

BlinkMouse-On-Screen Mouse Controlled by Eye Blinks

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Abstract. The paper concerns issues related to assistive technologies for disabled people. An interface which emulates a computer mouse, handled using eye blinks, is presented in the paper. A computer should be equipped with a low cost webcam to use the interface. Icons related to different directions of mouse cursor movements and real mouse buttons are sequentially presented to the user. An action corresponding to currently shown icon is performed when the user keeps his eyes closed for a specified period of time.

The interface is now used by a disabled girl with SMA (Spinal Muscular Atrophy). The part responsible for an analysis of an eyes behaviour was prepared as a dynamic linked library (DLL), so it can be used for other purposes.

Keywords: computer vision, assistive technologies.

1 Introduction

Nowadays almost everybody can have a computer equipped accordingly to his needs without much difficulty. It is particularly important for disabled people who cannot communicate with others in usual manner. A computer equipped with a special devices or software interfaces can allow such people to participate in social life, learn a profession and take up a job. This results in increased independence and life activity of disabled people. Disabled children can learn and play using such systems. Their teachers and therapists can use computer programs designed for educational and therapeutic purposes in their work.

People with serious motor impairments, such as spinal muscular atrophy (SMA), Amyotrophic Lateral Sclerosis (ALS) or spinal cord damages, are probably in the most difficult life situation. They often communicate with others using alternative communication systems, such as picture symbols (black and white pictures called pictograms or color pictures in the case of Picture Communication System – PCS). The symbol illustrating what the person wants to say is usually indicated by specified signal, which can be generated by disabled person. In the case of the above diseases face expressions or eye blinks are often used as these signals.

To communicate with the use of pictograms or PCS it is required that a person, which flips through the pages of the book with symbols with pictures, assists the disabled person. Computer program can substitute such person. Moreover, a speech synthesizer can read statements chosen by disabled user. It allows disabled person to feel more independent of others. Moreover, well tailored user interface can make communication more convenient.

Children using an alternative way of communication, such as pictograms, often do not learn reading and writing. It impairs their mental development and decreases their potential for participation in social life. It can be changed by providing tools for handling a computer equipped with special programs for communication and education. A virtual keyboard and a special interface which enables to emulate a computer mouse can give an access to the whole of a computer functionality. Virtual keyboard is standard component of Windows operating systems. There are many similar solutions freely available in the Internet (see e.g. <http://www.techsupportalert.com/best-free-onscreen-keyboard-osk.htm>.) Most of them are inconvenient in the use, but it is possible to freely download solutions which incorporates innovative technologies, such as word prediction, which makes it possible to reduce the number of clicks needed to write a text [1,2]. Thus, providing a disabled user with the interface for mouse handling, which is tailored to his capabilities, is very important for such person.

We present some solutions of this kind which can be used by people with considerable motor impairment (Sect. 2). Our aim was to give a 12 years old girl suffering from SMA the possibility to communicate with the others by means of a computer equipped with one of such interfaces. At first we experienced with b-Link system [21]. It allows to handle a computer using eye blinks and it is freely available from the Internet. Unfortunately, the system proved to be useless. We found out that it resulted from wrong face position relative to the camera. Namely, eyes line was not parallel to the bottom line of the face image. Fulfilling this condition in regard to the girl who lies on the bed, was impossible without an additional camera set-up equipment. Moreover, the graphical interface seemed to be too complicated and too little intuitive for the child. Inability to configure the application with a traditional computer mouse was also very inconvenient (it was possible to do it only using eye blinks, which was very arduous). The drawback of b-Link is also that it occupies a lot of screen area and there is no possibility to change it.

These remarks induced us to develop much simpler interface dedicated to children, without loss of functionality of b-Link. We decided to prepare an universal software interface for eye blinks detection, which could be used for other purposes. We decided to base on a blink detection method proposed in [22], because its high reliability in varying environment condition and high accuracy was reported by the authors. The interface is described in Sect. 3. Our main goal was to design an on-screen mouse application, which is intuitive for the children and will allow the girl mentioned above to handle the computer without help of any assistant person. We named it *BlinkMouse*. The solution is presented in Sect. 4.