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A Mini-Project

Report On

"**CV BASED EYE TRACKING MOUSE**"

Submitted in partial fulfillment requirements for the award of the Degree

BACHELOR OF ENGINEERING

IN

INFORMATION SCIENCE AND ENGINEERING

By

VARUN R RAO	**4NM20IS174**
VIJAY RAJ V	**4NM20IS176**
VINYAS S SHETTY	**4NM20IS180**

Under the Guidance of

Dr. Karuna Pandit

Professor

Department of Information Science and Engineering

Department of Information Science and Engineering

NMAM Institute of Technology, Nitte
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CERTIFICATE

This is to certify that **VARUN R RAO** 4NM20IS174, **VIJAY RAJ V** 4NM20IS176 and **VINYAS S SHETTY** 4NM20IS180 ,Bonafide students of NMAM Institute of Technology, Nitte has submitted the seminar report for the mini-project entitled "**CV BASED EYE TRACKING MOUSE**" in partial fulfillment of the requirements for the award of Bachelor of Engineering in Information Science and Engineering during the year 2022-23. It is verified that all corrections / suggestions indicated for internal assessment have been incorporated in the report deposited in the departmental library. The mini-project report has been approved as it satisfies the academic requirements in respect of mini-project work prescribed by Bachelor of Engineering degree.

Signature of the Supervisor	**Signature of the Supervisor**	**Signature of the Coordinator**	**Signature of the HOD**
Dr. Karuna Pandit	Dr. Balasubramani R	Mr. Vasudeva Pai	Dr. Karthik Pai B H

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DECLARATION

I hereby declare that the entire work embodied in this Seminar report titled "**CV BASED EYE TRACKING MOUSE**" has been carried out by us at NMAM Institute of Technology, Nitte under the supervision of **Dr. Karuna Pandit** for Bachelor of Engineering in Information Science and Engineering. This report has not been submitted to this or any other University for the award of any other degree.

Varun R Rao (4NM20IS174)

Vijay Raj V (4NM20IS176)

Vinyas S Shetty (4NM20IS180)

Department of ISE

NMAMIT

Nitte

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It is with great satisfaction and euphoria that I am submitting the Mini Project report on “CV Based Eye Tracking Mouse”. I have completed it as a part of the curriculum of Vishveshvaraya Technological University, Belagavi for the award of Bachelor of Engineering in Information Science and Engineering.

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Finally, yet importantly, I express my heartfelt thanks to our family and friends for their wishes and encouragement throughout the work.

VARUN R RAO (4NM20IS174)

VIJAY RAJ V (4NM20IS176)

VINYAS S SHETTY (4NM20IS180)

Abstract

Some people cannot be able to operate computers because of being physically handicapped or suffering from an injury or a major illness. The idea of eye controls of great use to not only the future of natural input but more importantly the handicapped and disabled. Moreover, implementing a controlling system in it enables them to operate computer without the help of another person. It is more helpful to physically challenged people. Those are needed to operate computers without hand this one is most useful those can operate cursor by movement of eye. In this project, Camera is capturing the image of eye movement. First detect pupil center position of eye.

Then the different variation on pupil position gets different movement of cursor. While this is not a problem for a healthy individual, this may be an insurmountable bound for people with limited freedom of movement of their limbs. In these cases, it would be preferable to use input methods which are based on more abilities of the region such as eye movements. To enable such substitute input methods a system was made which follows a low-price approach to control a mouse cursor on a computer system. The eye tracker is based on images recorded by a mutated webcam to acquire the eye movements. These eye movements are then graphed to a computer screen to position a mouse cursor accordingly. The movement of mouse by automatically adjusting the position were of eyesight. Camera is used to capture the image of eye movement.

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1. Introduction

Nowadays personal computer systems are carrying a huge part in our everyday lives as they are used in areas such as work, education, and enjoyment. What all these applications have in common is that the use of personal computers is mostly based on the input method via keyboard and mouse. While this is not a problem for a healthy individual, this may be an insurmountable bound for people with limited freedom of movement of their limbs. In these cases, it would be preferable to use input methods which are based on more abilities of the region such as eye movements. To enable such substitute input methods a system was made which follows a low-price approach to control a mouse cursor on a computer system. The eye tracker is based on images recorded by a mutated webcam to acquire the eye movements. These eye movements are then graphed to a computer screen to position a mouse cursor accordingly. The movement of mouse by automatically adjusting the position were of eyesight. Camera is used to capture the image of eye movement. The vision- based interface technique extracts motion information without any high-cost equipment from an input video image. Thus, vision-based approach is taken into account as an effective technique to develop human computer interface systems.

2. Literature survey

[1] Yiu-ming Cheung, Senior Member, IEEE, and Qinmu Peng, Member,IEEE
"Eye Gaze Tracking with a Web Camera in a Desktop Environment"

This paper addresses the eye gaze tracking problem using a low cost and more convenient web camera in a desktop environment, as opposed to gaze tracking techniques requiring specific hardware, e.g., infrared high-resolution camera and infrared light sources, as well as a cumbersome calibration process. In the proposed method, we first track the human face in a real-time video sequence to extract the eye regions. Then, we combine intensity energy and edge strength to obtain the iris center and utilize the piecewise eye corner detector to detect the eye corner. We adopt a sinusoidal head model to simulate the 3-D head shape, and propose an adaptive weighted facial features embedded in the pose from the orthography and scaling with iterations algorithm, whereby the head pose can be estimated. Finally, the eye gaze tracking is accomplished by integration of the eye vector and the head movement information

[2]Chetan Kumar, Sunil Kumar Beemanapally, Diksha Kumari, BE Student, Member,IEEE
"Eye Ball Based Cursor Movement"

In this paper, a private human computer interface system using eye motion is introduced. In traditionally system, human computer interface uses mouse, keyboard as an input device. This technology is meant to exchange the traditional computer screen pointing devices for the utilization of disabled or a replacement way to interact with mouse. The system we describe is real time, on- intrusive, fast and affordable technique for tracking face features. The paper presents interface between computer and human. This technological idea is capable to get rid of and replace the unique interface which is that the mouse or we will say traditional mouse with the human eyes, as a new way to interact with computer.

3. Methodology

The proposed system is a computer vision application that is based on real time application system. It makes the use of OpenCV for image processing and image acquisition and PyAutoGUI for handling mouse control in order to replace the actual mouse with the coloured object. The basic block diagram of computer vision pipeline is shown in Figure 1.

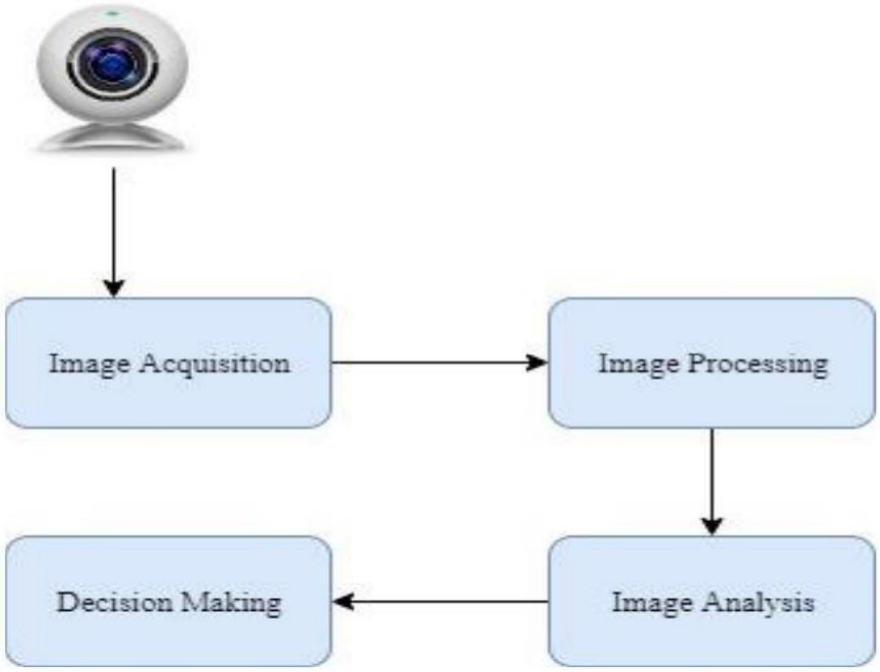

Fig 1 Block Diagram of Computer Vision Pipeline

Each Steps are further divided into smaller steps, based on the application and the project.

A. Image Acquisition: - Image or the frame that is detected by the web-cam is acquired as the digital representation of the visual characteristics of the physical world. An image sensor or the web- cam is used to detect and capture the information required to make an image.

B. Image Processing: - Image acquired are then processed in the next step. The signals in the acquired images are filtered to remove the 10noise or any irreverent frequencies. If needed, images are padded and transformed into a different space, so to make them ready for the actual analysis.

C. Image Analysis: - The processed image is analysed to extract useful information. This step involves many important image properties like pattern identification, colour recognition, object recognition, feature extraction, motion tracking, and image segmentation.

D. Decision Making: - High dimensional data obtained from all the above steps are used to produce meaningful numerical information, which leads to making decisions.

The detailed working of the proposed system is shown in the following flowchart.

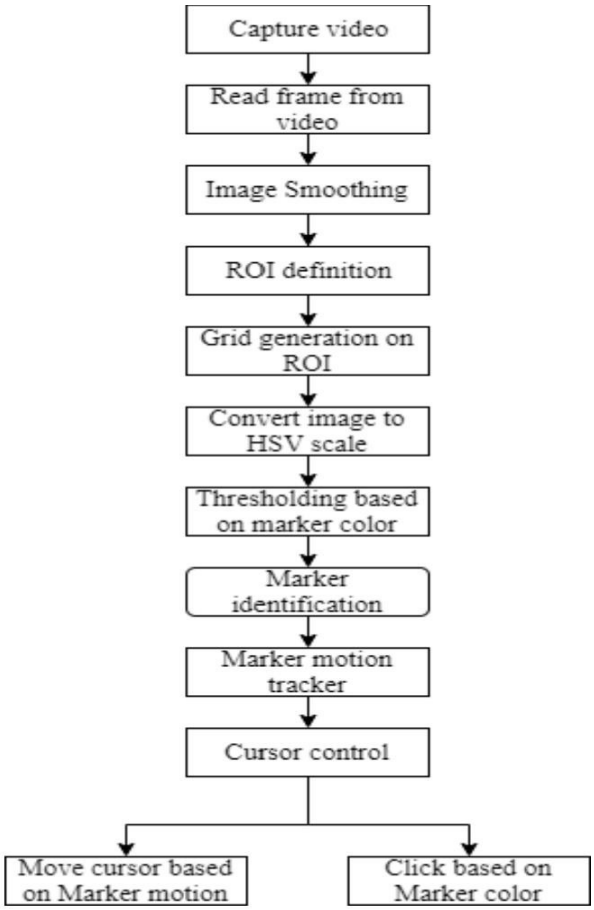

Figure 2. Flowchart of working model

4. Implementation

Implementation Steps:

- Step 1: Take camera input
- Step 2: Map landmarks on face
- Step 3: Process image and obtain an RGB-formatted frame
- Step 4: Obtain landmark co-ordinates for both eyes
- Step 5: Use the landmarks on the right eye to track facial movement
- Step 6: Replicate facial movement on cursor
- Step 7: Scan for wink, based on the distance between the eye landmarks
- Step 8: If left eye is winked, left click is performed and if right eye is winked, right click is performed
- Step 9: Wait 1 second after click
- Step 10: Repeat steps 5 through 9

eye_controlled_mouse.py

#Importing the libraries

```
import cv2
1. import mediapipe as mp
2. import pyautogui
```

#Identifying the eye

```
3. cam = cv2.VideoCapture(0)
4. face_mesh = mp.solutions.face_mesh.FaceMesh(refine_landmarks=True)
5. screen_w, screen_h = pyautogui.size()
6. while True:
7. _, frame = cam.read()
8. frame = cv2.flip(frame, 1)
```

#Converting RGB to Greyscale

```
9. rgb_frame = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
10. output = face_mesh.process(rgb_frame)
```

#Identifying the landmark

```
11. landmark_points = output.multi_face_landmarks
12. frame_h, frame_w, dimensions = frame.shape
13. if landmark_points:
14. landmarks = landmark_points[0].landmark
15. for id, landmark in enumerate(landmarks[474:478]):
16. x = int(landmark.x * frame_w)
17. y = int(landmark.y * frame_h)
```

#Providing input to the mouse

```
18. cv2.circle(frame, (x, y), 3, (0, 255, 0))
19. if id == 1:
20. screen_x = screen_w / frame_w * x
21. screen_y = screen_h / frame_h * y
22. pyautogui.moveTo(screen_x, screen_y)
23. left = [landmarks[145], landmarks[159]]
24. for landmark in left:
25. x = int(landmark.x * frame_w)
26. y = int(landmark.y * frame_h)
27. cv2.circle(frame, (x, y), 3, (0, 255, 255))
```

#Left Click option to mouse

```
28. if (left[0].y - left[1].y) < 0.01:
29. 12pyautogui.click()
30. pyautogui.sleep(2)
31. right = [landmarks[374], landmarks[386]]
```

#Right Click option to mouse

```
32. if (right[0].y - right[1].y) < 0.01:
33. pyautogui.rightClick()
34. pyautogui.sleep(1)
35. cv2.imshow('Eye Controlled Mouse', frame)
36. cv2.waitKey(1)
```

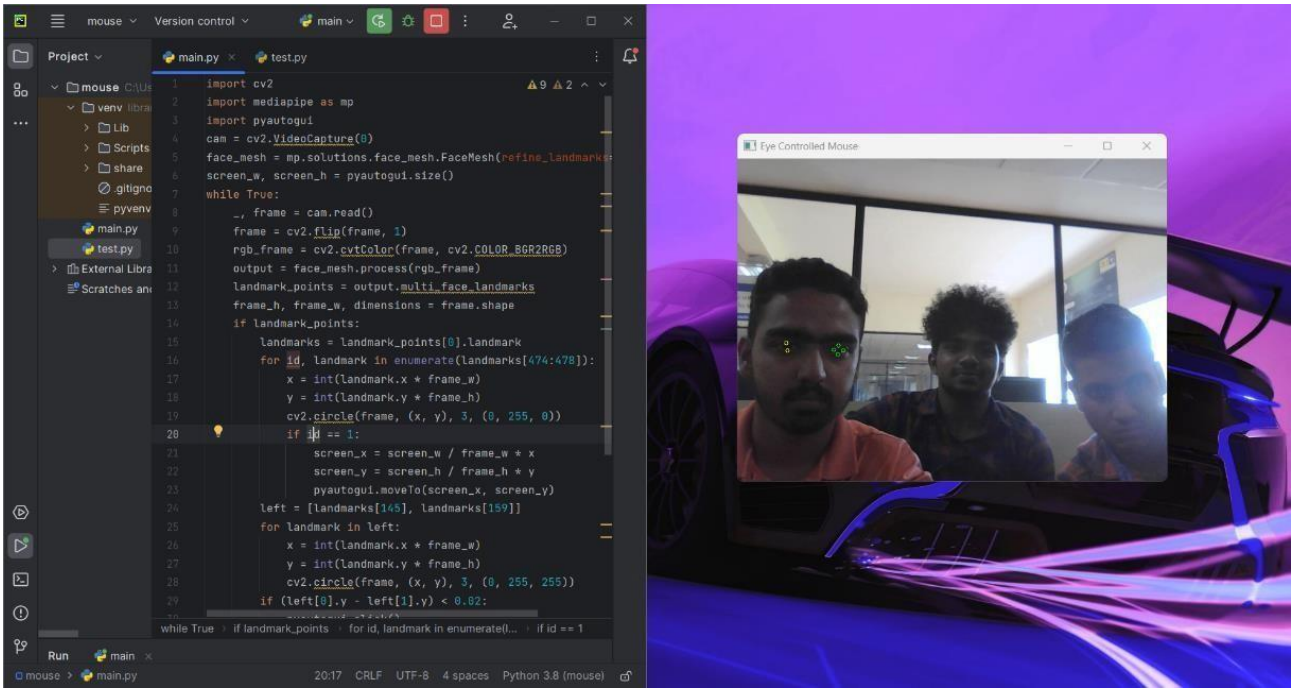

Figure 3:- Detection of the iris after running the program

5. Results and Discussions

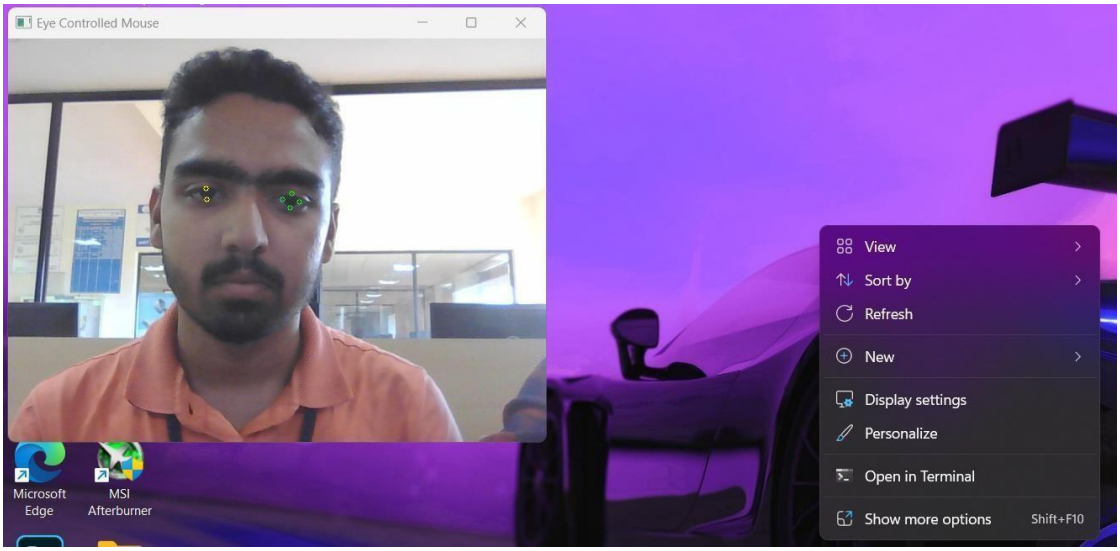

Figure 4:-Left wink causes left click and Right click causes right click

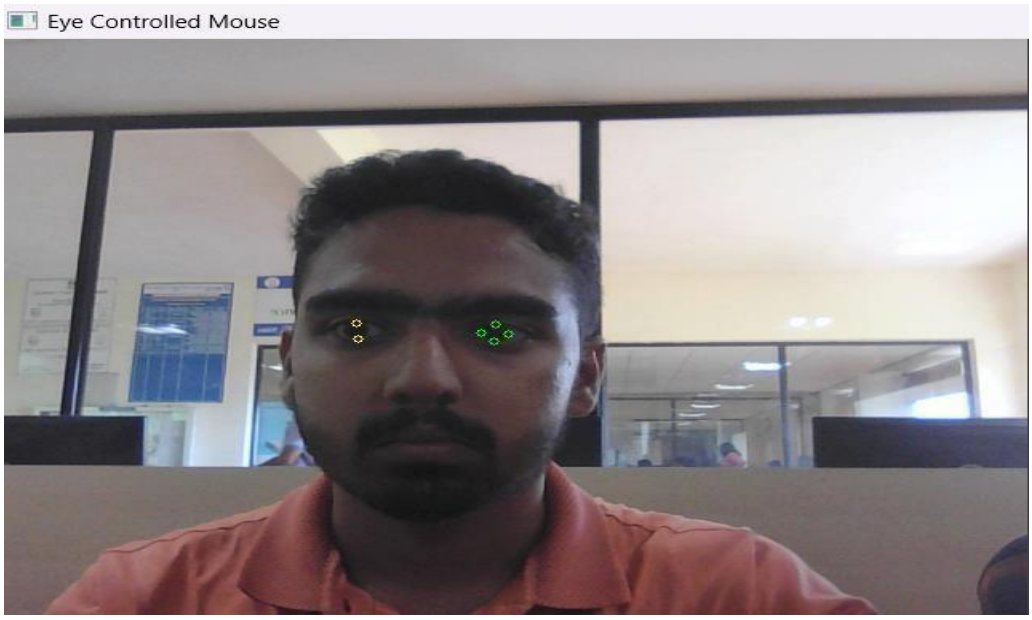

Figure 5: Tracking the movement of the eyeball

Some of the key goals achieved by the eye-controlled mouse include:

- To aid those physically handicapped to use computers
- To make computers more accessible to everyone
- To reduce the use of physical devices

6. Conclusion and Future enhancement

This project presents a system for controlling the mouse cursor using eyes.

The technique proposed in the report helps physically disabled people to operate the computer seamlessly with just the eye movement. This proposed system allows the user to perform several actions such as left click, right click, scrolling by moving eyes in the respective directions.

Problems for the physically disabled and other people related to mouse cursor can be solved using this system. The project is designed very beginner friendly, so as physically disabled people can use it easily.

This system will bridge the gap between physically disabled people and computers and will also allow them to contribute to the world with their creative ideas.

7.References

[1] Yiu-ming Cheung, Senior Member, IEEE, and Qinmu Peng, Member, IEEE
"Eye Gaze Tracking with a Web Camera in a Desktop Environment" ieee transactions on human-machine systems, vol. 45, no. 4, august 2018.

https://www.comp.hkbu.edu.hk/~ymc/papers/journal/THMS2400442_publication_version.pdf

[2] Chetan Kumar, Sunil Kumar Beemanapally, Diksha Kumari, BE Student, Member,

IEEE "Eye Ball Based Cursor Movement"

https://ieeexplore.ieee.org/document/8408915/ (12.5.2018)

[3]Programming Hero
https://youtube.com/@ProgrammingHero