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Iris Controlled Access Mechanism for the Physically Challenged

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Abstract:- About 19 % of the population in the world are physically disabled. It is a difficult task for them to interface and access the computer along with its accessories. Researchers have discovered many techniques to help them in accessing the computers. These techniques were implemented by analysing the various biometric signals and the various parts of eye. However these methods require additional equipments, which make their use, a more complicated one. An Open CV based model that analyzes the movement of the Iris, with the aid of a camera and positions the cursor in accordance to the movement of Iris is being designed. The system works in an efficient manner and is a boon to the physically challenged.

Keywords – Open CV; Iris; Haar Cascade; EAR algorithm.

1 .INTRODUCTION

The advancement in technology is all bound with the advancement in the computing system. This helps human beings to do the complex task in an easier and quicker manner. A normal man can easily access the computer without any difficulties but it is a real challenge to the physically impaired.

In this model the centroid of the iris is determined. Based on the centroid, the cursor is moved according to the movement of the eye. The eyeball tracking mechanism involves many applications like home automation using python GUI robotic control. Existing method uses MATLAB to detect the iris and control the cursor[1]. But in MATLAB it is difficult to predict the centroid of the eye, so we go for Open CV. The hardware requirement includes computer, a specialised video camera to capture the image of the eye. No other external hardware is required. The camera obtains the input from the eye. Initially centroid of the eye is detected, then the variation on the pupil position provides different command for computer cursor[2].

II. METHODOLOGY

The proposed model obtains video stream from the camera. Then the video is converted into frames. From the input frames, the faces are detected using Haar algorithm. After detecting face using facial landmarks, the eye is detected using Haar cascade[3]. The next target is to determine the centroid of eye using the centroid formula. Blink detection is done using Eye Aspect Ratio (EAR) algorithm. Based on the result the cursor selects an application. Using the gradient analysis, the cursor is made to move in the direction of eye[4].

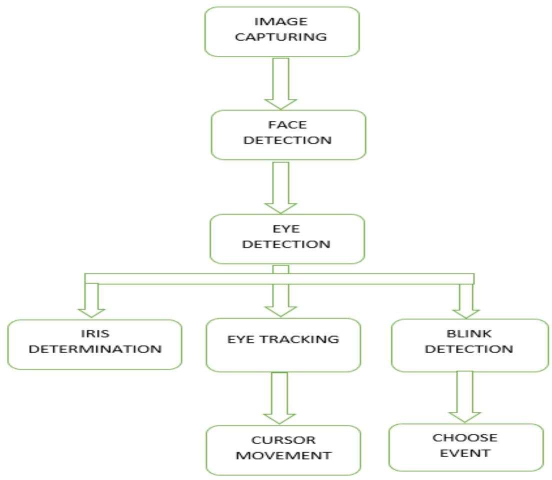
III. IMPLEMENTATION

By following a series of simple operations the cursor is controlled in accordance to the movement of the Iris.

A. Haar Cascade

For real time applications OpenCV uses Haar Cascade classifier to detect the face. RGB based detection is not efficient for real time applications. Haar Cascade classifier is trained with lot of sample input images and it is used for object recognition.

B. Block Diagram



C. Face detection

Initially the webcam records the image of the user and convert them into frames. The obtained input image frames are converted into gravy scale image.

The Haar classifier is trained with several images. This algorithm consists of several classifiers. Each classifier is allocated with different facial landmarks. If the classifier passes through one stage, it will proceed to the next. Otherwise, it will discard the image frame[6]. Using this algorithm the face in the input frame is detected and resized for processing.

The frame is processed several times. After processing the images the Iris is tracked and the program makes the cursor to move on the screen to the required location.

Fig. 2: Detection of face using Haar cascade

Facial landmarks is used to detect the face in real time. It detects face with the help of shape predictor[5]. Shape predictor localizes the area of interest.

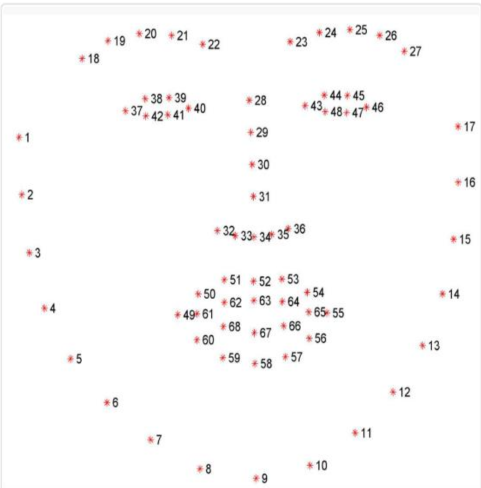


Fig. 3: Represents 68 facial coordinates

D. Identification of eye

The obtained facial images are divided into different segments. Features such as eyelash, eyelid, eyebrow, surrounding skin are used to find the position of the eye from the segmented images.

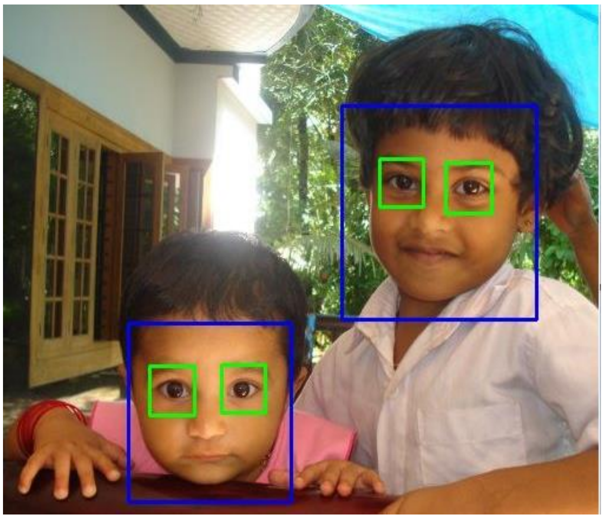


Fig. 4: Detection of eye

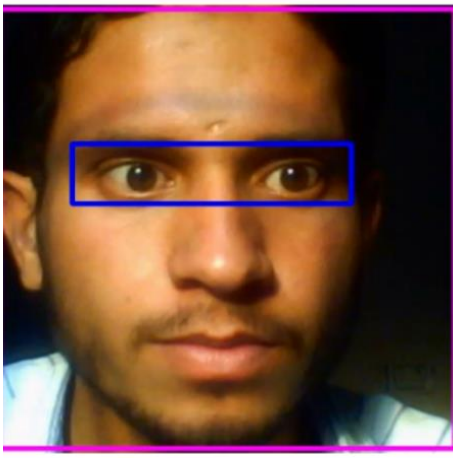


Fig. 5: Segmentation of Eye

E. Detection and analysis of Iris movement

After successful identification of the eye, the position of the iris is determined from the edges of the eye. Markings are made over the outer region of eye. The location of the iris is obtained.

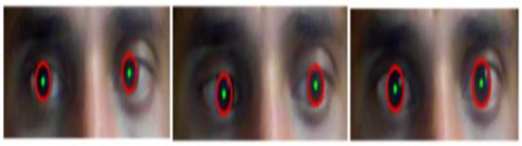


Fig. 6: Iris is detected using Hull

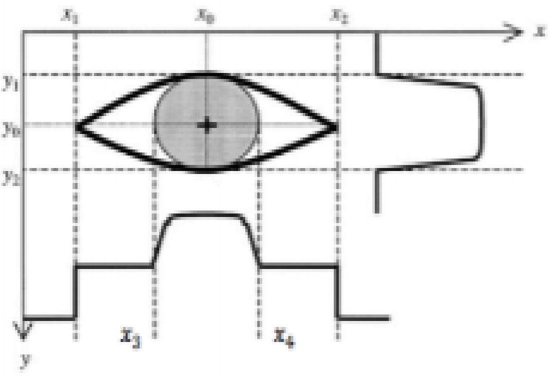


Fig. 7: Determining the iris position

Centroid is calculated using the formula

$$x_0 = \frac{x_3+x_4}{2},\ y_0 = \frac{y_1+y_2}{2}$$

The deviation of iris from its initial position in both x and y co-ordinates is analysed from the obtained images.

The variation in iris movement in both x and y axis from 10 input images. The gradient is calculated from the datum obtained from the graphs. Using the value of gradient the cursor is made to move in the direction of eye.

F. Eye Aspect Ratio

The main purpose of Eye Aspect Ratio in OpenCV is Blink Detection. When the Eye Aspect Ratio falls below the preset threshold it is considered as blink. If the Eye Aspect Ratio in the right eye falls below the preset threshold it will consider it as right click and if both the eye is blinked it will consider it as left click[7]. Based on the Iris the cursor is controlled.

G. Eye blink Detection

There are six coordinates used to represent each eye starting from the left corner. Relationship between the height and the width is derived from Eye Aspect Ratio.

$$\text{EAR} = \frac{||p_2-p_6||+||p_3-p_5||}{2||p_1-p_4||}$$

Here p_1 *to* p_6 are the facial landmarks. EAR is zero when there is a blink and it is constant when the eye is kept open.

Due to interference such as noise in the videos captured by the camera, the threshold of the Eye Aspect Ratio may produce false results[8].

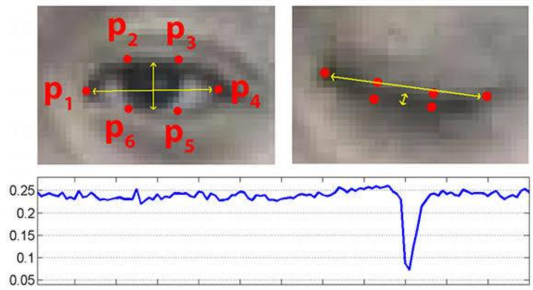


Fig. 8: Blink Detection using EAR algorithm

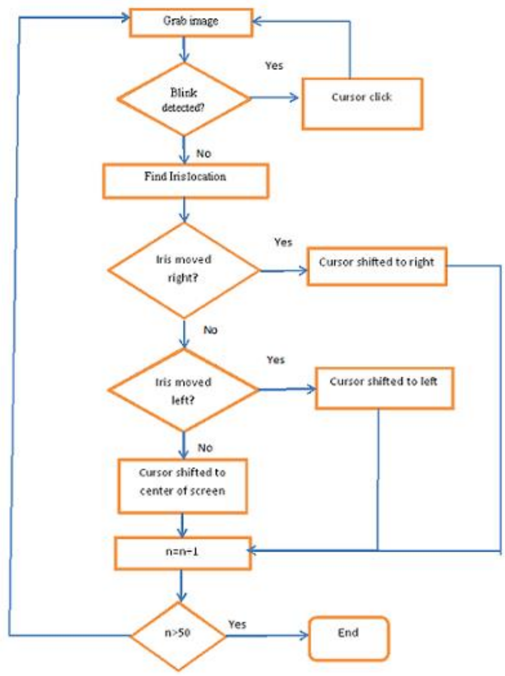


Fig. 7: Flow chart for Blink Detection

IV. CONCLUSION

A system that enables the physically challenged to interact with the computer was developed and tested. The method can be further enhanced to be used many other applications. The system can be adopted to help the disabled to control home appliances such as TV sets, lights, doors etc. The system can also be adopted to be used by individuals suffering from complete paralysis, to operate and control a wheel chair. The eye mouse can also be used to detect drowsiness of drivers in order to prevent vehicle accidents. The eye movement detection and tracking have also potential use in gaming and virtual reality.

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