VIRTUAL MOUSE

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ABSTRACT
The project's main objective is to provide the virtual experience of a virtual mouse simply. This project describes a real-time, contact-free eye-gaze tracking system that bases its accuracy on very precise estimation of the pupil center. The eye camera follows the head movements maintaining the pupil-centered image. When a tracking error is produced, the image from a camera with a wider field of view is used to locate the eye and quickly recover the tracking process. Its special shape has been exploited to allow the optimization of the image processing algorithms developed for this system. The system was developed using python, pycharm. We presented the content very beautifully and effectively. Finally, the Conclusion is project gives the experience of a Virtual Mouse very efficiently. It also shows how the concept of face recognition is used. Although, this software can be further modified to be used as multitasking and bigger software and it also efficiently works under any condition and on any system. The iris position will be located first and it will be mapped on the computer screen at a certain position. This can be useful for the physically handicapped individuals to communicate with the computer and also do the work required. With the help of the Iris movement, we can move the cursor up and down as well as left and right. It also helps the person to make right and left clicks of the mouse by blinking the eyes which helps to open the files and also close them. This algorithm will also help a person to scroll the pages down and up.

Keywords: Face recognition, image processing, eye-gaze tracking

1.INTRODUCTION

Recently there has been a growing interest in developing natural interaction between human and computer. Several studies for human-computer interaction in universal computing are introduced. The vision-based interface technique extracts motion information without any high cost equipment's from an input video image. Thus, vision-based approach is taken into account an effective technique to develop human computer interface systems. For vision-based human computer interaction, eye tracking is a hot issue. Eye tracking research is distinguished by the emergency of interactive applications. However, to develop a vision-based multimodal human computer interface system, an eye tracking and their recognition is done. Real- time eye input has been used most frequently for disabled users, who can use only their eyes for input.

Eye gaze tracking technology over the past few decades have led to the development of promising gaze estimation techniques and applications for human-computer interaction. Historically, research on gaze tracking dates back to the early 1900s, starting with invasive eye tracking techniques. These included electro-oceanography using pairs of electrodes placed around the eyes or the scleral search methods that include coils embedded into a contact lens adhering to the eyes. The first video-based eye-tracking study was made on pilots operating airplane controls in the 1940s . Research on t h e head-mounted eye trackers advanced in the 1960s and gaze tracking developed further in the 1970s with a focus on improving accuracy and reducing the constraints on users. With increasing computing power in devices, real-time operation of eye trackers became possible during the 1980s. However, till this time, owing to

the limited availability of computers, eye tracking was mainly limited to psychological and cognitive studies and medical research. The application focus on general-purpose human computer interaction as sparse. This changed in the 1990s as eye gaze found applications in computer input and control. Post-2000, rapid advancements in computing speed, digital video processing, and low-cost hardware brought gaze tracking equipment closer to users, with applications in gaming. . Eye gaze information is used in a variety of user platforms. The main use cases may be broadly classified. Applications based on desktop platforms involve using eye gaze for computer communication and text entry, computer control, and entering gaze-based passwords. Remote eye tracking has recently been used on TV panels to achieve gaze-controlled functions, for example selecting and navigating menus and switching channels. Head-mounted gaze tracking setups usually comprise two or more cameras mounted on a support framework worn by the user. Such systems have been extensively employed in user attention and cognitive studies, psychoanalysis, occulo-motor measurements, virtual and augmented reality applications. Real-time gazd is used in driver support systems to evaluate driver vigilance and drowsiness levels. These use eye-tracking setups mounted on a car's dashboard along with computing hardware running machine vision algorithms. In handheld devices such as smartphones or tablets, the front camera is used to track ii user gaze to activate functions such as locking/unlocking phones, interactive displays, dimming backlights, or suspending sensors.

Furthermore, the variations in eye movement and biological aspects of individuals lead to challenges in achieving consistent and repeatable performance from gaze tracking methods. Thus, despite several decades of development in eye gaze research, performance evaluation and comparison of different gaze estimation techniques across different platforms is still a difficult task. To provide insight into the current status of eye gaze research and outcomes, this paper presents a detailed literature review and analysis that considers algorithms, system configuration, user conditions, and performance issues for existing gaze tracking systems. Specifically, use cases based on five different eye gaze platforms are considered.

This system is a vision-controlled communication system. This can be prevailed by the people who are lacking in the use of their hands and voice (physically disabled). It can be used by both adults and children with cerebral palsy and brainstem strokes. Already in the overtaken period of time the eyes are used for many biometric systems. For example, our Aadhar cards are also scanned with our biometrics since these are the unique features that a human being has. There was a huge demand when the brain computer interaction that was introduced earlier and was popularly used by the great scientist Stephen Hawking, but our project is an interaction between an eye and the computer, it builds a interface that can build a system of communication with eyes with the help of computers. The human eye blink detection is widely used for many other purposes also like the drowsiness checking for the drivers who drive long routes and it's also widely used in protection one's information likewise how we use fingerprint biometrics. The advancement in this field can easily make the disabled people more livable. To use this system, only thing that is needed is good control of eye, vision. As the user is positioned in front of the monitor, a webcam is mounted on the monitor that observes the user's eyes.

1.1. OVERVIEW

Personal computers were initially used for solving mathematical problems and word processing. In recent years, however, computers have become necessary for every aspect of our daily activities. These activities range from professional applications to personal uses such as internet browsing, shopping, socializing and entertainment. Computers are designed to be readily accessible for normal individuals. However, for individuals with severe physical disabilities such as cerebral palsy or amyotrophic lateral sclerosis, usage of computers is a very challenging task. There have been many research studies on human computer interface (HCI) to improve the interaction between the user and the computer system. Most of these are applicable only to normal individuals. These interfacing methods include a touch sensitive screen, speech recognition methods and many others. Despite the success of these techniques, they were not suitable for the physically disabled individuals. Many researchers have tried to develop methods to help the disabled to interact with computers by using signals such as electroencephalography (EEG) from the brain, facial muscles signals (EMG) and electro-oculogram (EOG). Other methods

include limbus, pupil and eye/eyelid tracking, contact lens method, corneal, pupil reflection relationship and head movement measurement. These methods require the use of attachments and electrodes to the head, which makes them impractical.

1.2. PROBLEM STATEMENT

Eye tracking technology has become one of the most popular techniques within the human and computer interaction (HCI) this is very important for the people who have difficulty with speech and movement disabilities, especially for the paralyzed and amputee's person. The idea of controlling the computers with the eyes will serve a great use for handicapped and disabled person. Also, this type of control will eliminate the help required by other person to handle the computer. This measure will be the most useful for the person who is without hands through which they can operate with the help of their eye and facial movements.

THE SOLUTION

In this paper, an individual human computer interface system using eye motion is introduced. Traditionally, human computer interface uses mouse, keyboard as an input device. This paper presents hands free interface between computer and human. This technology is intended to replace the conventional computer screen pointing devices for the use of disabled. The paper presents a novel idea to control computer mouse cursor movement with human eyes It controls mouse-moving by automatically affecting the position where eyesight focuses on, and simulates mouse-click by affecting blinking action. However, the proposed vision-based virtual interface controls system work on various eye movements such as eye blinking.

1.3 OBJECTIVES

- Easy interaction with computer without using mouse.
- Limitation of stationary head is eliminated.
- Pointer of the mouse will move on screen where the user will be looking & the clicks will be performed by blinking.
- To develop a system which will only use Webcam, and to use human eyes as a pointing device for computer device. ¬
- To provide user friendly human-computer interaction.Designing a System for tracking Face and Eye using Camera.
- Using Facial landmark's technique to detecting the movement of the face, eyes and calculating it cursor position and mouse clicks.

1.4 PROJECT SCOPE

- This will be helpful for the people having disability in using the physical parts of the computers to control the cursor points.
- Hands – free computing.
- Facilitating the handicapped in using the computer.
- Controlling the mouse pointer through eye movement. Eye based human computer interaction provides real time eye tracking and eye-gaze estimation.

2.LITERATURE SURVEY

[1] "An image-based eye controlled assistive system for paralytic patients" Author's name: Neil Castellino and Michelle Alva Published in: 2017

Communication is an essential part of human life which paralytic patients with locked-in syndrome are deprived of. In locked-in syndrome, the patient cannot move any of his voluntary muscles except the eyes. Taking this into consideration, the proposed system is designed to detect the face and pupil of the patient through a standard webcam using Haar cascade classifiers and Circular Hough Transform algorithm respectively. The proposed system displays different images of daily activities. The patient will have to look at an image for a period above a pre-decided threshold time in order to select it. Subsequently, the system will track the point of gaze of the patient and will select the image accordingly

after a confirmation from the patient. Based on this confirmation, the aide will be notified via text or audio. Successful implementation of the system will help the paralytic patient to easily communicate his needs to the aide.

Merits:

- It helps to communicate with machines in order to automate manual tasks.
- It increases user experience and performance in playing games.

Demerits:

- It does not work with few users who wear contact lenses or have long eye lashes.

[2] "Using for avideobased mouse-Kernels replacement interface". Author's name: Samuel Epstein-Eric MissimerMargritBetke Published in: 2012

Some people cannot use their hands to control a computer mouse due to conditions such as cerebral palsy or multiple sclerosis. For these individuals, there are various mouse-replacement solutions. One approach is to enable them to control the mouse pointer using head motions captured with a web camera. One such system, the Camera Mouse, uses an optical flow approach to track a manually selected small patch of the subject's face, such as the nostril or the edge of the eyebrow. The optical flow tracker may lose the facial feature when the tracked image patch drifts away from the initially-selected feature or when a user makes a rapid head movement.

Merits:

- Ideal for use with desktop computers.
- Usually supplied as part of a new computer system.

Demerits:

- They need a flat space close to the computer.
- Older style mice which have roller balls can become clogged with grease and grime and lose their accuracy until cleaned.

[3] "Real-time eye-gaze estimation using a low-resolution webcam" Author's name: Yu-Tzu Lin Ruei-Yan Lin Yu-Chih Lin Greg C Lee Published in: 2012

Eye detection and gaze estimation play an important role in many applications, e.g., the eye-controlled mouse in the assisting system for disabled or elderly persons, eye fixation and saccade in psychological analysis, or iris recognition in the security system. Traditional research usually achieves eye tracking by employing intrusive infrared-based techniques or expensive eye trackers. Nowadays, there are more and more needs to analyze user behaviors from tracking eye attention in general applications, in which users usually use a consumer-grade computer or even laptop with an inexpensive webcam.

Merits:

- Eye detection and gaze estimation play an important role in many applications, e.g., the eye-controlled mouse in the assisting system for disabled or elderly persons, eye fixation and saccade in psychological analysis, or iris recognition in the security system.

Demerits:

- It requires some calibration time before it gives satisfactory results. Hence few users deviate themselves from using it.
- It is expensive technology due to costly hardware requirements.

2.1. EXISTING SYSTEM AND LIMITATIONS

Many researchers have tried to develop methods to help the disabled to interact with computers by using signals such as electroencephalography (EEG) from the brain, facial muscles signals (EMG) and electro oculogram (EOG). The camera mouse was proposed by MargritBetkefor people who are quadriplegic

and nonverbal. The movements of the user are tracked using a camera and these can be mapped to the movements of the mouse pointer which is visible on the screen. Yet another method was proposed by Robert Gabriel Lupu, for human computer interaction that made use of head mounted device to track eye movement and to translate it on screen. Another technique by Prof. Prashant salunke presents a techniques of eye tracking using Hough transform.

- **Limitations:**
  - Other methods include limbus, pupil and eye/eyelid tracking, contact lens method, corneal, pupil reflection relationship and head movement measurement.
  - These methods require the use of attachments and electrodes to the head, which makes them impractical. Other high-end techniques that are based on infrared tracking of the eye movements to control computers were exceptionally expensive and were not affordable for those who need them.

2.2. PROPOSED SYSTEM AND ADVANTAGES

In the proposed system, we have included the face detection, face tracking, eye detection and interpretation of a sequence of eye blinks in real time for controlling a nonintrusive human computer interface. Conventional method of interaction with the computer with the mouse is replaced with the human eye movements

Advantages:

- no external device is required to perform the mouse operations.
- A person can operate even while wearing glasses or having lens.
- Accuracy is high compared to previous models.
- Less expensive as no external device is required.
- No caliberation time required before giving the results.

3.METHODOLOGY

Artificial Intelligence

Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.

In general, AI systems work by ingesting large amounts of labeled training data, analyzing the data for correlations and patterns, and using these patterns to make predictions about future states. In this way, a chatbot that is fed examples of text chats can learn to produce lifelike exchanges with people, or an image recognition tool can learn to identify and describe objects in images by reviewing millions of examples.

AI programming focuses on three cognitive skills: learning, reasoning and self-correction.

Learning processes. This aspect of AI programming focuses on acquiring data and creating rules for how to turn the data into actionable information. The rules, which are called algorithms, provide computing devices with step-by-step instructions for how to complete a specific task.

Reasoning processes. This aspect of AI programming focuses on choosing the right algorithm to reach a desired outcome.

Self-correction processes. This aspect of AI programming is designed to continually fine-tune algorithms and ensure they provide the most accurate results possible.

Image Processing

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is

an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.

Image processing basically includes the following three steps:

- Importing the image via image acquisition tools;
- Analysing and manipulating the image;
- Output in which result can be altered image or report that is based on image analysis.

Python

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.

PyAutogui

PyAutoGUI is a cross-platform GUI automation Python module for human beings. Used to programmatically control the mouse & keyboard.

OpenCV

OpenCV is the huge open-source library for the computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today's systems. By using it, one can process images and videos to identify objects, faces, or even handwriting of a human. When it integrated with various libraries, such as Numpuy, python is capable of processing the OpenCV array structure for analysis. To Identify image pattern and its various features we use vector space and perform mathematical operations on these features. The first OpenCV version was 1.0. OpenCV is released under a BSD license and hence it's free for both academic and commercial use. It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. When OpenCV was designed the main focus was real-time applications for computational efficiency. All things are written in optimized C/C++ to take advantage of multi-core processing.

Mediapipe

MediaPipe Iris a new machine learning model for accurate iris estimation. Building on our work on MediaPipe Face Mesh, this model is able to track landmarks involving the iris, pupil and the eye contours using a single RGB camera, in real-time, without the need for specialized hardware. Through use of iris landmarks, the model is also able to determine the metric distance between the subject and the camera with relative error less than 10% without the use of depth sensor. Note that iris tracking does not infer the location at which people are looking, nor does it provide any form of identity recognition. Thanks to the fact that this system is implemented in MediaPipe — an open source cross-platform framework for researchers and developers to build world-class ML solutions and applications — it can run on most modern mobile phones, desktops, laptops and even on the web.

4.IMPLEMENATION

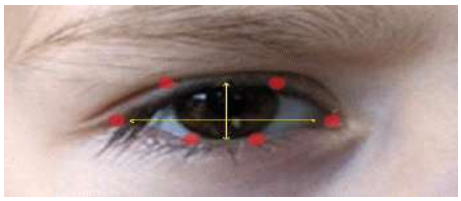
FACE DETECTION:

It is a technology of recognizing human faces from any image or video. Mostly, OpenCv and mediapipe are used to detect face by using various methods. The detector used here is made up of classic Histogram of Oriented Gradients (HOG) feature along with a linear classifier. Facial landmarks detector is implemented inside media pipe to detect facial features like eyes, ear, nose, etc.

- **EYE DETECTION:**

After detecting the face, eye region is detected with the help of facial landmark features. Using the face landmarks datasets, we can point out 68 landmarks on the face, each landmark is assigned with an index. Using these indices, the desired region of the face is detected.

After extracting eye region, it is processed for detecting eye blinks. The eye region detection is done at the initial stage of the system.

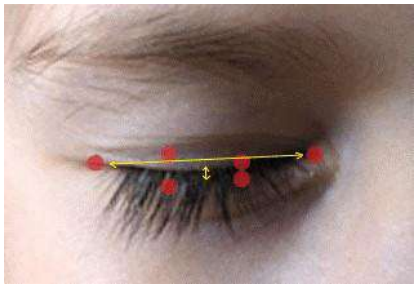


- **EYE BLINK DETECTION:**

With the exact eye region, we can detect the blinks with the help of two landmarks. These landmarks are drawn vertically splitting the eyes. Temporary closure of eyes along with the movement of eyelids is known as blink. It is a rapid natural process.

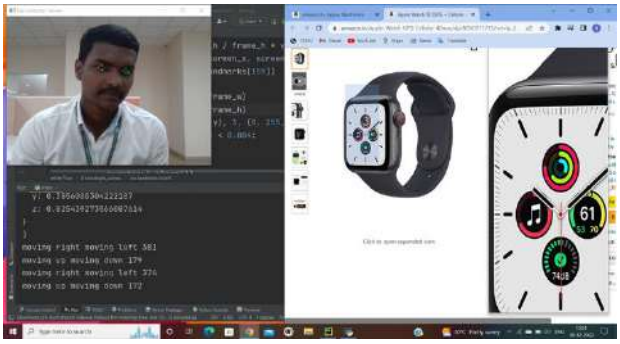
We have to find out what happens when eye is blinked. We can conclude that the eye is closed/blinked when:

- Eyeball is not visible Eye lid is closed
- Upper and lower eyelids are connected together

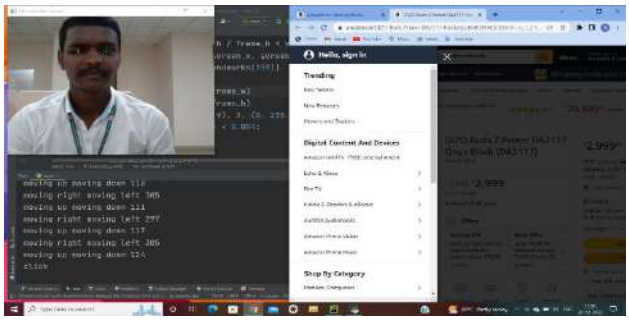


5.EXPERIMENTAL RESULTS

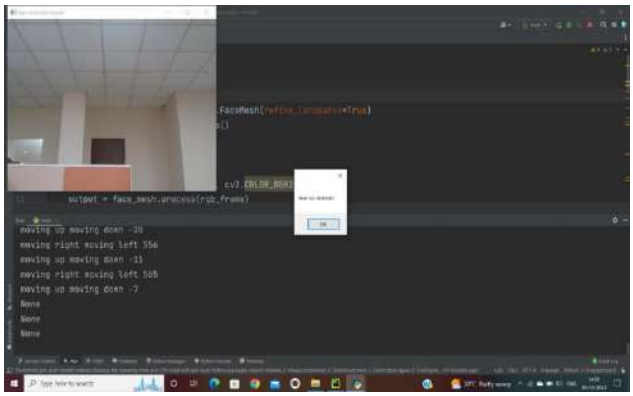
- During execution of the code , the pupil of the eye is detected and the cursor movements are performed according to the pupil movements.
- Right eye is used to perform the cursor movements.



- By the blink of the left eye, click operation is performed.
- Simultaneously we can perform both cursor and click operation through our eye movements.



- When face is not detected a pop-up of 'face not detected' is mentioned.



6.CONCLUSION

Eye gaze estimation is an interdisciplinary area of research and development that has received quite a lot of interest from academic, industrial, and general user communities in the last decades owing to the ease of availability of computing and hard- ware resources and increasing demands for human-computer in- interaction methods. A detailed literature review is made on the recent advances in eye gaze research, and information in statistical format is presented to highlight the diversity in various aspects such as platforms, setups, users, algorithms, and performance measures existing between different branches of this field.

The most unique aspect of this system is that it does not require any wearable attachments. This makes the interaction more efficient and enjoyable. A user interface is the system by which human interact with a computer. The user interface includes hardware and software components. No external hardware is attached or required. This system helps the physically disabled people to communicate their ideas and thoughts and needs for them. To differentiate voluntary and normal eye blinks, the eye blink frame rate is used. This algorithm helps the physically disabled people to communicate efficiently. This complete project consists of proposed system, pc or laptop and web Cam. The system can be used in many places like hospitals, homes, nursing homes etc. This system provides a new possibility in the life of paralyzed people with eye movement. The aim of this system is to reduce the efforts of physically disabled people to communicate their thoughts by using eye movement. Surely this system will provide a solution for people.

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