lacks in modern GUI development environments.

In order to solve this problem there is a need to find a proper approach. When analyzing possible approaches to be taken in order to do this there are several options.

First there could be interpreters of forms and form's elements in the same way as existing tools for text to speech interpret windows elements, just a little bit more sophisticated. The interpreter would have to be able to tell attributes of each visual element and enable visual changes of positions, size and appearance.

Secondly, the process could be reversed. The tools could support manual or audio creation of certain graphical elements.

The third option that has already been tested in some particular cases would be to create a special scripting language [2] that would enable blinds to create graphical elements by using textual files and textual descriptions of every element. A scripting language of this kind was developed for usage with Visual Basic.

All of these solutions ask for development of proper interface for every programming environment. To overcome this problem the whole concept could be brought to a higher level and a description language could be created that would then be easily translated into every programming language graphical interface using GUI generator and this will be one part of our future research.

4   Conclusion

Involving disabled people, in this case the blinds into computer and programming world is one of the tasks of modern and civilized society. There is definite interest among blind population for programming and computers. There are some associations and foundations that support blind people activates, including their effort to compete as a programmers.

There are existing methods and tools to aid blind in using computers and the same tools are used to aid in programming. These tools are completely sufficient when talking about textual programming but lack features when it comes to visual design.

Possible approaches as well as existing efforts can be recognized and a step toward the complete so-

lution can be proposed. Since all existing tools are base on text to speech recognizing, the new approaches try to perfect the programming process by using for example completely audio interface or try to go a step forward and address the issue of visual programming disadvantages.

There is a need to produce more sophisticated audio interpreters of visual elements or more sophisticated development tools that would enable the blinds to create forms by using their voice or keyboard in combination with scripting language that would enable textual forms decryption and development. Finally, the universal solution would be to create a new description language that would enable the creation of models which could be easily translated into every programming language graphical interface using GUI generator. This part will be included in our further research efforts.

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