# EYE BALL CURSOR DETECTION USING IMAGE PROCESSING

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## ABSTRACT

*Eye motion is used to create a private human-computer interface system. The mouse and keyboard are used as input devices in the classic human computer interface. This technology is intended to replace standard computer screen pointing devices for the use of disabled people or as an alternative for using a mouse. The approach we describe is a real-time, non-intrusive, quick, and cost-effective method of tracking facial features. An interaction between a computer and a human is presented in this study. This technical concept has the potential to eliminate and replace the mouse, or more accurately, the standard mouse with human eyes, as a new way to interact with computers. As a result, a mouse that works with the help of human eyes is known as a Virtual mouse. The technology we discussed is practical, quick, and a viable method for tracking facial traits. The availability of this approach is projected to hasten the development of eye-tracking applications and, as a result, the eventual integration of eye tracking into future generations of common human computer interfaces.*

**Keyword:** - *OpenCv ,eye Recognition, CNN.*

## 1. INTRODUCTION

As computer technology advances, the importance of human-computer 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. Human-Computer 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 human-computer collaboration. The importance of human-computer connection cannot be overstated. As a result, there is a need to develop a mechanism for disseminating an alternate mode of human-computer communication to people with disabilities, giving them an equal opportunity to participate in the Information Society. Human-computer interfaces have piqued the interest of numerous scholars throughout the world in recent years. For impaired individuals, a human computer interface is an implementation of a vision-based system for eye movement detection. Face detection, face tracking, eye detection, and real-time interpretation of a sequence of eye blinks are all incorporated in the proposed method for managing a nonintrusive human computer interface. The mouse is no longer used to interface with the computer; instead, human eye motions are used. The nose tip was chosen as the pointing device because of its placement and shape in the middle of the face; it is more pleasant to use it as the feature that moves the mouse pointer and specifies its coordinates because it is placed in the center of the face. The user's eyes were used to simulate mouse clicks, allowing him to fire events when he blinks. The nose tip is tracked in order to use its movement and coordinates as the mouse pointer's movement and coordinates. The eyes are tracked to detect blinks, which are then converted into mouse clicks. The tracking mechanism works by estimating where the feature will be in the current frame based on its prior location; template matching and various heuristics are used to find the feature's new coordinates. To make the application accessible to everyone, we used an off-the-shelf webcam with a moderate resolution and frame rate as the capturing device.

### 1.1. Problem Statement

The system is a face-based human computer interface for mouse activities. The system acts as a link between the users and the computer. It will use a webcam to capture the desired feature and track its movement in order to translate it into events that interact with the computer. While numerous devices were employed in HCI (e.g. infrared cameras, sensors, and microphones), we used an off-the-shelf webcam with a reasonable resolution and frame rate as the capturing device to make the software accessible to everyone.

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### 1.2. Motivation

In our work, we try to compensate persons who have hand limitations that prevent them from using the mouse by creating an application that interacts with the computer using facial cues (nose tip and eyes).

## 2. LITERATURE SURVEY

Vandana Khare, S.Gopala Krishna2, Sai Kalyan Sanisetty3, “Cursor Control Using Eye Ball Movement”[1], Because of their illness , a few people and groups are unable to use computers. In this case, it makes more sense to provide a computer operating method that is easily accessible, even when taking into account the infirmities of the differently abled. The human eye can be used as a suitable replacement for computer operating hardware. An Internet protocol camera was utilised to capture an image of an eye frame for cursor movement in this paper. In this regard, we must first concentrate on the role of the EYE. We use a Raspberry Pi for pupil identification since it can handle the computer's cursor, and in this task, an Eye Aspect Ratio (EAR) is calculated, which corresponds to the snaps of the eye (left or right) using the Python programming language's Open Source Computer Vision module. The major purpose of our suggested methodology is to improve the computing experience of physically challenged people by assisting them in overcoming challenges such as mouse usage

Aditya Dave1 and C. Aishwarya Lekshmi ,“Eye-Ball Tracking System for Motor-Free Control of Mouse Pointer”[2], Recent developments in the field of image processing have resulted in a number of high-quality feature detection techniques. While there is a constant need for new algorithms, there is also a need for an equal number of applications of such algorithms in order to achieve their full potential and use by the general public. For building a robust eye ball tacking system for directing the mouse pointer, this work uses a combination of Viola-Jones, Kanade–Lucas–Tomasi (KLT), and Circular Hough transform algorithms. The system's new feature is the ability to represent clicks. A single click is represented by one blink, and a double click is represented by two blinks in a short period of time. Other methods that were tried but failed to track characteristics are also described in the study. Because computer dependence has risen so dramatically in recent years, this technique can help people with motor difficulties browse through their files on the computer more quickly. Different algorithms excel at different things. So, rather than creating one algorithm extremely complex in order to perform well on all parameters, combining the best features of all three methods greatly simplifies the work and provides a better result than any of the three alone. The system was tested in a variety of lighting settings and distances from the screen, and it successfully tracked the iris with an accuracy of about 96 percent, which is impressive given that this is a real-time implementation. The authors' ultimate goal is to create a software package out of this system and make it open source, therefore ease of implementation has been a top priority in order to improve user understanding of the algorithm

Sivasangari.A, Deepa.D, Anandhi.T, Anitha Ponraj and Roobini.M.S “Eyeball based Cursor Movement Control”[3], A human computer interference system is being introduced one at a time. Human computer interference systems used the mouse and keyboard as input devices in the past. Those who are afflicted with a specific ailment or ailment 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, the initial step would be to locate 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.

Pierluigi Cigliano, Vincenzo Lippiello, Fabio Ruggiero “Robotic Ball Catching with an Eye-in-Hand Single-Camera System “[4] This study proposes a unified control framework for realising a robotic ball catching job utilising only a moving single-camera (eye-in-hand) system capable of recording flying, rolling, and bouncing +balls in the same formalism. To visually track the thrown ball, a circle detection approach is used. Following the recognition of the ball, the camera must follow a baseline in the space to capture an initial collection of visual measurements. To obtain an initial estimate of the catching point, a linear technique is applied. Then, using a nonlinear optimization methodology and a more exact ballistic model, new visual measurements are acquired on a regular basis to keep the current estimate up to date. A typical partitioned visual servoing technology is utilised to operate the translational and rotational components of the camera separately. Experiment results on an industrial robotic system indicate the efficacy of the proposed solution. Using a motion-capture system, ground truth is employed to validate the proposed estimating technique.

Osama Mazhar, Muhammad Ahmed Khan, Taimoor Ali Shah, Sameed Tehami “A Real-time webcam based Eye Ball Tracking”[5] The Eye Ball Tracking System is a technology designed to help individuals who are unable to conduct any voluntary duties in their daily lives. Patients who can only control their eyes can use assistive gadgets like the one proposed in this research to communicate with the outside world. This device uses a human-computer interface to make judgments based on the user's eye movements. A webcam captures a real-time data stream that is serially transferred to MATLAB. Then, using a reference axis, a sequential image processing algorithm segments the iris of the eye and determines the centroid, providing a control signal. Using a USB microcontroller interface, the control signals are then used to manipulate the position of a motorised platform

R.Rithi1, V.Manjuarasi2, M.Yesodha3, G.Renuka4 “CURSOR control using eyeball Movement with raspberry pi”[6], Some people are unable to use computers due to disease. Not only for the future of natural input, but also for the handicapped and crippled, the concept of eye controllers is extremely useful. Furthermore, by including a control system, they will be able to run the computer without the assistance of another person. This device is particularly useful for people who can move their cursor with their eyes. The image of eye movement is captured using a camera in this research. It begins by determining the position of the pupil's centre. Then, depending on the pupil location, the cursor moves in different ways. The Pupil Detection process is carried out on a Raspberry Pi and on the terminal of the Raspier image loaded on the Raspberry Pi. The Raspberry Pi is a single computer or SoC the size of a credit card that runs on the ARM1176JZF-S core. System on a Chip (SoC) is a method of putting all of the circuitry needed to run a computer on a single chip. To get started, the Raspberry Pi requires an operating system. The Raspberry Pi does not have any on-board non-volatile memory to store boot loaders, Linux kernels, or file systems, as seen in more traditional embedded systems, in order to save money

## RELATED WORK

Mouse clicks and mouse movements are the two most basic mouse activities. With the help of an Open CV, advanced technology replaces mouse movement with 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 environments can benefit from gaze estimation because they provide essential natural computer interface cues.

This innovative method of estimating gaze is based on a three-dimensional examination of the human eye. 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, support vector machines are used. For impaired people, a camera mouse has been utilised 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. For supporting the disabled, a real-time eye-gaze estimation technology is employed for 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. First, in the system The input from the webcam is fed into the system, which detects the face. The system will then track the location of the face as well as its attributes.

The nose tip and eye location are detected by the system. On the input, geometrical operations and integral picture processes are conducted. The face will be tracked by the system, and the coordinates will be saved in a file. When a movement of the face is detected, it will verify the file. The system will compare the two coordinates and take action, allowing the user to control mouse actions through camera. 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. Because our application primarily interacts with the computer using facial characteristics, there will be no need to use your hands to operate the mouse.

## 3. SYSTEM ANALYSIS

### 3.1 SYSTEM ARCHITECTURE

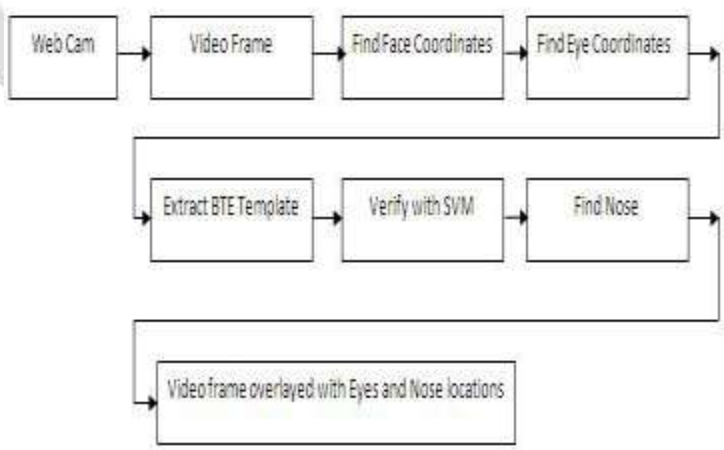


Fig. System Architecture

In our system The nose tip will be selected as the pointing device; the reason behind that decision is the location and shape of the nose; as it is located in the middle of the face it will more comfortable to use it as the feature that moves the mouse pointer and defines its coordinates. Eyes will be used to simulate mouse clicks, so the user will fire their events as he blinks.

The capturing device will capture the frames and finds the face coordinates according to the face detection algorithm.[1] Then it will find the eye coordinates and extract the BTE templates. After verifying the BTE templates it will verify the data with the SVM.[2] Based on this calculation it will find the nose position and the video frame that captured early will be overlay with eyes and nose locations.

**Components:**

**1.Detect Face**:

This component's primary function is to detect the webcam and the face. If more than one webcam is identified, the system will prompt you to choose one. It recognizes the face and does a geometrical analysis of their relative positions, areas, and distances. The component will recognize face characteristics and apply geometrical analysis to determine their distance. It causes facial features to be localized. Pattern recognition and Template matching are used in the second method, which is image-based.

**2. Track face movement:**

The nose tip is tracked so that its movement and coordinates can be used as the mouse pointer's movement and coordinates. The eyes are tracked to detect blinks, which are then converted into mouse clicks. The tracking mechanism works by anticipating where the feature will be in the current frame based on its previous location; template matching is then used to find the feature's new coordinates.

3**. Perform mouse operations**:

In this module, new pixels are compared to previous pixels to determine the threshold value, and to perform mouse click actions on blinks, first test whether the blink is right or left, then click.

## 4. CONCLUSION

The face is not rotated more than 5° around the axis that passes from the nose tip in detection mode for accurate localization of eyes and nose (as long as the eyes fall in sectors S1 and S3 of the SSR filter). The face is not rotated more than 30° around the axis that passes from the neck for accurate localization of eyes and nose. Our detecting methodology is unaffected by the use of glasses. When it comes to different scales, it's advisable to stand about 35 cm away from the webcam. When the frame rate is 20 fps or above, the results in tracking mode are quite stable; the user can move extremely quickly without the program losing his facial features. The glasses reflect light and create bright spots, causing our program to lose track of the eyes on occasion. Because side light causes erroneous face detection and subsequently affects the tracking process, the lighting conditions must be tuned so that the light is frontal and spreads uniformly across the face for accurate and robust detection and tracking.

## 5.REFERENCES

[1] Eye gaze location detection based on iris tracking with web camera
https://ieeexplore.ieee.org/document/8404314/ (5.7.2018).

[2] Disabled persons Ratio [online] Available At: https://www.disabled world.com/disability/statistics/ (Accessed 2 Jan 2018).

[3] John J. Magee, MargritBetke, James Gips, Matthew R. Scott, and Benjamin N.Waber"A Human-Computer Interface Using Symmetry Between Eyes to Detect Gaze Direction" IEEE Trans, Vol. 38, no.6,pp.1248-1259, Nov (2008).

[4] SunitaBarve, DhavalDholakiya, Shashank Gupta, DhananjayDhatrak, "Facial Feature Based Method For Real Time Face Detection and Tracking I-CURSOR", International Journal of EnggResearchand App., Vol. 2, pp. 1406-1410, Apr (2012).

[5] Yu-Tzu Lin Ruei-Yan Lin Yu-Chih Lin Greg C Lee "Real-time eye-gaze estimation using a low-resolution webcam", Springer, pp.543-568, Aug (2012).

[6] Samuel Epstein-Eric MissimerMargritBetke "Using Kernels for avideobased mouse-replacement interface", Springer link, Nov (2012)

[7] Hossain, Zakir, Md Maruf Hossain Shuvo, and Prionjit Sarker. "Hardware and software implementation of real time electro oculogram (EOG) acquisition system to control computer cursor with eyeball movement." In 2017 4th International Conference on Advances in Electrical Engineering (ICAEE), pp. 132-137. IEEE, 2017.

[8] Lee, Jun-Seok, Kyung-hwa Yu, Sang-won Leigh, Jin-Yong Chung, and Sung-Goo Cho. "Method for controlling device on the basis of eyeball motion, and device therefor." U.S. Patent 9,864,429, issued January 9, 2018.

[9] Lee, Po-Lei, Jyun-Jie Sie, Yu-Ju Liu, Chi-Hsun Wu, Ming-Huan Lee, Chih- Hung Shu, Po-Hung Li, Chia-Wei Sun, and Kuo-Kai Shyu. "An SSVEPactuated brain computer interface using phase-tagged flickering sequences: a cursor system." Annals of biomedical engineering 38, no. 7 (2010): 2383-
2397

[10]"An eye tracking algorithm based on Hough transform" https://ieeexplore.ieee.org/document/8408915/ (12.5.2018).

[11]]Prajakta Tangade, Shital Musale "A Review Paper on Mouse Pointer Movement Using Eye Tracking System and Voice Recognition" http://www.ijeert.org/pdf/v2- i8/20.pdf (08/11/2014).