

# Eye Pupil Movement Based Cursor Mechanism

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## Abstract:

In this paper we will be talking about how we can use our eye movement to control the mouse cursor. This project is mainly developed to help physically disabled people. We can accurately detect the movement of eye by detecting the position of iris present in our eyes this can be done by converting the recorded image into edges and counters, here we use regression tree algorithm or Decision trees algorithm. This algorithm is used to give the best possible outcomes of the eye position using the decision tree algorithm so that the eye movement is detected and the mouse moves accordingly. It also enables the user to open and close the applications by blinking of the eye.

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## I. INTRODUCTION

. In this project we use the attention tracker which is employed to live the attention movements and its positions which is that the process of motion or measuring of the eye the purpose of gaze .By this, movements of our eyes can be captured and used as signals to control and enable people to interact with the computer just by using our eyes. [2]

The project developed uses a simple mechanism .besides, the user doesn't need to interact with the system physically. All we need is a computer or laptop with a web cam pre-installed built-in web-cam in laptop or pc. [2]

Eye control mouse cursor is especially focused for physically handicapped people to assist them use computers on their own. Previously many have developed method for helping the disabled to work on computers by using signals such as Electro Encephalography (EEG) from the brain, facial muscles signals (EMG) and electro-oculogram (EOG).[2,8].We use Image processing for the background elimination which is Grayscale and

edges and counter to detect the eyes, mouth which is present in the frame

## II. METHODOLOGY

Firstly, with the assistance of web camera, the video is claimed to be recorded. The recorded video is converted into Frames. From the frames it is further converted into Grayscale for the background elimination .After the elimination of background it takes a proper face image to find counter and Edges in the image. From edges and counters it Identifies Eye and Mouth in the Frame. After identifying we calculate Aspect Ratio of Eye and Mouth. Eye Blink and Head Moment is Detected through Decision Algorithm .Here both the eyes are used for a better or faster processing time.

## III. IMPLEMENTATION

### MODULES

The modules which are used in this project are has follows

Facial Features Extraction: This module is employed to process this of an eye fixed gaze

tracking algorithm and countenance detection which are mouth and eyes extraction. [5]

Point of Gaze Calculation: PoG are often calculated by the extraction of eye patch and other crucial eye features.

When the person uses this mechanism. Their eyes are focused on the screen we firstly detect the face and the extract the midpoint between the two eyes which can be used as center point. This is done by converting the image into 2D.

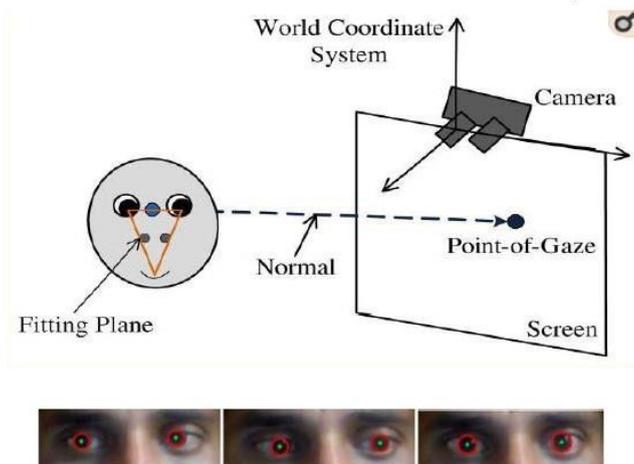


Fig-1 Detection of point of gaze

**Eye Features Detection:** There are two important eye features necessary to detect the PoG were to spot,

**Pupil and Eye Corners.** These are the techniques which are used for eye extraction. Here in the following equation, x and y are the coordinates which is used to calculate the Center of Eye (COE) [2]

$$COE_x = \frac{TopRightCorner_x + TopLeftCorner_x}{2} \quad (1)$$

**Aspect Ratio calculation:** The basic formula for calculating the aspect ratio is:

$$Aspect\ Ratio = (old\ Width / old\ Height).$$

In this project to calculate the aspect ratio we need to check the movement of eye in the previous frames to the current frames:

$$Aspect\ ratio = (new\ frame/ old\ frame). [2]$$

#### IV. ALGORITHM

#### Decision Tree - Regression

•Decision tree regression is that the fast algorithms which are commonly utilized in ensemble methods which is within the sort of a tree structure. It is the process which breaks down a dataset into smaller and smaller subsets. The final result is a tree with decision nodes along with leaf nodes, Numerical data.

• Regression trees are used to calculate the face's critical positions directly from a pixel intensities which produces high quality [7]

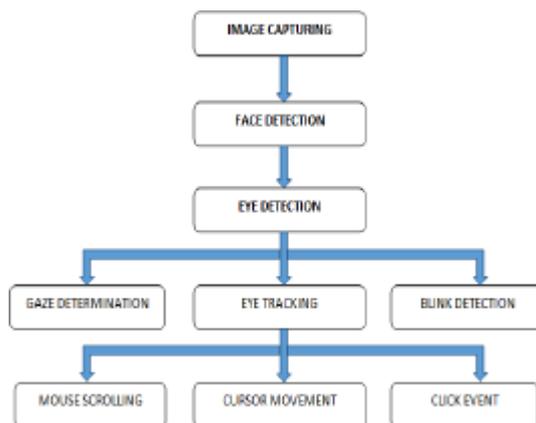


Fig 2-Regression tree architecture

#### Gradient Boosting:

In machine learning, gradient boosting is the method that gives a prediction model for learning an ensemble of regression trees that optimizes the sum of square error loss and naturally handles missing or partially labelled data. [4]

#### V. STEPS

1. With the help of web camera, the video is said to be recorded.
2. The recorded video is converted into Frames.
3. From the frames it is further converted into Grayscale for the background elimination.
4. After the elimination of background it takes a proper face image to find Counter and Edges in the image.
5. From edges and counters it Identifies Eye and Mouth in the Frame.
6. After identifying we calculate Aspect Ratio of Eye and Mouth.

7. Eye Blink and Head Moment is Detected through Decision Algorithm

**LIBRARIES USED IN THIS PROJECT:**

**Numpy:**

The NumPy is a multidimensional array used to store values of same datatype. These arrays are indexed just like Sequences, starts with zero.

**Pyautogui:**

Mainly used to operate mouse events imutils: It is a series of OpenCV + convenience functions for translation, rotation, resizing, and skeletonization.

**Dlib:**

Dlib is a generally written in the programming language C++ toolkit which consists of machine learning algorithms in C to solve the real world problems.

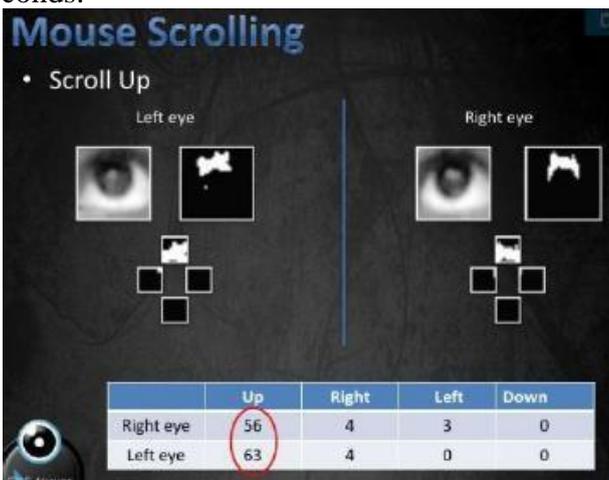
**OpenCV2:**

OpenCV is a cross-platform library. That shall be used to develop the real-time computer vision applications.

**CLICK ACTIVITY**

It used to read the input from the video and starts detecting the face features like eyes and mouth.

We can enable the scroll mode by simply opening mouth and disable by closing it for few seconds.



For clicking purpose we use

Right Eye	Left Eye	Action
True	False	Left Click
False	True	Right Click
True	True	Moving mode
False	False	Blink

Fig-2 Blink actions

**VI. UML DIAGRAMS**

Here we be using 4 types of uml diagrams, there are use case diagram is a simple process to represent the interaction of the user with system. It is used to show the relation between user and different use cases in which the user is involved. [9]

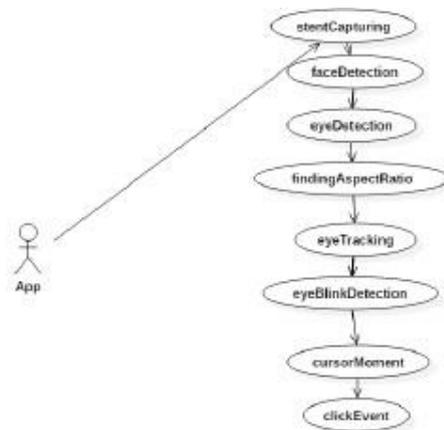


Fig 6.1-Use case Diagram of eye controlled mouse cursor

**Sequence Diagram:** Sequence diagram is an interaction diagram which shows the relation between the objects participating in a particular interaction and the messages that are exchanged in the time sequence.

This diagram is additionally referred to as Event diagrams which helps in understanding the objects we use it has two dimensions time which is represented in vertical and objects which is in Horizontal [9]

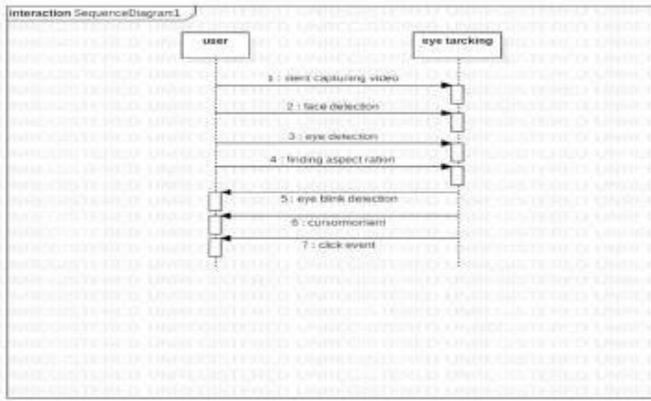
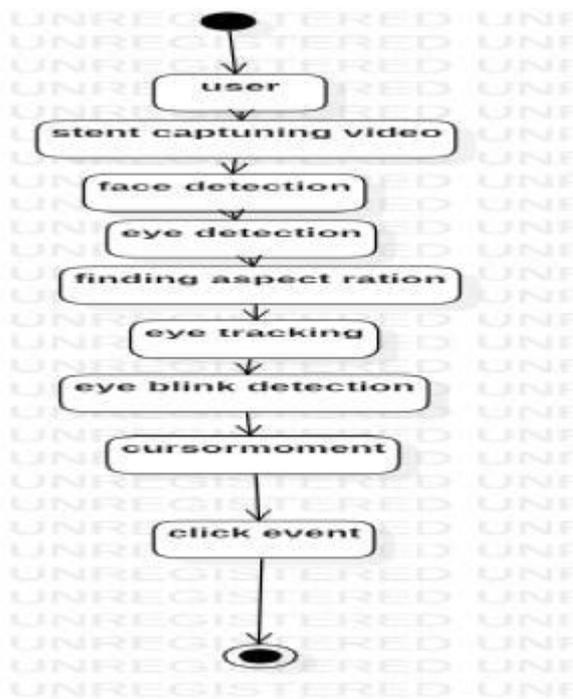


Fig 3.2-Sequence Diagram

**State chart Diagram:** State machine diagrams are used to capture the behaviour of a software. This diagram is employed to look at the various states of object.

A state chart diagram is made for one class state chart diagrams are useful to model the reactive systems. [9]



**VII. FEATURES AND BENEFITS**

- 1) It is very easy to use and simple.
- 2) Applicable to any low resolution camera.
- 3) No need for any hardware requirements.
- 4) Specially used for disable persons.

Drawback:

It doesn't perform in low light environments

**VIII. CONCLUSION**

The main goal of developing this project is to supply hands free cursor control which reduces the dependency on mouse we mainly focused on physically disabled persons who cannot use they hands to operate the system. Doesn't perform well in poor lightening environment. In this paper a computer vision algorithm primarily based answer is enforced. An endeavour has been created towards development of low value, period answer for eye gaze trailing. There are several applications of eye gaze trailing, as an example in HCI, appliances management, usability studies and in advertising effectiveness. Accuracy for options extraction algorithms depends upon image quality and lighting conditions. Algorithmic rule performance drops down in poor lighting setting. Higher image quality would improve accuracy of laptop vision algorithms. Refined Pre-Processing algorithms need to be introduced to compensate lighting variations and web-cam resolution need to even be multiplied to decrease the pointer size. A feature describing head-posture should even be introduced, it'll enable the user to maneuverer freely whereas interacting with system. Introducing the construct of gaze estimation in conjunction with gaze projection are going to be useful as a result of it'll improve gaze projections drastically. The thought of gaze estimation guarantees to be told from usage statistics and infer gaze projections. Particle Filters will be accustomed implement gaze estimation as a result of they're quite straightforward and has likeness with drawback of gaze estimation.

**IX. REFERENCES**

[1] Alex Poole and Linden J. Ball, "Eye Tracking in Human-Computer Interaction and Usability Research: Current Status and Future Prospects," in Encyclopedia of Human Computer Interaction (30 December 2005) Key: citeulike: 3431568, 2006, pp. 211-219.

[2] Rafael Barea, Luciano Boquete, Manuel Mazo, and Elena Lpez, "System for assisted mobility using eye movements supported

electrooculography,” IEEE TRANSACTIONS ON NEURAL SYSTEMS AND REHABILITATION ENGINEERING, vol. 10, no. 4, pp. 209-217, DECEMBER 2002.

[3] Wei Sun, Nan Sun, Baolong Guo, Wenyan Jia, Mingui Sun. "An auxiliary gaze point estimation method based on facial normal" , Pattern Analysis and Applications, 2014.

[4] P Ballard and George C. Stockman, “Computer operation via face orientation,” in Pattern Recognition, 1992. Vol.I. Conference A: Computer Vision and Applications, Proceedings, 11th IAPR International Conference on, 1992, pp. 407-410.

[5] T. Horprasert, Y. Yacoob, and L.S. Davis, “Computing 3-D head orientation from a monocular image sequence,” in Second International Conference on Automatic Face and Gesture Recognition, 1996, pp. 242- 247.

[6] K. Arai and M. Yamaura, “Computer Input with Human Eyes-Only Using Two Purkinje Images Which Works during a Real-Time Basis

Mohamed Nesor, K K Mujeeb Rahman, Maryam Mohamed Zubair, Haya Ansari, Farida Mohamed. "Eye-controlled mouse cursor for physically disabled individual", 2018 Advances in Science and Engineering Technology International Conferences (ASET), 2018.