Cursor Movement with Eyeball

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Abstract - *A single individual A human-computer interference system is now being implemented. Human computer interference systems used the mouse and keyboard as input devices in the past. Those who are afflicted with a specific ailment or illness are unable to use computers. For handicapped and impaired people, the idea of controlling computers with their eyes will be extremely useful. This form of control will also eliminate the need for other people to assist with the computer. This approach will be particularly effective for people who are unable to function with their hands and must instead rely on their eyes. The movement of the cursor is directly related to the pupil's centre. As a result, our initial step would be identifying the point pupil's centre The Raspberry Pi and OpenCV are used to build this pupil detection procedure. The SD card is inserted into the SD/MMC card port of the Raspberry Pi. The operating system that is required to start up the Raspberry Pi is installed on the SD card. Once the application programme is loaded into the Raspberry PI, it will run.*

Key Words: Human Computer Interaction (HCI), Eyeball movement, Computer, OpenCV, Support Vector Machine.

1. INTRODUCTION

As computer technology advances, the importance of humancomputer interaction becomes increasingly apparent. Some people with disabilities are unable to utilize computers. Eye movement control is mostly utilized by those who are impaired. By incorporating this eye-controlling mechanism into computers, they will be able to work without the assistance of others. HumanComputer Interface (HCI) is concerned with the use of computer technology to establish a human-computer interface. There is a need to discover appropriate technology that allows for good humancomputer collaboration. The importance of human-computer connection cannot be overstated. As a result, a mechanism for disseminating an alternative mode of human-computer communication to individuals is required persons with disabilities and provides them with an equal opportunity to participate in the Information Society. In recent years, human-computer interfaces have caught the curiosity of a number of academics throughout the world. A human computer interface is an implementation of a vision-based system for eye movement detection for people who are visually impaired. Face detection, face tracking, eye detection, and real-time interpretation of a sequence of eye blinks are all incorporated in the proposed system for managing a non-intrusive human computer interface. The mouse is no longer used to interface with the computer; instead, human eye motions are used. This technique will assist paralyzed persons, physically challenged people, and people without hands in computing efficiently and easily. To begin, the camera records the image and, using OpenCV code for pupil identification, focuses on the eye in the image. As a result, the human eye's centre position is determined (pupil). The centre position of the pupil is then used as a reference, and the human or user moves the pointer left and right depending on that . The following is a description of the paper's structure. Section II discusses different 3D models that can be used to find cursor movement. In Section III, we show how the cursor works using OpenCV approach and solely eyeball movement. In Section IV, you'll learn how to move the pointer with an eyeball using an example with superior solutions. Section V contains the main body of the paper, as well as the conclusion.

1.1 CONNECTED WORK

Mouse clicks and mouse movements are the two most basic mouse activities. This mouse has been replaced by advanced technology. with the aid of an OpenCV and eye motion Any facial emotion, such as blinking eyes, opening mouth, or head movement, can be used to activate the mouse button. This model introduces a revolutionary camera mouse powered by a bias face tracking algorithm based on a 3D model. Because of the conventional configuration, a personal computer (PC) achieves human-machine interaction through faster visual face tracking and provides a viable solution for hand-free operation. To operate the mouse and perform mouse actions, the face tracker utilized here is based on a 3D model. Head-mounted display (HMD) environments can benefit from gaze estimation since they provide key natural computer interface cues. This innovative method of estimating gaze is based on a threedimensional examination of the human eye. There are numerous options. Gaze detection technology is used in a variety of commercial items. This approach requires the user to merely point one point for calibration, after which it will estimate the gaze points. To avoid the usual mouse motions with the human face for human connection with the computer, facial features such as the eyes and nose tip are identified and monitored. This procedure can be used on a wide variety of face scales. For quick extraction of face candidates and face verification,

the SixSegmented Rectangular (SSR) filter and support vector machine are used. This is the foundation of our detection approach. The scale adaptive face detection and tracking system is implemented using JAVA (J2ME) for face candidate detection and to perform left/right mouse click events when the left/right eye blinks. For impaired people, a camera mouse has been utilized to interface with the computer. All regular mouse and keyboard actions are replaced with the camera mouse. All mouse click events and keyboard actions can be provided by the suggested system. The camera mouse system, in conjunction with the timer, functions as a left click event, whereas blinking acts as a right click event in this manner. Eye-gaze estimation in real time The system is used to assist the disabled with an eye-controlled mouse. This system is based on the concept of using a low-resolution webcam to detect and track gaze accurately at a lower cost and without the need for special equipment. The PIR sensor is specifically designed to detect human movement. This paper describes a new 3D camera mouse that is powered by visual face tracking. This camera has a common configuration for PCs that increases calculation speed while also allowing for hands-free control via visual face tracking. Rigid and nonrigid motions are two types of human facial expressions. Rotation and translation are rigid motions, but opening, shutting, and stretching of the mouth are non-rigid motions. Firstly We employ a virtual eyeball model that is based on the human eyeball's 3D properties. Second, we will calculate the 3D position of the simulated eyeball and gaze vector using a camera and three collimated IR-LEDs [2]. Finally, on an HMD monitor, the determination of 3D eye position and gaze position is permitted. This used three reference frames to simplify difficult 3D conversion calculations (the camera, the monitor and the eye reference frames). Fourth, a simple user-dependent calibration approach based on kappa compensation was proposed by looking at one place. In our work, we are attempting to meet the needs of people with hand problems who are unable to use internet resources without the assistance of others. Our application has been accepted. Because interacts with the computer primarily through face characteristics, no hands are required to operate the mouse . The lack of muscle functions in a portion of your body is known as paralysis. It occurs when the transmission of messages between your brain and muscles is disrupted. The person's capacity to control movement is confined to the muscles around the eyes when this happens [4]. Blinking and eye movement are their only means of communication. The aid provided to such communication faults is frequently obtrusive, requiring special hardware or a gadget. An alternative method of communication is to use a non-intrusive communication technology like Eye Keys without the use of special lighting If a person stares at the camera, the eye direction is recognized, which can be utilized to operate numerous apps.

2. Work to be Done

The proposed system makes use of a Raspberry Pi 3 board that is connected to a monitor, PIR sensor, and camera. USB adaptors are used to connect these materials. Raspberry is an important component of the working module that uses sensors to track eye movement. Raspberry Pi is powered by an SD card, which is used to install Raspbian and programming scripts. Human movement can also be detected with a PIR sensor.

3. Face Recognition

Face detection is a computer technique that identifies human faces in digital images and is used for a range of applications. Face features are detected using the proposed method. A basic face tracking system has been created. Face photographs can be examined without the user/person ever having to interact with them. Facial recognition can be a useful tool for keeping track of attendance and time information. The human face provides facial data that can be used in a variety of applications, including emotion recognition and humancomputer interface. For feature extraction, a local binary pattern method might be utilized. The web camera can produce a 33-pixel image. Pixel values can be encoded and then translated into binary values of 0 or 1. The face image is divided into N blocks. The thresholding function is described below:

$$S(g_c, g_i) = \begin{cases} 1, if\ g_c \geq g_i \\ 0, if\ g_c < g_i \end{cases}$$

Weight values are calculated for every neighbor and calculate the LBP value.

3.1 Detection of the Eye Region

Vertical integral projection and horizontal projection are used to determine the exact position of the pupil. These projections break the entire image down into homogeneous subsets. The proposed technique employs an arbitrary threshold. A Gaussian filter can be used to remove the noise. The minimal gradient point is used to calculate the strong pixel value. In the contrast region, the lower threshold guards against splitting edges. Circular The inner and outer boundaries are determined using the Hough transform. Check all the edge points with centre coordinates using the Hough transform.

3.2 Classification of Eye Movements

The support vector machine classifier is used to classify the various eye-motions. The web camera records eye movements such as eye open, eye close, eyeball left, and eyeball right. Data can be analyzed using SVM, which can also be utilized for classification and regression analysis. SVM stands for supervised learning model, and it is used to solve classification and regression issues. The multi class

file is utilized in SVM. This PIR sensor is linked to the Raspberry Pi's General Purpose I/O port, and it detects eye pupil movement, causing the camera to begin taking images. The sensor has a range of up to 5cm.

When the sensor detects movement of the eye pupil, the camera begins to record images and sends them to the Raspberry Pi via USB. The camera in this case is a low-cost USB web camera. Following that, the image is processed and monitored. The SD card's purpose is to hold the Raspbian Jessie operating system module as well as the software. The Python programming language is used to activate the Raspberry Pi hardware. The SD card may hold up to 8GB of data. The raspberry board's HDMI port provides the monitor input. HDMI stands for High Definition Multimedia Interface, and it's a connection for viewing uncompressed video data. HDMI is a digital picture signal converter. It converts the digital signal into an analogue signal and sends it to the monitor. The eye movement is captured using a camera. The centres of the eye, as well as the position of the individuals, are used to determine the various eye movements. Raspberry Pi is used to carry out the process. The pupil reference in Figure 1 contains the coordinates of (x, y). The Raspberry Pi will be used in conjunction with a USB camera. The SD card will be used to install raspier OS and Opencv on the Raspberry Pi. The USB Camera will capture the first image. Opencv code focuses on the eye in the image and detects the pupil's centre position.

For classification, the support vector machine technique is utilized. The image of the eye is represented as a vector. The pixel values are represented by the letter I. There are two sets of training photos. SVM's job is to figure out if fresh data belongs in the positive or negative set. The training data is subjected to principle component analysis, which minimize the data's dimensionality.

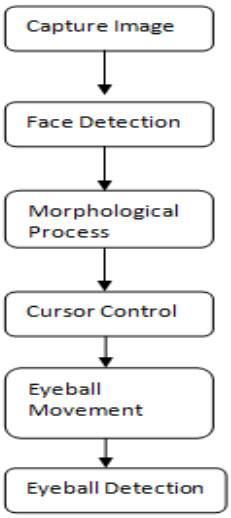

Fig. 1 Flow of Proposed Work

3.3 **ANALYSIS OF PERFORMANCE**

The operation begins after the OS has been started. PIR sensor is first used to detect the presence of a person in front of the device. If a person is spotted, the camera will turn on and capture a picture with the USB camera. Figure 2 shows the focus on the eye in the image. OpenCV now detects the pupil's central position. Take the exact position of the pupil as a starting point, and then adjust the X and Y coordinates for a more precise instruction.

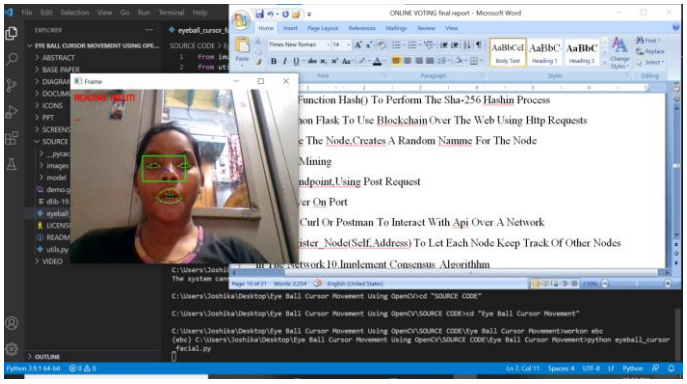

Fig. 2 Detection of Eye

$$d = \frac{max\{||L-L'||, ||R-R}{L-R}$$

One of the parameters used to assess the accuracy of proposed work is detection error. The BioID database can be used to obtain images. The proposed method outperforms existing methods in terms of accuracy. The efficiency at various error levels is depicted in Fig. 3.

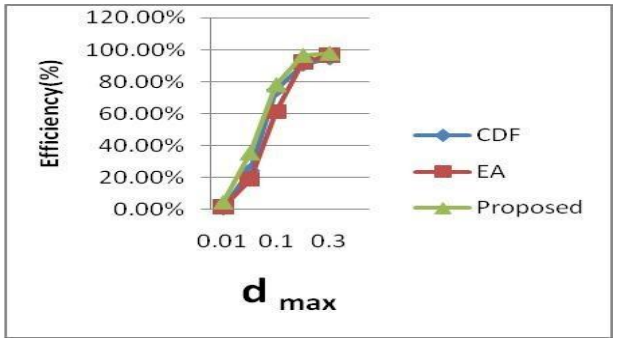

Fig. 3 Efficiency Analysis

4. CONCLUSION

It is evident from the process that the cursor can be controlled by ocular movement, rather than using hands on the computer. This will be useful for persons who have difficulty controlling cursor points on computers using the physical parts of the machine. Because the eyeballs can be used to control the cursor points. Disabled people can utilise computers without the assistance of others. This technology can be improved in the future by introducing new approaches such as clicking events, mouse motions, and human interface systems that use eye blinks. To achieve efficient and accurate movement, technology was extended to ocular movement and eye blinking.

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