Eye-Blink Detection System for Virtual Keyboard

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Abstract - *This paper is about Human-Computer Interaction (HCI). It focuses on the interface and interaction between people and computers. The main goal of the HCI is to design machinery that lets people interact with computers in a novel way. This is very useful for people who are physically challenged as they can interact and surf the internet. An eyeblink is used in this system to enter special characters and alphabets similar to when a user enters it manually on a keyboard instead of the user entering it by blinking an eye. The most substantial method people use to interact is eye blinking and eye movement for people with physical disabilities.*

Key Words: **Eyeblink, keyboard, Virtual Keyboard, Blinking Keyboard**

1. INTRODUCTION

Artificial intelligence is of many different technologies to interact, comprehend and use in our life [1-4]. Technologies like machine learning and natural language processing are all part of the AI landscape. Each one is evolving along its own path and, when applied in combination with data, analytics, and automation, can help businesses achieve their goals, be it improving customer service or optimizing the supply chain by Afraa Z. Attiah, Enas F. Khairullah[1]. HCI is a part of AI that is an emerging technology field focused on designing and enhancing the interaction process between humans and computers. HCI is widely implemented in many areas, such as medical technologies, robotics, urban design, gaming, and assistive technologies as shown in Brazil Chambayil, Rajesh Singla, R Jha, [2]. AI plays an essential role in image processing and powers facial recognition, giving functionality to detect and recognize objects and patterns in images and videos. There are different types of image processing that can be adopted by an eye-tracking system [1]. Images or a sequence of images comprise the input data, which are acquired first and converted to digital form. To perform the next operation, the images must be enhanced, which is achieved by applying different mathematical operations. There are many systems, including applications that are based on human eye movements and eye blinking. There is a tremendous need for an eye-tracking system, especially for people with severe motor disabilities resulting from injury, illness, or disease[4]. The system works to alleviate the symptoms of their disability and create self-expression tools. This technology is aimed at mitigating the isolation suffered by disabled communities in terms of social interaction by providing a system for enhanced interaction through self-expression eye detection is widely used in face detection and different areas like artificial intelligence (AI), virtual reality (VR), ubiquitous computing (UC), augmented reality (AR), artificial neural network (ANN), etc. Eye gaze is another method of HCI. In such techniques, real-time data is gathered for tracking and estimation of eye gaze.

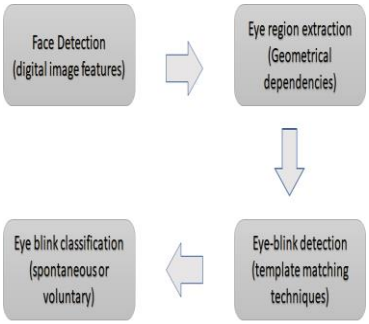
In these paper [1-10], they investigate and discuss recent proposed virtual keyboard-controlled systems. We propose an eye-blinking detection system that translates eye movement into a message, which will allow those severely impaired to become more independent and interact with others using an interface adapted to their needs.

2. ANALYSIS OF TASK

The keyboard which is being commanded by our eyes mainly in three steps. Firstly, detect the eyes and when the eye is blinking, gaze will be detected where the person is looking at the top, bottom, or right and left with their eyes [4-5]. Then create the virtual keyboard on the screen where all the letters from the keyboard are present, and finally link both these parts, the first one i.e., where it uses eyes, and the second part one with the virtual keyboards so that one can command the keyboard. for.eg choosing the key by looking at some specific part of the screen. Person can also decide the frames how long you want to keep the eyes closed for the selection and how long want to keep the gaze to select the part of the cube [4]. When eyes are open it's red and when eyes are closed it becomes green which means person will be pressing the key. The keyboard is divided into two-part i.e., left, and right and it includes half letters on the left side and half on the right side [6]. Here webcam is controlling the position of our eyes, so if you want to select the left side you need to look on the left side for a second, and for the right side, you need to look on the right side. So now if person see on the right side to press a key, person need to wait for the key to focus i.e., person need to wait for the key to light up, and then they can blink the eyes and can keep the eyes closed until they hear the sound, that sound means the key has been pressed. Each time you need to repeat these steps.

In this system, OpenCV and the dlib library used to first detect the face and from the face, eye will be detected. To calculate the facial points and for other mathematical calculations NumPy library will be imported. To get to know when the eyes of the person has opened, or closed blinking ratio of an eye will be calculated.

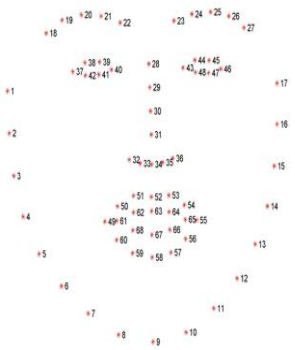
3. METHODS



4. ALGORITHMS FOR THE EYE BLINK DETECTION

Face detection is a very important part of the developed eye-blink detection algorithm. Since face localization is computationally expensive and therefore time-consuming, this procedure is run only during the initialization of the system and in cases when the tracked face is ‘‘lost’’. The objective of an eye blink-controlled keyboard system is to detect the eye and then blinking to select the desired key to type a letter without using hands. This system includes two components: I) an imaging processing module and ii) a virtual keyboard on a screen. The imaging processing module is the main module that detects the face and the eyes. For people who are not ready to control the muscles around their eyes to a degree that they can wink, the framework still empowers them to reproduce the left-click summon of a customary mouse [4]. This is a changeover present assistive mouse-substitution frameworks, for example, Camera Mouse.

AN IMAGING PROCESSING MODULE

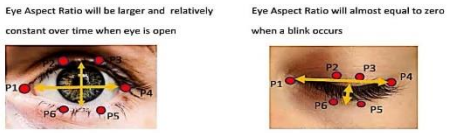


A huge amount of the data collected today is made up of images and videos. That is why effective image processing for translating and obtaining information is crucial today. Technology is increasing day by day and image processing has become a major role [8]. Vision-based eye-blink monitoring systems have many possible applications, like fatigue monitoring, human-computer interfacing, and lie detection. No matter what the purpose of the system is, the developed algorithm must be reliable, stable, and work in real-time in varying lighting conditions [10]

So, it starts from here, as the image will be detected, and These are the facial landmarks. As you can see, 68 points are marked as per our features on the face. By these points, it will detect our face. By facial points eyes will be detected.[4]

After the detection of the eye, the next work will be to measure the Eye Aspect Ratio as shown above if the ratio is larger and relatively constant over time that indicates the eye is open. If the ratio is almost equal to zero that indicates the eye is closed. Hence, blink can be detected and as per the application.[5]

Testing Results



A virtual keyboard on a screen

ChangZheng Li, Chung-Kyue, Jong-Seung Park [4] showed a keyboard will be created where the letters will be highlighted, and white highlighted box will move in a specific interval of time. It keeps moving as one will blink on the specific letter it will get printed. It's just an alphabet that has been done till now. There is a limitation to the project as many things are limited and are not specified enough..

All the above methods and ideas had been tested and were successful to ensure the requirement [1-12]. It came for the help of people who are disabled and can be implemented everywhere as per requirement. But it can be only 100% sure if and only if every step is done properly. The main elements of the developed user interface are a virtual keyboard and a screen mouse. The operation of the interface is based on activating certain ‘‘buttons’’ of the virtual keyboard or mouse by performing control blinks [4-8]. These parameters show that the proposed algorithm fulfils the assumptions made to develop a reliable eye-blink detection system.

CONCLUSION

An eye-blink detection system for a virtual keyboard is presented in this paper. The computer's camera is used to capture a facial image, then the eye detection module detects the eye location. Eye blinking is used to select the desired character as the highlighted one on the virtual keyboard like pressing an "Enter" button. The system is designed for people with a disability. The results show high user satisfaction and prove the benefit of the system. The framework effectively permits the clients to reproduce a traditional machine mouse. It allows users to open a document and perform typing of letters with the help of blinking of their eyes.

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BIOGRAPHIES

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