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Dheeraj Narahari, Chandra Vamsi Ballani, Uday Kiran Divi, Kavin Raj and Krishnaveni Kommuri

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EYEBALL MOVEMENT-BASED CURSOR CONTROL FOR PHYSICALLY CHALLENGED PEOPLE

Dheeraj Narahari[1, a,] Ballani Chandra Vamsi[2, b,] Uday Kiran Divi[3, c,] Kavin Raj[4, d*] and Krishnaveni Kommuri[5,e]

[1, 2,3,4] Department of Electronics and Computer Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Andhra Pradesh, INDIA

[a]180050013@kluniversity.in, [b] 180050033@kluniversity.in, [c] 180050040@kluniversity.in, [d]180050018@kluniversity.in, [e] krishnavenikommuri@kluniversity.in

Abstract. This study presents a novel human-computer interaction system based on eye movement. A mouse is a type of data input device that is commonly used in computer systems. However, we use our eyes instead of a mouse with this system, which gives a unique manner of controlling the computer via eyeball motions. The technical work behind this pupil identification system makes use of a Microcontroller device to operate the cursor of the computer, and the Eye Aspect Ratio approach is used in combination with OpenCV to identify the pupil. This system uses an IP cam (Internet Protocol camera) to track the user's eye movements and duplicates them as mouse cursor movements on the screen. It also detects the user's eye looking on an icon and converts it into a click operation on the screen. The major goal of this technology is to assist the user in controlling the cursor without the use of hands, and it is especially useful for those with disabilities. Eyeball movement, Mouse, PY Charm Software, IP Cam are all keywords (Internet Protocol camera)

INTRODUCTION

Personal computer systems now play a major role in our day-to-day existence since they are used in places such as the workplace, among other things. These apps all have one thing in common: the operation of personal computers is heavily reliant on data input techniques such as the mouse. However, this is not a concern for a healthy person; however, it may be a problem for persons who have reduced mobility of movement in their hands. In such instances, it may be desirable to utilize input techniques that support the region's skills, such as eye movements. To allow such an input technique as a replacement, a system is built that uses a low-cost way to operate the pointer on a computer system without the usage of a mouse.

The eyeball movement is used to control the computer system's cursor movement in the proposed approach by OpenCV. This system is made out of PY Charm Software. It is linked to a Camera, which detects pupil movements and allows the cursor to be controlled based on these eyeball motions, which are processed using the Open CV (Open Computer Vision).

PROPOSED METHODOLOGY

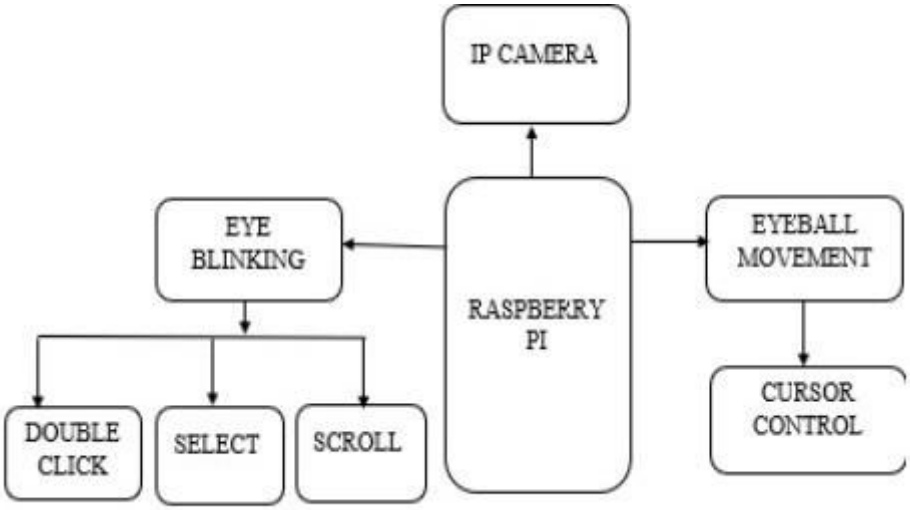

Figure 1 Block diagram of eyeball movement-based cursor

Figure 1 shows a PY Charm Software 4 GB of RAM, and built-in Wi-Fi. A Camera is connected to the PY Charm Software to provide PC vision to the machine. The camera will detect eye movement and, as a result, operate the cursor. It will also do activities such as double-clicking, scrolling, and choosing. The steps are as follows:

1. Cam records eye movements, which are then analyzed using Open CV.
2. The Eye Aspect Ratio (EAR) method is used to identify eyes.
3. The recognition of EAR values and the commencement of frames based on ocular movements.
4. Using the cursor to do various actions such as scrolling, selecting, and double-clicking

IMPLEMENTATION

This research is mostly focused on predicting eyeball movements. Before we can detect eye movements, we *must* first identify face landmarks [4]. We can do a lot with the help of these markers. In a video, we can identify ocular movements and blinks, as well as forecast emotions [8]. How to Use the dibs Facial Landmark Finder: Dlibs model not only detects faces quicker but also reliably predicts the 68 2D facial landmarks.

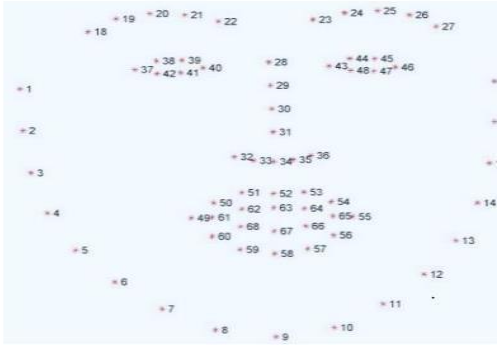

Figure 2 Picturing the 68 facial landmark positions

Only the eyes are considered while detecting eyeball movements. As illustrated in Figure 3, the eye is represented by 6 (x, y) coordinates beginning in the upper left corner and proceeding clockwise to the right, covering the remaining region of the eye.
Based on the study conducted by Project. the second and ability to self in the Real-Time Eye Blink Detection Using Face Landmarks system an equation may be constructed that fulfills the relationship between all six facial coordinates known as eye aspect ratio and can be computed as follows.

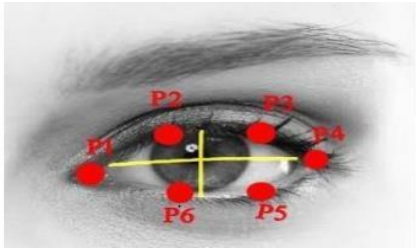

Figure 3 The 6 facial points linked to the eye

$$EAR = \left(\frac{||P2 - P6|| + ||P3 - P5||}{2||P1 - P4||} \right)$$

Points p1, p2, p3, p4, p5, p6 in the above equation are termed two - dimensional facial landmark locations.

The distance between the vertical points of the eye is substituted in the equation's numerator, and the distance between the horizontal points of the eye is substituted in the denominator. When the eyes are wide open, the eye aspect ratio is practically constant, and when the individual blinks, the number drops to zero.

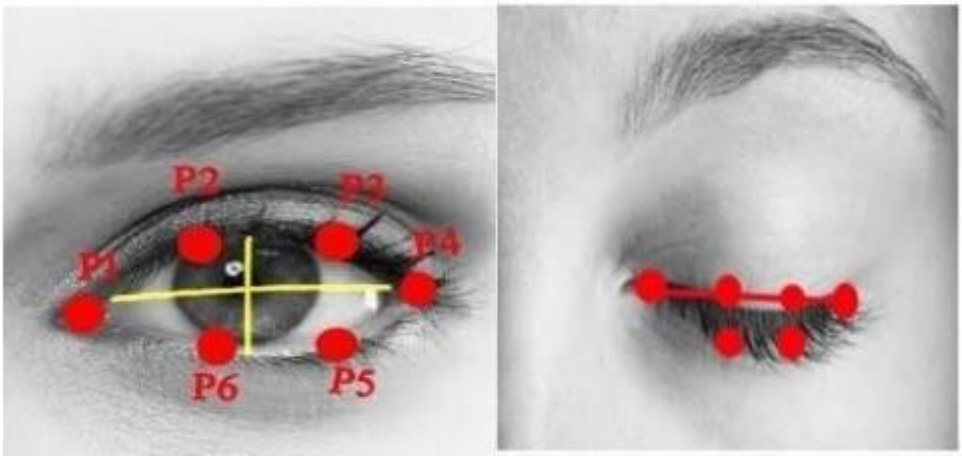

Figure 4 Landmarks of the eye when the eye is fully open (left) and landmarks of the eye when the eye is closed (right)

When the user's eyes are completely open, the eye aspect ratio increases and remains constant over time, as shown in Fig 4. (Left). When a person blinks, the eye aspect ratio declines dramatically and approaches zero, as seen in Figure 4. (Right). Furthermore, the eye aspect ratio remains constant throughout time and gradually approaches zero. It then rises, indicating that the subject has blinked once.

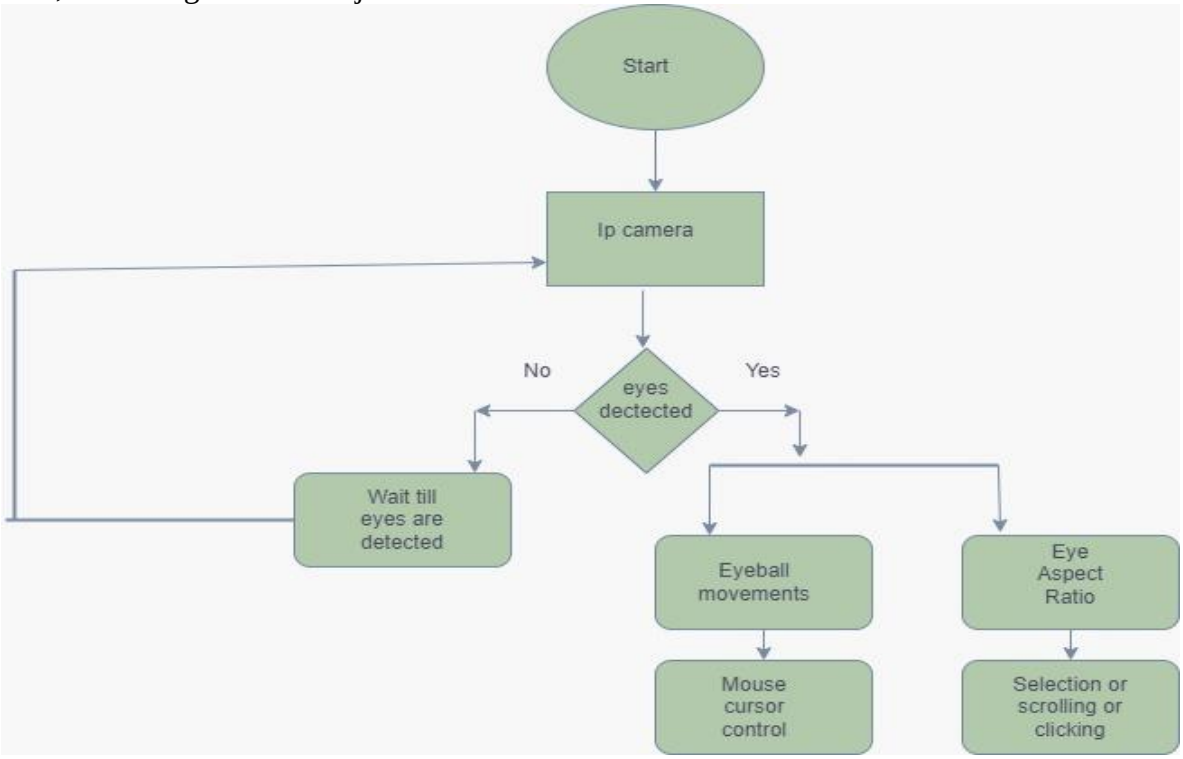

Figure 5 Flowchart depicting the whole process of ocular movement-based cursor control

The flowchart above shows the overall process of eye movement-based cursor control using PY Charm Software and OpenCV. The PY Charm Software is the core component of the processing module that records eye movements by interacting with an Internet Protocol camera. The camera waits until the eyeballs are detected before capturing a picture. The OpenCV technology's photo processing method is used to distinguish eyes. The mouse cursor may be controlled by eyeball movement, and blinking is used to determine the Eye Aspect Ratio (EAR), which is used to perform activities like clicking, scrolling, and selecting.

RESULTS AND DISCUSSION

We have to any python software and we have to run the software we have to change the directory as shown in Figure 6. After Starting the software and changing the path the frame gets started and eye aspect ratios values will be detected as shown in Fig 7 Streaming is started.

Figure 6 Running of Python Software

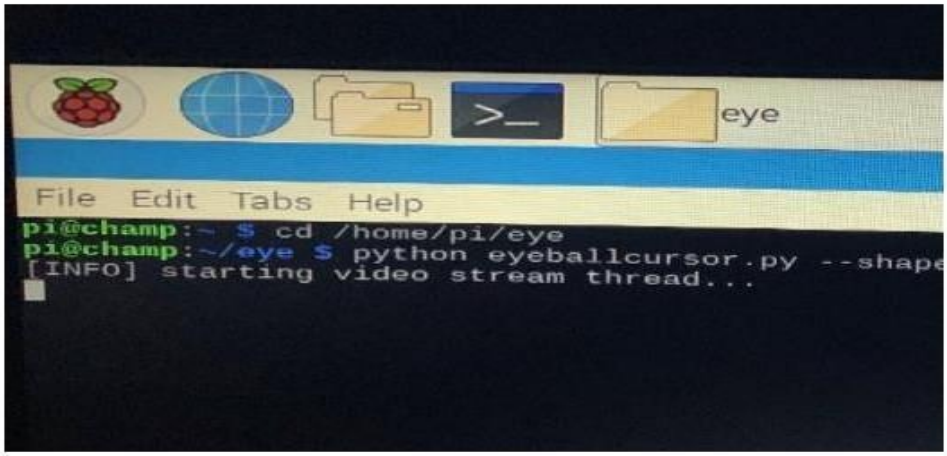

Figure 7 Starting Video Stream

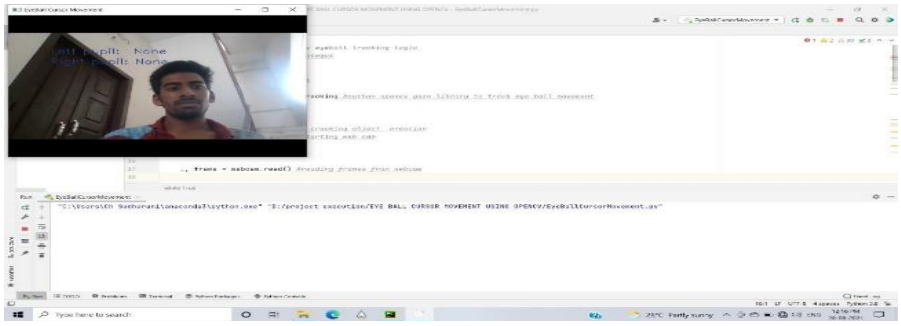

Figure 8 Output of Face Detection

After starting the video stream thread, the frame gets started with the eye aspect ratio values being detected as shown in figure 7.

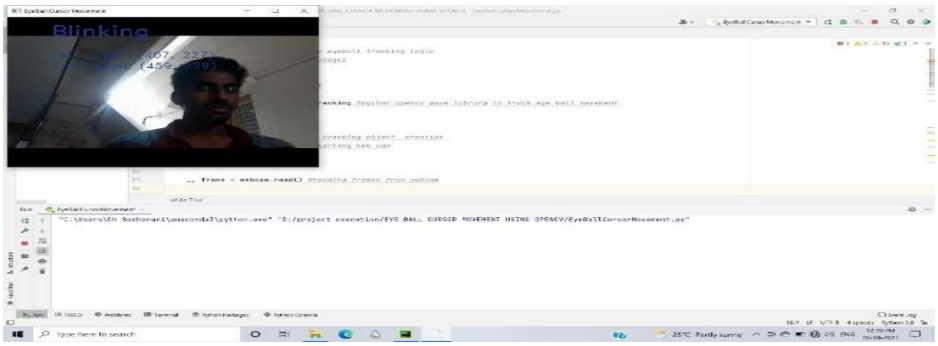

Figure 9 Output of Eyes Blinking.

In figure 8, we can see that eyes are in a normal position. So, the value of the eye aspect ratio is 0.35 that is considered constant.

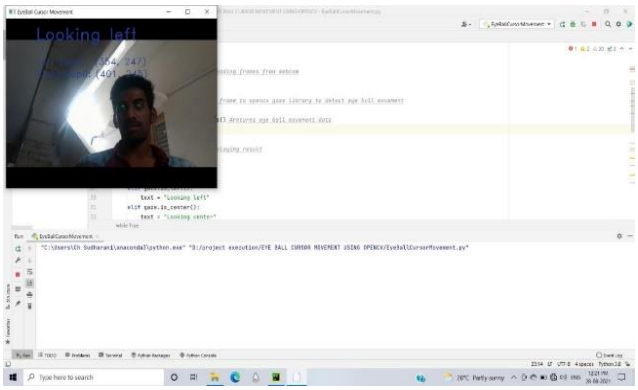

Figure 10 Output of Eyes Looking Left.

In figure 9, we can see that eyes are Looking left. So, the value of the eye aspect ratio has increased to 0.38, and accordingly, the cursor is controlled.

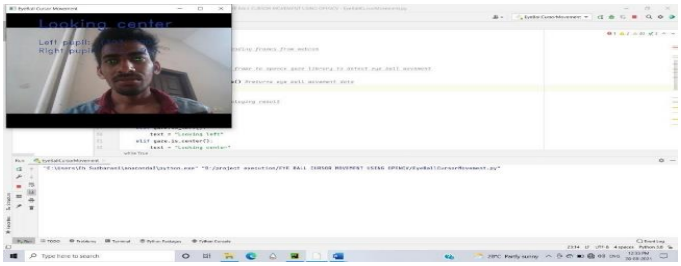

Figure 11 Output of Eyes Half Closed.

In figure 10, we can see that eyes are half-closed. So, the eye aspect ratio has decreased to 0.28 and we can Also, see the cursor pointing on the frame tab.

CONCLUSION

The PY Charm Software and open cv systems are used to create an eye movement-based cursor control system. The foregoing experimental findings demonstrate that we can efficiently control cursor functions without using a mouse. In terms of cursor control, the actions performed by this system are simple [2]. This method may be a solution to all of the difficulties that have arisen as a result of the present way of controlling the cursor with the help of the mouse, which is not practicable in the case of persons with disabilities. This technology provides users with new ways to operate their machines. The work may be expanded to increase system efficiency by covering all mouse functionalities with eyeball motions. For the time being, this system can be beneficial for general operational behavior by communicating with the computer system without the usage of a mouse. Through the use of an eyeball movement-based cursor control system, it is possible to deduce that there will be a significant advancement in the field of human-computer interaction with the usage of IoT.

FUTURE SCOPE

1. In the future, we may add new functionalities that the user can use to control the cursor and apply this system on platforms such as mobile phones, tablets, and so on.
2. In the future, we can also create a series of operational units to provide the handlers with a whole operational experience from turning on to turning off the computer system.

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