International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 06 | June – 2025 DOI: 10.55041/ISJEM04671
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

Eye-Controlled Mouse for Physically Disabled Individual Using OpenCV

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Abstract— This study proposes a simple, affordable and available technology for controlling the computer cursor with only your eyes. The proposed design method was designed and developed for people with significant upper limb disabilities that don't use a keyboard or a mouse, and has been framed as a standard input method re-defining the notion of input by an eye-re-URL sing interface. Based upon a standard web camera and real-time image processing, the eye tracking system uses the direction of an individual's facial gaze and blinking detect and translate that into the movement needed for the cursor action. The proposed eye tracking system is lighter and less accessible because it is not dependent upon sophisticated input-device hardware, thus able to obtain reliable cursor movement whenever the lit conditions in the environment are suitable to allow the eye-tracking input system to function smoothly. Based upon early trials, there has been a reported ease-of-use and high responsivity to potential use of a system using assistive technology capabilities.

Keywords— *Eye tracking ,Cursor control, Webcam interface Blink detection, Physically disabled*

I.INTRODUCTION

Technology has the potential to remove all barriers for people with physical disabilities. Traditional input methods like a mouse and keyboard are common to everyone. However, they remain quite difficult to use for people with compromised motor control. Therefore, we wanted to present a creative alternative by using only eye movement to control a computer cursor. Instead of using specialized sensors or external tracking hardware, we simply use a standard webcam. The goal of this work was to develop an easy, low-cost tool that would support independence and improve quality of life for users with physical disabilities. Today, we engage with computers daily and it's conventional. Unfortunately, using standard input devices such as a keyboard and mouse is difficult for people with physical disabilities. Our project is to create a system where we can control a mouse using eye movement while being simple and easy to use for the physically challenged individual, in addition to being a low-cost solution. With a basic webcam and Python's OpenCV library, we created a system that detects and tracks eye movement and then translates this data to move the mouse cursor. The mouse delays commands for blinks or clicks. Our aim is to give disabled people some independence in how to interact in a digital world. This project presents an "Eye-Controlled Mouse with Face Lock" system specific to physically disabled users. The system is capable of mouse movement via eye-tracking, and has an additional layer of defense—face recognition- based password security. The user does not have to wear special devices like glasses or contact lenses, as the system only requires a standard web camera. The system detects and locates the user's facial landmarks like their eyes to move their cursor and clicking also using their eyes, while only the authorized user can activate the system through the biometric identity verification of their facial recognition. The project aims to create an eye-controlled mouse system that allows the user to navigate and interact with the computer interface. This mouse system is created through the combination of a webcam and computer vision and image processing to track the user's eyes in real-time. The position and movement of the user's eyes will now be mapped to the x and y movement of the cursor, and blinking or dwell time can be mapped to mouse clicks! This project is intentionally promoted as affordable, easy to use, and compatible with most computers so that it can reach the vast majority of people, regardless of one's economic status. The primary objective of the project is to enhance computer accessibility for people with physical disabilities and thereby increase independence and quality of movements. As the development of assistive technology that builds more bridges between physical ability and digital access and inclusion - we can further promote the intention of accessibility for all in a more inclusive approach to society.

II.LITERATURE SURVEY

Eye-controlled interfaces have emerged as an important assistive technology to empower people with physical disabilities to use digital systems in a hands-free way. Advancements in computer vision, and more specifically with OpenCV framework, have allowed developers to create low-cost real-time eye-tracking systems using standard webcams, rather than requiring expensive specialized hardware. Some works have employed OpenCV haarcascades classifiers for face/eye detection. After the open and close events are detected, the students that follow this include various algorithms such as pupil/iris tracking to drive cursor movement. Kumar et al. [1] proposed a system in which the mouse cursor directly follows the tracked position of the pupil, which is an improvement and frees the user from having to rely on commercial eye-tracking hardware. They were able to use a standard webcam and a few image-processing techniques in real-time. They added blink detection as a way to simulate a click. Kaur and Sharma [2] presented an eye-tracking system that used the Eye Aspect Ratio (EAR) which is a geometric measure of how open the eye is. Their approach used OpenCV and Dlib library for the detection of eye landmarks and evaluates for reliable detection of blinks that can trigger a click event. Gaze estimation is another important area for research. Patel [3] developed a gaze estimation system that can provide the gaze direction to help a user navigate their screens. While they are usable systems, these systems are still limited. To overcome those limitations, Gupta and Arora [4] demonstrated preprocessing methods along with adaptive thresholding to improve the stability of the detection during different conditions. Their study progressively improved the robustness and reliability of the systems, and integrating with automation libraries (e.g., PyAutoGUI) allowed these interfaces to mimic mouse movements, mouse clicks and scrolling actions for greater usability for end users.

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III.METHODOLOGY

The webcam captures real-time video continuously as video input. The Haar cascade object classifiers detects the user's face and the eyes in each frame. The pupils are located by converting the video frames from color to grayscale, applying thresholding and detecting contours. The direction of gaze is estimated based on the pupil's relative position within the eye (left, right, up, down). The intentional blink is detected using the Eye Aspect Ratio (EAR) method. The position of the cursor is updated using PyAutoGUI, and a blink simulates a left-click. The system resets when no eyes are detected to stop unwanted movement. All of these still work on their local machine and do not require an internet connection.

IV.IMPLEMENTATION

The system primarily focuses on tracking eye movements through webcam feed & translating them into cursor movements ,along with a face recognition-based login module for added security. The implementation is divided into major modules:

A. Face Recognition-based Authentication:

In order to provide only authorized registered users access to the system, implementation of (face recognition-based login face lock)is the way to go, OpenCV is used to detect & match the face of user against the pre-registered image in the in-built database of the authentication system.

The user face is captured & compared against the stored prior stored photo to determine if any match exists, the step of capturing the face and comparison is shown in Fig. 1: Face Match-User then, if there is a match to the user's face, the system is allowed to proceed in Fig. 2 face detection unlock action.

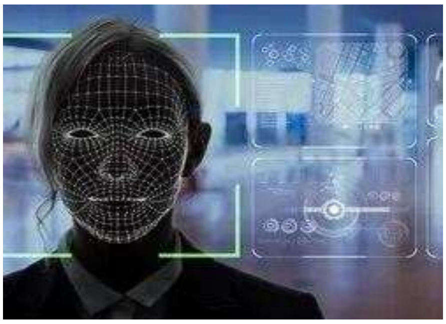

Fig. 1: Face Match-User

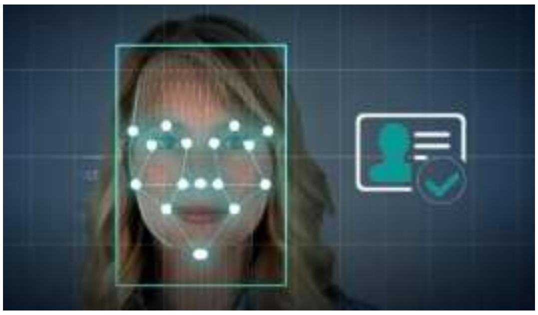

Fig. 2 face detection and unlock face

B. Eye Detection & Tracking

Once the user has successfully logged in, the system begins eye-tracking, as real-time eye-position detection is essential for mapping a user's gaze direction to a cursor movement as illustrated in Fig. 3 eye tracking location

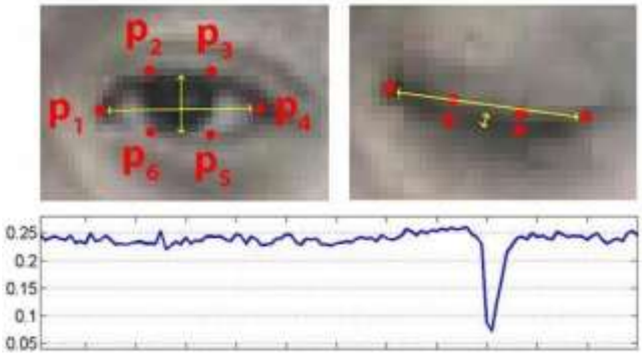

Fig. 3 eye tracking area

The normalized pixel (0 – 1 scale) values of the left eye image is shown in Fig. 4.

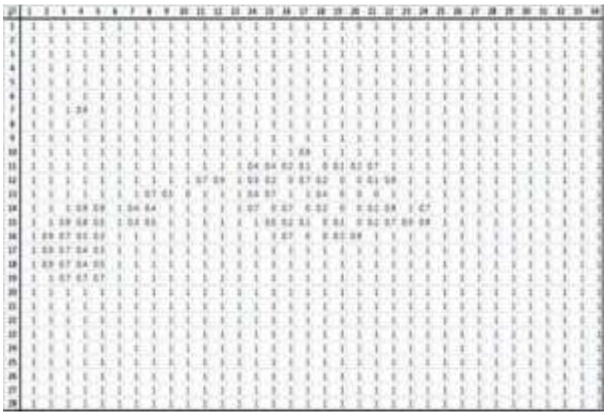

Fig. 4 Normalized pixels values of left eye image

C .Cursor Movement Mapping

The user gaze direction corresponds to an associated cursor movement on the screen.

A mapping logic is defined for cursor movement in the following way:

- Looking left moves the cursor left
- Looking right moves the cursor right
- Looking up or down changes the vertical position of the cursor.

Fig 5: left (a) and right (b) & Pupil upwards (a) and pupil downwards(b)

D. Blink Detection For Click Events

Blinking is employed as a replacement for mouse click actions.

- Eye aspect ratio (EAR) is calculated for each frame

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with help of facial landmarks.

- A blink is detected when EAR is below a specified blink threshold or a right-click.
- It removes the need for physical buttons/input devices.

E. System Architecture

A camera input, image processing unit, decision module, and a cursor control/protocol interface are the components of the system architecture. The captured frames are processed using computer vision algorithms to determine the eye region, pupil position, and blinking events. The decision module takes the gaze vector and analyses it and outputs it as mouse movements, while clicking events are mapped to blinking events.

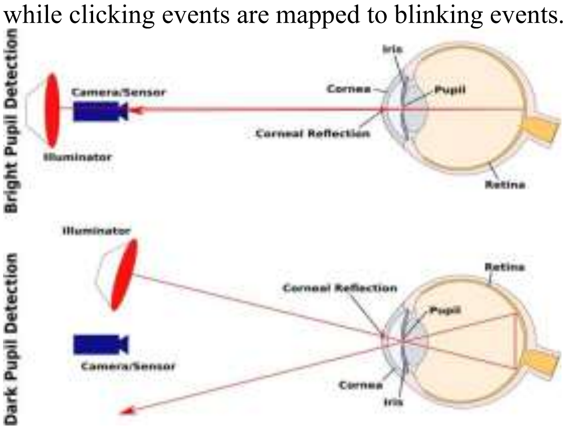

Fig.6: Pupil Detection

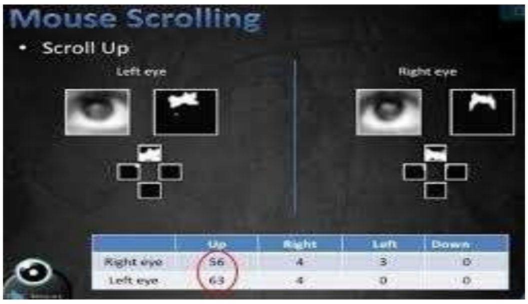

Fig7.Mouse Scrolling

V.RESULS AND DISCUSSION

The outcome is that after the authentication is complete, the system automatically starts up with your eye direction, and depending on the blinking of the eye it starts to perform click operation is the system.

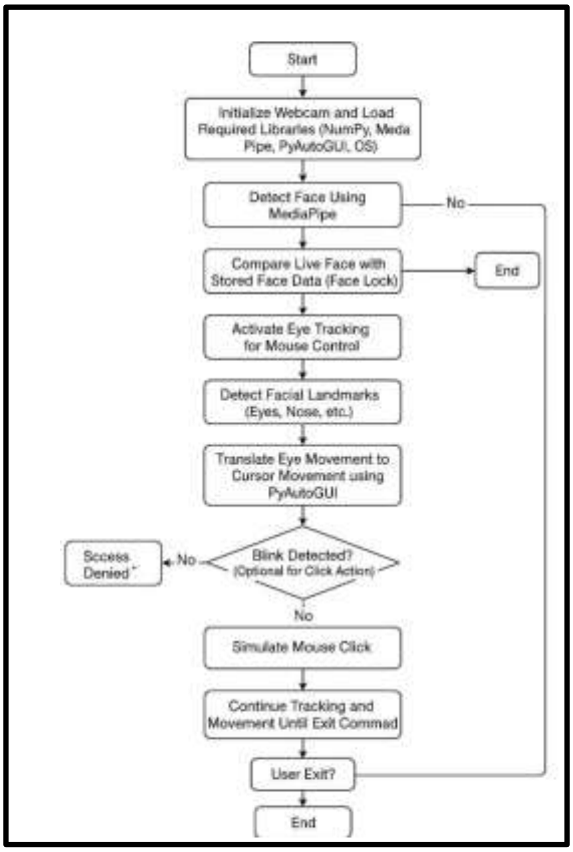

Fig.8:.flow chart of cursor system

The flow chart shows the working system of cursor step by step

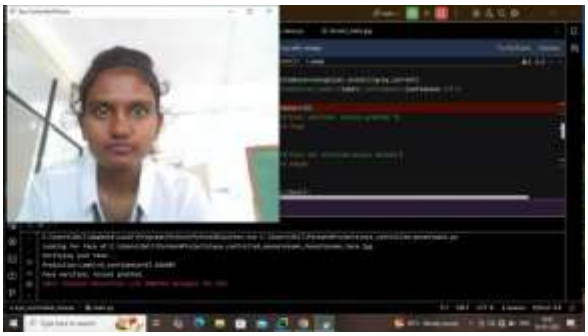

Fig.9: Result of eye-controlled mouse

This Fig.9: Result of eye-controlled mouse shows the way to collects the landmarks of the eyes and the way how to particular eye-area is detected after the movement of the eyes pupil.

VI.CONCLUSION

A system that allowed a disabled user to interface with the computer has been developed and tested successfully. The method has inspiriting possibilities which can be extended to many. The system can be adapted to assist the disabled to control household items from TV sets, lights, doors, etc. The system might be provided as a useful service for those with complete paralysis to operate and control a wheelchair. The eye mouse may also be suitably adapted to measure driver fatigue and drowsiness to help prevent motor vehicle accidents.

ISSN: 2583-6129
DOI: 10.55041/ISJEM04671

VII. REFRENCES

[1] P. Kumar, S. Singh, and R. Tiwari, "Real-time cursor control using eye movement detection," International Journal of Computer Applications, vol. 182, no. 10, pp. 20–24, 2018.

[2] P. Kaur and M. Sharma, "Blink detection for human computer interaction using Eye Aspect Ratio," Proceedings of the International Conference on Intelligent Computing and Control Systems (ICICCS), pp. 122–126, 2020.

[3] A. Patel, R. Mehta, and D. Shah, "Gaze-controlled human-computer interface using webcam," International Journal of Scientific Research in Computer Science, Engineering and Information Technology, vol. 4, no. 5, pp. 132–137, 2019.

[4] R. Gupta and A. Arora, "Improving accuracy of eye-tracking systems using adaptive thresholding and preprocessing," Journal of Engineering Research and Applications, vol. 11, no. 2, pp. 45–49, 2021.