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MOUSE CURSOR CONTROL USING FACIAL MOVEMENTS

[1]Pokala Sai Teja, [2]Vishwanatha Sai Charan, [3]Puri Vikas, [4]Vadla Rahul, [5]K Adi Lakshmi

[1]Student, [2]Student, [3]Student, [4]Student, [5]Asst. Professor

[1]Computer Science & Engineering,

[1]Gokaraju Ranga Raju College of Engineering and Technology, Hyderabad, India

Abstract: People with physical disabilities play a significant role in our society. The idea of eye controls is particularly advantageous for the development of natural input as well as for people with disabilities and other impairments. The goal of this project is to introduce new technology to persons with disabilities. This research presents an algorithm that is designed with impaired persons in mind. In this project a web camera is used for capturing facial movements. We used a toolkit called Dlib, which not only performs rapid face detection but also helps us to predict facial landmarks. This algorithm handles user-machine interaction allows people with physical disabilities to move the computer cursor with the use of facial expressions to the left, right, up, and down directions. Through winks and blinks, the algorithm also enables the user to open and close folders, files, and apps. It provides disabled people with the chance to work.

Index Terms **- Human Computer Interface, Dlib, Winks, Blinks.**

I. INTRODUCTION

Personal computer systems now play an important role in our daily lives, as they are used for work, education, and enjoyment. Computers are made to be readily available for regular people. However, using a computer can be extremely difficult for people with physical limitations like cerebral palsy or amyotrophic lateral sclerosis. In order to enhance the user's contact with the computer system, numerous research studies on human computer interface (HCI) have been conducted. Touch-sensitive screens, speech recognition technology, and many more technologies are among these interfaces. Most of these only apply to normal people. The concept of eye controls is quite helpful for the growth of natural input.

In order to control a non-intrusive human-computer interface, the proposed work involves face detection, face tracking, eye-blink detection, mouth gestures, and interpretation of a sequence of blinks in real time. using the human face and eye movements to engage with the computer instead of the conventional mouse. It is intended to make computer use efficient and simple for those who are physically disabled and lack hands. We use a camera in this project to track the position of the eyes as well as their motion, which is used to determine where the eyes are looking. This allows us to track the motions of our eyes and utilize them as signals to control and enable computer interaction. Using eye tracking, this is a straightforward solution for persons with physical disabilities. The only thing we require is a laptop or PC that has a webcam built in.

II. LITERATURE SURVEY

Survey Paper-1
Title: Development of Real-Time Eye Tracking Algorithm
Authors: Syed Hasan Adil, Azrina Abd Aziz, Sheikh Anwar
Approach: Numerous uses of eye tracking have been developed to help paralysed people, forecast human behaviour, and assess driver consciousness. A critical stage in the development of eye tracking is iris centre recognition, which is commonly accomplished using the Conventional Circular Hough Transform (CCHT). But when ambient light changes and an object's head is not orthogonally positioned to the camera, the CCHT method's accuracy suffers. To solve this issue, the facial landmark detector is used to classify the eye locations as left, right, and centre. This allows the eyes to be detected as the Region of Interest (ROI), tracked, and identified as the focus of the gaze. Python software is used to implement the eye tracking algorithm in OpenCV for portability. The outcomes demonstrate that the iris detection and gaze position classification, respectively, achieve average accuracy of 100% and 90%.

Survey Paper-2
Title: An Eye Blink detection technique in video surveillance based on Eye Aspect Ratio
Authors: Lam Thanh Hien, Do Nang Toan, Ngo Duc Vinh
Approach: The eyes, one of the most prominent features of the human face, are crucial for assessing and gauging a person's shifting emotions and state of mind. In applications involving human facial expressions, such as monitoring driver exhaustion and sleepiness for the prevention of auto accidents, and human computer interface input, detecting the open/closed state of the eyes is a crucial step in defining the state of the face. This study focuses on a method for detecting whether an eye is open or closed using variations in the ratio rectangle that surrounds the eye. The method has been evaluated and shown to be successful in identifying tiredness from photographs.

Survey Paper-3
Title: Embedded System for Eye Blink Detection Using Machine Learning Technique
Authors: R. Ibrahim, M. Khalifa, A. Othman, R. Zebari
Approach: This study offers a useful method for calculating the degree of closed and opened eyelids. We provided a real-time blink detection technique combining computer vision and machine learning frameworks. The proposed method is divided into four steps: capturing a frame using a raspberry pi camera attached to a raspberry pi 3 platform; identifying faces in the identified frames using the haar cascade algorithm; locating facial landmarks using the facial landmark detector algorithm; detecting the location of the eyes; and calculating the eye aspect ratio. The suggested method successfully identified the shutting or opening of the eye with great accuracy. In this study, a reliable and reasonably priced integrated eye blink detection system was implemented on the Raspberry Pi platform using an aspect ratio technique.

III. PROPOSED APPROACH

Our system uses face detection and facial features to track the movement of the mouse cursor in real time without being intrusive. By removing the usage of external gear that seriously injured eyes, it outperforms the current system. The first step was to use a face detection algorithm to locate the face on an image frame captured by an ordinary webcam. Once a face has been found, facial landmarks can be predicted with accuracy. With the use of these anticipated facial landmarks, we may create the necessary features to enhance our ability to recognise specific behaviours and carry out associated actions.

IV. IMPLEMENTATION

The main focus of this study is on predicting eye movements. We must first determine the landmarks on the face in order to detect eye movements. These landmarks allow us to accomplish a lot of things. In a video, we can recognise eye movements and eye blinks as well as anticipate emotions. Understanding the dlibs facial landmark finder: Dlib's model not only detects faces more quickly, but it also accurately predicts the 68 2D facial landmarks. The image in figure can be used to visualise the records for the 68 directions.

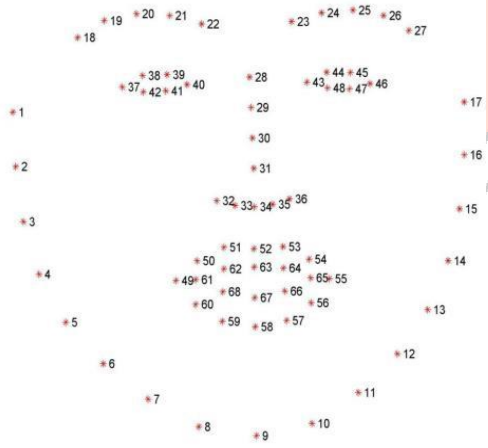

Fig. 1

4.1 Calculating EAR

When a user's eyes are fully open, their aspect ratio will be larger and remain constant over time. When a person blinks, the eye aspect ratio dramatically drops to almost zero. Additionally, the eye aspect ratio stays constant throughout time and gradually approaches zero. Then it goes up from only showing that the subject has blinked once.

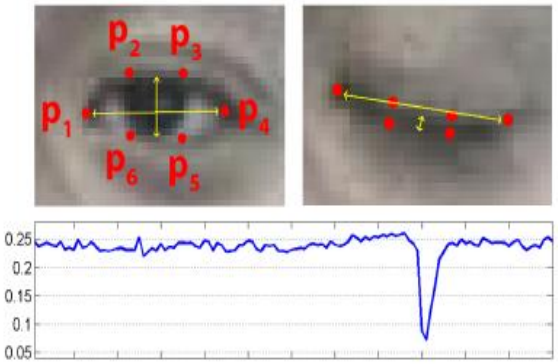

Fig. 2

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

Fig. 3

4.2 Calculating MAR

Similar to EAR, Mouth Aspect Ratio(MAR) value goes up when the mouth opens. Similar intuitions hold true for this metric as well.

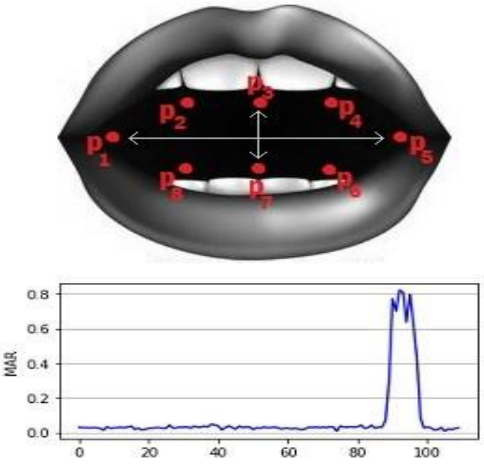

Fig. 4

$$\text{MAR} = \frac{\|p_2 - p_8\| + \|p_3 - p_7\| + \|p_4 - p_6\|}{2\,\|p_1 - p_5\|}$$

Fig. 5

4.3 Flow chart

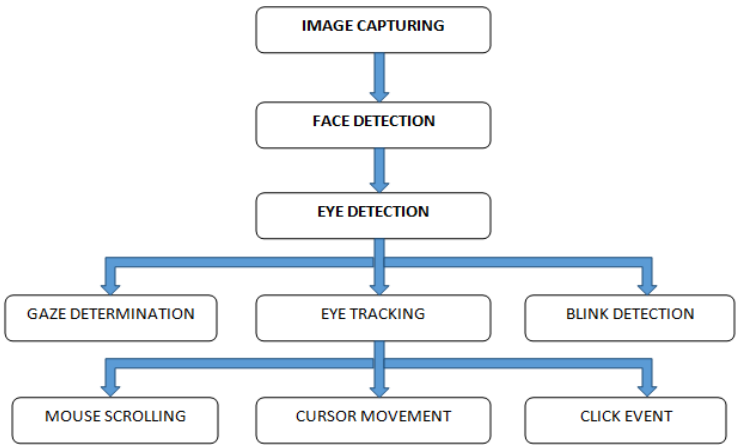

Fig. 6

First, the video is supposed to be recorded using a web camera. The footage that was captured is changed into frames. For the purpose of removing the background, the frames are further transformed into Grayscale. After the background has been removed, a correct face image is needed to locate the counters and edges in the picture. It recognizes the eye and mouth in the frame from the edges and counters. We determine the Aspect Ratio of the Eye and Mouth after identification. Dlibs's Algorithm Detects Head Moment and Eye Blink. For a better or quicker processing time, both eyes are used in this situation.

V. RESULTS

The goal of this project is to eliminate dependency on the mouse by enabling hands-free cursor control. We specifically targeted those with physical disabilities who cannot use their hands to operate the system. Our system is able to give the output as expected.

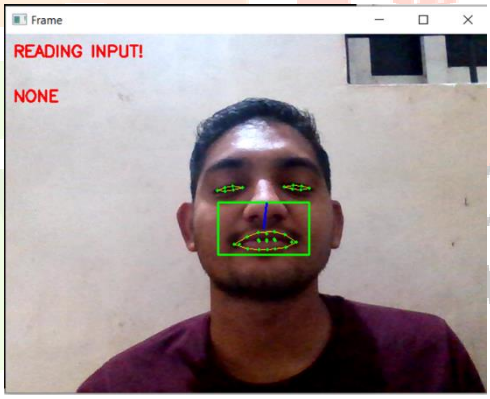

Fig. 7

Fig. 8

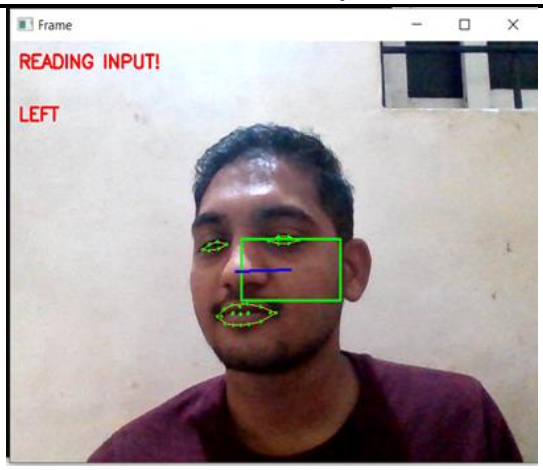

Fig. 9

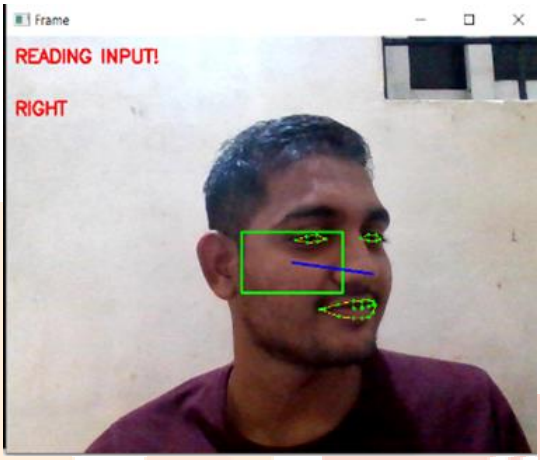

Fig. 10

VI. CONCLUSION

A system that makes it possible for a person with a disability to engage with a computer has been successfully designed and tested. The technique can be improved even more and applied in several other applications. The system can be modified to make it easier for people with disabilities to operate home appliances like TVs, lights, doors, etc. The technology can also be modified such that people with total paralysis can use it to steer and operate wheelchairs. In order to avoid car accidents, the eye mouse can also be used to identify driver tiredness. The recognition and analysis of eye movements have potential applications in virtual reality and gaming.

VII. ACKNOWLEDGEMENT

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