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IRIS INPUT FOR COMPUTER INTERACTION

SIDDESH DHURAT[1] SHUBHAM KHOPDE[2] VENUGOPAL POOJARYI[3] RITIKA SHARMA[4]
PROF.YOGESH KARUNAKAR[5]

[1-5]Department of Electronics and Telecommunication
K.C. College of Engineering & Management Studies & Research, Kopri, Thane (E)-400 603, India.

Abstract— The goal of the project is to design and build a low-cost eye tracker, which will enable tracking of a subject's focus of gaze within his/her field of vision. The unit is significantly cheaper than existing units available in the market. Real-time eye and iris tracking are important for hands-off gazebased computer usage, password entry, instrument control by paraplegic patients, Internet user studies, as well as homeland security applications. In this project, a smart camera and some open-source software tools are utilized to generate eye detection and tracking algorithms. Eye detection refers to finding eye features in a single frame. Eye tracking is achieved by detecting the same eye features across multiple image frames and correlating them to a particular eye. Keywords—Tracking, gaze, python, package, detection, IR camera, GUI, automation, mouse, video, user, technology, click, computer, software, accuracy, interface

I. INTRODUCTION

Eye tracking is the method of locating an eye across video frames to ascertain a person's gaze direction. Eye tracking is crucial in the fields of visual systems, psychological analysis, cognitive science, and product design research and development. An eye-tracking system combines a variety of tools and programmes for tracking the location and movement of the eyes while connecting the results to the same eye in a series of time-stamped photos.

A. OVERVIEW

The direction of a person's gaze can be ascertained in a variety of ways. The "pupil-center/corneal-reaction" technique is perhaps the most efficient and popular one. The approach is predicated on the notion that a person's gaze direction is directly tied to the relative positions of the pupil and the response of a corneal object. There is no need for direct physical contact with the user's eye or eye socket with this distant eye-tracking technique. It makes use of reactor trackers, which shoot a light beam into the eye. A sophisticated camera then detects the difference between the pupil reaction and predetermined reference points to determine what the user is looking at.So, this method involves some critical procedures.

B. RELATED RESEARCH

There are currently numerous eye-gaze tracking methods available. Some researchers used the Electro-Oculography tracking method to track person's eye movements. It makes use of the electrostatic field that surrounds the eyes and changes in response to eye movement. These minute variances can be measured using electrodes positioned on the skin surrounding the eyes. This method is complicated and unsuitable for routine use because electrodes are used. Multiple techniques have been created using contact lens tracking. Although they work quite well, these devices are intrusive, painful, and frequently call for a topical anesthetic. "Matin and Pearce (1964) created a scleral contact lens system with a resolution of 0.00028 within a range of 10 for all three dimensions using a pair of noncoplanar 4-mm-diameter mirrors placed in the surface of the lens on

III. PROPOSED SYSTEM

Video Based Eye Tracking: • Connect the IR camera to the laptop using raspberrypi 3 B module. • Open the pycharm IDE and run the code and wait for 3 seconds. • The camera will now track and detect the movements of eyes and head and move the cursor accordingly. • When the user will blink its left eye, the software will detect it and clicking function will be performed on the screen. • After the click, the function desired is performed. Eye images are captured using a IR video camera by eye tracking systems that employ video. Video-based eye tracking systems can be classified into two groups: head-mounted and remote, depending on where this "eye camera" is placed. While remote eye trackers frequently operate in conjunction with a computer monitor on which the subject is executing a task, head-mounted eye trackers frequently include an additional camera to photograph the scene the person is looking at. The optical module for head-mounted video-based eye trackers is mounted on the user's headgear. They give the observer more mobility but are, in some ways, more obtrusive than remote trackers. The eye camera and scene camera would not move with respect to the subject's eye, and any displacement of the pupil or CR within the eye images would only result from rotational eye motions if the headpiece were absolutely stable and moved exactly with the subject's head. This idealized scenario is unreal.

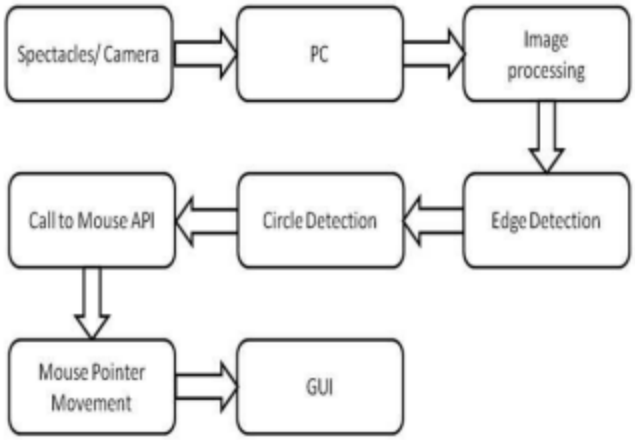

Fig.1. Block diagram of system

A. Eye gaze tracking algorithm

1) Facial Features Extraction This paper intends to present an eye tracking algorithm and facial features detection i.e. face and eyes extraction is an important task in this regard. i. Histogram Equalization: By altering image intensities in accordance with the image histogram, the technique of histogram equalisation allows for the normalising of contrast . It is a contrast-enhancing technique that makes use of histogram data and makes an effort to balance the histogram. Histogram equalisation offers a superior performance in terms of accuracy for face feature detection. ii. Face and eye patch extraction: The problem of classifying the obtained image into face and non-facial regions is a part of face detection. Face and eye extraction is carried out using a quick and reliable object detection system that uses machine learning as its foundation. For this a python package called as Mediapipe is used. This package tracks all the landmark points on the face and filters the landmark points down.

Face and eye patch extraction:

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uses machine learning as its foundation. For this a python package called as Mediapipe is used . This package tracks all the landmark points on the face and filters the landmark points down.

B. Eye Features Detection

The mediapipe python package traces a lot of landmark points on our entire face as shown below. As the system does not require all the landmark points other than that of eyes. Each of these landmarks has it's own number as shown in figures ahead. In the python code only those landmark numbers are entered which are dedicated to the eyes. As mentioned in the picture below, we can see that for the left eye the points numbers are 159 and 145 and for the right eye the point numbers are 474,475,476,477,478. The result will be highlighted circles on those landmark points in figure below.

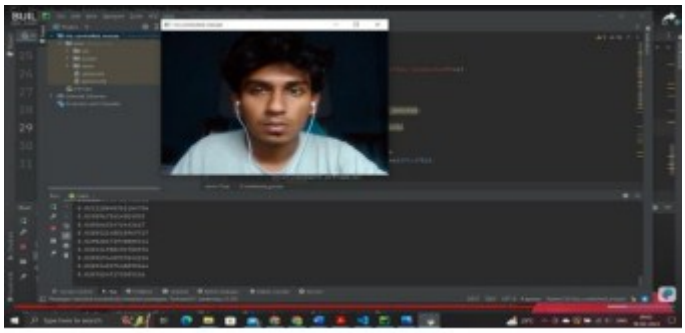

Fig.2. Required landmarks traced

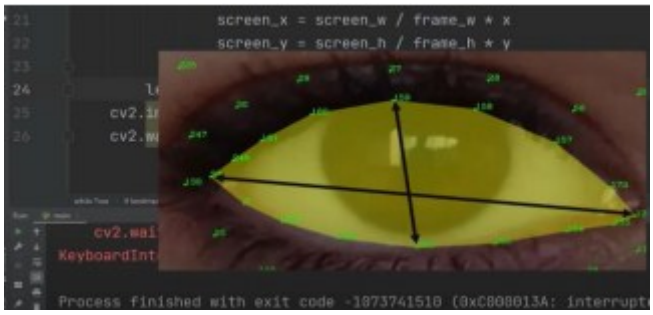

Fig.3. Landmarks point numbers

In this system we have used a IR camera and connected it to a laptop using raspberry-pi 3 B module and with the help of special python packages eye and head movement techniques have been implemented to control the cursor on the GUI. The packages used in python and its functions are explained below:

C. Open-cv2

OpenCV can also be used for video processing. With OpenCV, we can capture a video from the camera and it also lets us create a video capture object which is helpful to capture videos through webcam and then you may perform desired operations on that video. Besides this you can also play and perform operation on a video file and save them. OpenCV also provides the functionality to control and manage different types of mouse events and gives us the flexibility to manage them. As we know there can be different types of mouse events such as double_click, left button click, right button click, etc. For managing these events, we need to design callback functions for each of these mouse click events while the window or frame is opened by OpenCV.The callback function gives us flexibility to implement what type of functionality you want with a particular mouse click event.

D. Mediapipe

Mediapipe is an open-source cross-platform ML solution for live and streaming media. It is built on top of TensorFlow Lite and offers end-to-end acceleration, allowing for fast ML inference and processing on common hardware. It is used in leading ML products and teams, and offers low code.APIs for customizing and deploying on-device machine learning solutions with only a few lines of code. It is also designed to be build once and deployed anywhere, working across Android, iOS, desktop/cloud, web and IoT.

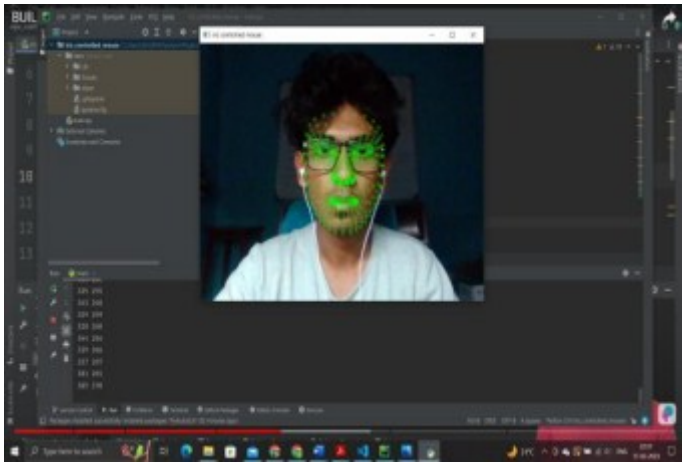

Fig.4. All landmark points

E. PyautoGUI

Python package pyautogui is a cross-platform GUI automation Python module for human beings. Pyautogui is an open source, free and easy to use library that allows you to automate the mouse and keyboard without any programming skills. It can be used for automating almost anything in your computer including web browsers, games, office applications, and much more it is also very powerful and flexible. It has many features that allow you to customize the automation process to fit your needs. Pyautogui is also cross-platform, which means it works on Windows, Mac and Linux. This makes it a very versatile tool that can be used by anyone regardless of their operating system. Overall, pyautogui is an excellent Python package for automating mouse and keyboard input. It is easy to use, powerful and flexible, and works on all major operating systems. If you need to automate any task on your computer, pyautogui should be your first choice. Pyautogui has many features including the ability to move the mouse, click and double-click, keystrokes, scrolling, etc. It also offers support for customizing the action of the mouse and keyboard based on specific conditions.

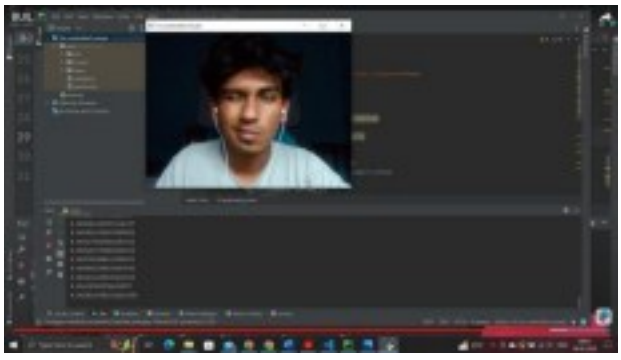

Fig.5. Click function performed

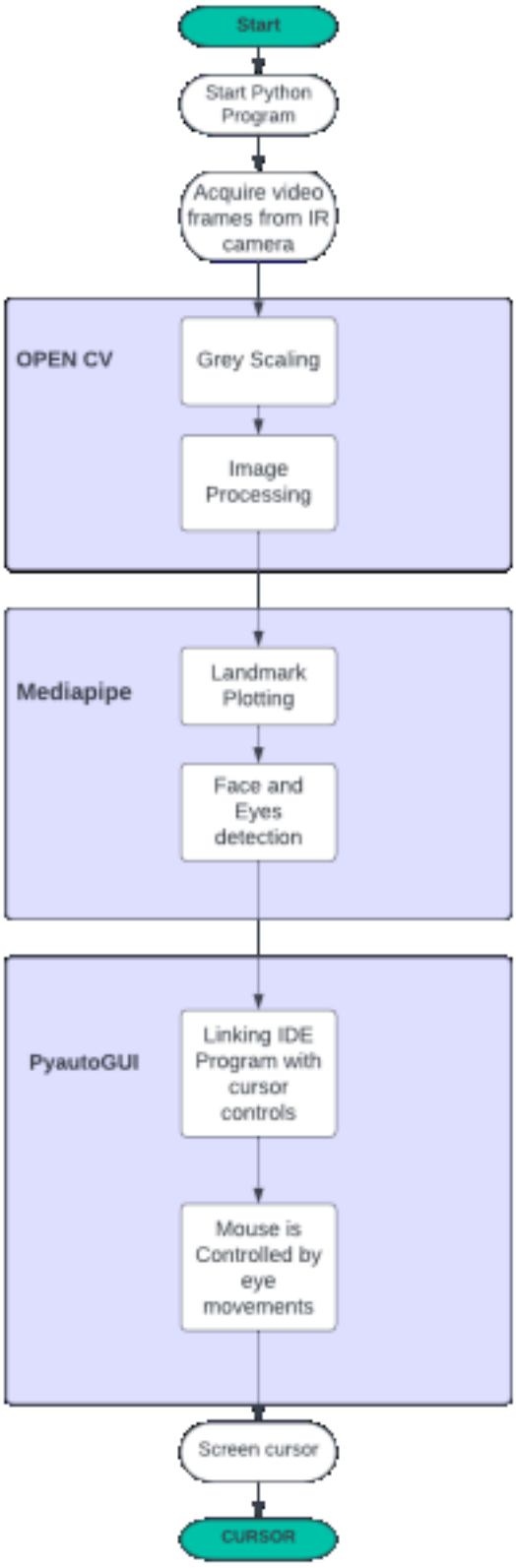

Fig.6. Flowchart of system

IV. ADVANTAGES

1) It was observed that the eye tracker can estimate the gaze position very accurately when properly calibrated.
2) This technology has primarily been applied to communication devices for individuals with disabilities that contain huge icons that the user may aim with their eyes.
3) The project's key benefit is that it essentially created a low-cost system compared to other readily available solutions on the market.
4) System is lightweight, allowing for improved portability.
5) Moreover, eye tracking equipment allows researchers record and quantify eye movements, pupil dilation, point of gaze, and blinking to determine where study participants focus their visual attention, what they pay attention to, and what they ignore.

V. FUTURE SCOPE

Using simplistic eye tracker technology, the System offers a dependable software solution for disabled persons and people with movement difficulties, finally enabling the person with severe disabilities to control computer operations. The high accuracy findings or accurate output reported have revealed the systems' dependability.
1) Monitor mouse motions and user eye movement. 2) Monitor the user's gaze at a specific location to enable mouse clicks.
3) Utilize mouse movements that have been observed to operate computer features.

VI. CONCLUSION

Using inexpensive eye tracker technology, the initiative offers paralysed individuals and those with motor impairments a dependable software solution that eventually enables them to operate computer functions. The results of reasonable accuracy have demonstrated the system's dependability.
The blink detection, however, loses accuracy if the camera is positioned too far above the user's head, aiming down at the user at a large angle. As almost the entire user's eyelid is visible to the camera, this is brought on by the extremely slight difference in correlation scores as the user blinks. So, it is advantageous to the detection accuracy to increase the degree of variance between the user's open and closed eye images when situating the camera. And finally, this technology offers a discrete alternative for the clinical setting. It has been determined that employing a web camera as a human computer interface can be a workable input technique for the website of severely impaired people.
This information will be extremely helpful for the company's marketing and UI designers.

TABLE I. TABLE OF FIGURES

Fig No.	Title of figure
Fig.1	Block diagram of system
Fig.2	Required landmarks traced
Fig.3	Landmarks point numbers

Fig.4	All landmark points
Fig.5	Click function performed
Fig.6	Flowchart of system

VII. ACKNOWLEDGMENT

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REFERENCES

[1] 1. 1.De Luca A. Weiss R., and Drewes H. Evaluation of Eye-Gaze Interaction Methods for Security Enhanced PIN-Entry In Proceedings of the 19th Australasian Conference on Computer-Human interaction, OZCHI 2007. vol. 51. ACM Press (2007), 199 202.

[2] 2. 2.Ashdown M., Oka K., and Sato Y. Combining Head Tracking and Mouse Input for a GUI on Multiple Monitors. In Extended Abstracts on Human Factors in Computing Systems, CHI '05. ACM Press (2005), 1188 1191.

[3] 3. Atterer R. Schmidt A., and Wnuk M. A. Proxy Based Infrastructure for Web Application Shar ing and Remote Collaboration on Web Pages, In Proceedings of the 11th IFIP TC13 International Conference on Human-Computer Interaction, INTERACT 2007, Springer (2007), 74 87.

[4] 4. Abrams R.A., Meyer D.E., and Kornblum S. Speed and Accuracy of Saccadic Eye Movements: Characteristics of Impulse Variability in the Oculomotor System, Journal of Experimental Psychol ogy: Human Perception and Performance (1989), Vol. 15, No. 3, 529 543.

[5] 5. 5.Santella A., Agrawala M., DeCarlo D., Salesin D., and Cohen M. Gaze-Based Interaction for Semi Automatic Photo Cropping, In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems CHI '06. ACM Press (2006), 771 780.

[6] 6. 6.Albert W. (2002). Do web users actually look at ads A case study of banner ads and eye-tracking technology, In Proceedings of the Eleventh Annual Conference of the Usability Professionals As sociation.

7. 7.Cowen L., Ball L. J., and Delin J. (2002). An eye movement analysis in X. Faulkner, J. Finlay, and F. Dtienne (Eds.), People and Computers XVI Memorable yet Invisible: Proceedings of HCI 2002 (pp. 317-335). London: Springer-Verlag Ltd.

[7] Huachun Tan, Yu-Jin Zhang, Detecting eye blink states by tracking iris and eyelids, Pattern Recognition Letters, Volume 27, Issue 6, 2006