STUDENT ATTENDANCE AND REGISTRATION USING INVERTRAC AS WEBAPI

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ABSTRACT: Pupil detection is essential in eye gaze video-based tracking systems. This study offers a brand-new, feature-based eye-tracking method for detecting pupils. Prior to the pupil identification step, morphological operators are employed to eliminate corneal reflections and minimise noise in the pupil area. This technique enables a large reduction in processing overhead without compromising tracking accuracy. InverTrac, which stands for Inversion and Tracking, is the name of the suggested pupil tracker. This allows us to scan any type of pupil, regardless of size or form, and to tell a real pupil from a design. The most common way to do this is to apply grayscale filters on the photos or videos to determine the brightest place in the pupil, which will allow you to detect movement and provide coordinates for the device being used.

Keywords- *Inversion and Tracking, grayscale filters*

1. INTRODUCTION

Human attention and focus can be seen through the gaze, which is an organic communication tool. Systems for real-time monitoring can benefit from the eye's spatial and temporal features [1]. The visual behaviour is represented by fixation and saccades. Fixation is the pause in the gaze at particular points, whereas a saccade is the movement of the gaze from one spot to another. Together, fixation and saccades make up one eye movement. Fixations can retrieve important data for an application. Eye movements can be studied using metrics including fixation frequency, duration, and density [2]. The typical fixation time is 200–600 milliseconds [3]. Capturing planned motions while suppressing accidental ones are necessary for controlling eye actions. Spectrum fluctuations, low contrast, and higher noise levels are the main obstacles to the recording of images in visible light. The visibility of the iris is affected by the subject's and camera's distance, the face's rotation, the subject's eye closure, and the eye's natural characteristics. Due of eye blinks, it is necessary to continually establish the pupil's centre. With quicker saccades, incorrect gaze direction detection is conceivable [4]. Determining the dwell time is crucial because it is the predetermined period for choosing the target.

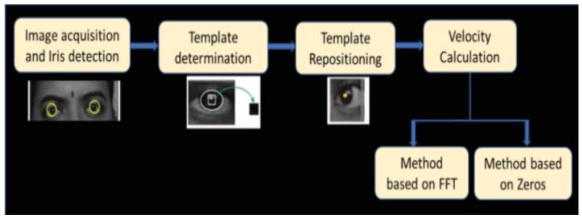

Fig.1: Feature based Methods for Eye Gaze Tracking

Systems for interacting with humans often use a keyboard, mouse, touch screen, and voice. In response to user input, eye contingent systems track their users' eye movements. Here, only a few applications are described. In order to communicate, spoken words are decoded from eye gestures [5]. For users with motor limitations, the app offers a modified user interface. Players' collective visual attention in a game is tracked via head and eye movements [6]. Users with neurological diseases can now access email thanks to an adaption of browser features [7]. In a human-robot interface, the input from gaze controls the movement of a teleoperated mobile robot [8]. A wheel chair navigation system with an eye-controlled feedback mechanism directs impaired people's movements [9]. Construction site visual observations give information for efficient processing and automation [10]. Eye movements are a viable method for usability evaluation of interface task performance [11]. Along with standard interaction, gaze input integrates a number of editing possibilities, including text selection and character typing [12]. Based on fixation positions, ocular tiredness is assessed [13].

2.LITERATURE REVIEW

2.1 Eye and gaze tracking for interactive graphic display [1] :

In order to follow a user's gaze in real time for an interactive graphic display, we developed a computer vision system based on active IR lighting. The preliminary results are described in this work. Our gaze tracker can conduct reliable and accurate gaze estimate without calibration and under fairly large head movement, in contrast to most existing gaze tracking algorithms, which frequently assume a static head to work properly. This is made possible by a novel gaze calibration method that uses Generalized Regression Neural Networks to identify the mapping from pupil characteristics to screen coordinates (GRNN). With GRNN, the mapping is not required to be an analytical function, and the gaze mapping function explicitly accounts for head movement. The mapping function can also be applied to people who weren't trained specifically for it. Preliminary studies using a gaze-responsive interactive graphic display show how effective our gaze tracker is.

2.2 Using eye gaze tracking for the usability evaluation of web sites [2]:

This chapter offers a helpful manual for software usability engineers who are thinking about eye tracking's advantages or for eye tracking experts who are thinking about using it to evaluate software usability. The fundamentals of industrial software usability evaluation are outlined, and then previous usability findings and eye tracking-derived recommendations are presented. The eye tracking methodology is then thoroughly discussed, with a focus on the usability engineer's practical concerns. Last but not least, a plea for study is made to encourage the development of eye tracking for usability evaluation.

2.3 Fixation Precision in High-Speed Noncontact Eye-Gaze Tracking [3] :

The utility of a noncontact eye-gaze tracking system for real-time applications is significantly influenced by the accuracy of point-of-gaze (POG) estimation during a fixation. This study's goals are to define and quantify POG fixation precision, offer strategies for enhancing fixation precision, and assess how the methods perform when used with two POG estimate approaches. Techniques for high-speed image processing that enable POG sampling rates of above 400 Hz are provided in order to accomplish these goals. Filtering can increase fixation precision with these high-speed POG sample rates while still retaining a respectable real-time latency. The high-speed pupil-corneal reflection (HS P-CR) vector method and a 3-D model-based method with free head motion both used the high-speed sampling and digital filtering techniques that were developed.

2.4 In the Eye of the Beholder: A Survey of Models for Eyes and Gaze [4]:

Eye recognition and tracking remain difficult due to the distinctiveness of eyes, occlusion, variable in scale, position, and lighting conditions, despite ongoing research and tremendous advancement in the last 30 years. Numerous activities involving human-computer interaction (HCI) and face detection require information on the location of the eyes and the specifics of eye movements. This study covers recent developments and the state-of-the-art in video-based eye tracking and detection in order to pinpoint innovative approaches as well as problems that require more research. We provide a thorough analysis of current eye models and methods for eye tracking and detection. We also review and contrast various gaze estimating techniques according to their purported accuracy and geometrical characteristics. This paper demonstrates that, despite their apparent simplicity, developing a general eye

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detection technique entails overcoming many obstacles, necessitates additional theoretical advancements, and is thus relevant to many other domains of computer vision problems as well as those outside of it.

2.5 See-Thru: Towards Minimally Obstructive Eye-Controlled Wheelchair Interfaces [8]:

For people with ALS or other motor limitations, the available eye-tracking input methods are now prohibitively expensive, weak in direct sunlight, and necessitate extensive, inflexible setups. Low-tech alternatives like eye-gaze transfer (e-tran) boards are difficult to master and have sluggish communication speeds. We developed GazeSpeak, an eye gesture communication system that operates on a smartphone and is made to be affordable, reliable, portable, and simple to learn, with a better communication bandwidth than an e-tran board, in order to lessen the shortcomings of these two current systems. With diverse user interfaces for speakers and interpreters, GazeSpeak can interpret eye gestures in real time, decode these gestures into expected utterances, and improve communication. Our analyses show that GazeSpeak is reliable, has positive user ratings, and speeds up communication compared to an e-tran board. We also point out areas for future development of low-cost, low-effort gaze-based communication technologies.

2.6 See-Thru: Towards Minimally Obstructive Eye-Controlled Wheelchair Interfaces [9]:

When utilising hands cannot be done, eye-tracking interfaces boost the communication bandwidth between people and computers. Some people can only control and engage with the different technologies that permit their independence using their eyes as an input modality. The objective of this work is to design and test an eye-controlled wheelchair navigation interface that reduces interference with the user's field of vision by doing away with the traditional feedback mechanism of a computer screen. We introduce See-Thru, an eye-tracking interface that gives the user feedback without using a screen while also giving them a good view of the road ahead. In a research involving three navigation tasks completed by seven users of power wheelchairs, our prototype is measured against a screen-based state-of-the-art interface. Our findings demonstrate that the majority of participants not only favour using the See-Thru interface but also outperform while using it for driving tasks. This demonstrates that consumers favour interfaces that are just marginally disruptive in navigational settings.

2.7 Eye Gaze Tracking Technology Application in Mobile Computing Platform Input Mechanism Study [10]:

The information gathered in the construction industry serves as the foundation for many significant company processes and crucial choices. Numerous technologies and techniques to automate the data input process have been investigated in research during the last few decades. Previous research found that as automated information block units for data input on mobile computing devices, images or pictographs representing various construction operations are more usable than predetermined text. The ability to use recent developments in eye tracking technology as both a tool to better understand human-computer interaction and a new method of interacting with mobile computing devices has considerable potential. This study tracks user gaze movements during predetermined visual search tasks on computer screens utilising a remote binocular eye tracker in conjunction with a test programme. Analyzed and explained are the visual findings from the eye tracker data. Using symbols in place of words in electronic construction papers can help handle construction data more effectively and efficiently, as the usage of tablets and other mobile devices is quickly becoming the norm on construction sites. Future research ideas that combine virtual reality and mixed reality technologies with eye tracking and iconography are presented.

2.8 Study On Hermitian Graph Wavelets in Feature Detection [11]:

The massive information flow in modern life needs the identification of the valuable data that should be concentrated. The role of feature detection in image segmentation and signal processing is to fixate on the data that needs to be focused. By focusing on the pixels or information that needs to be concentrated, the time and energy wasted on looking at the pixels or information that is least important is eliminated. This study, which focuses on the benefits of combining the Hermitian wavelet transform with the graph wavelet in feature detection to accurately identify the data that has to be processed further, is presented in the publication.

3. METHODOLOGY

A new problem began to emerge in the educational system as the globe began to accept working around COVID. Students fabricating their attendance in offline and online lectures by taking advantage of the use of masks is the issue mentioned. As a result, we took attendance using our "InverTrac" pupil recognition technology rather than a more efficient employee.

The goal is to record students' attendance in an offline or online classroom simply by identifying each student. InverTrac [Inversion and Tracking] will be transformed into a web-API that user-friendly and speeds the eye-tracking process, making it possible to easily integrate into any system (ex:- Linux, Android, Windows). As a result, regardless of the available technology, the system is able to track every type of coloured pupil in any situation. This enables us to track kids and record attendance while taking attendance of students in any setting utilising less expensive equipment and a computer.

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Limitations:

The project has four significant constraints. The first would be that no additional electronic devices are used in the project; just a personal server is used to store information. The second is that a dedicated webcam that is in working order must be installed on the personal computer. The third would be the requirement for prebuilt Python libraries in order for it to operate without requiring any prior configurations, which would render the general public incomprehensible. The final and most significant issue would be the need for RAM with more memory and faster speed, which would increase the cost of manufacturing the device.

Pupil Detection After Isolation and Fitting (PDIF), developed by FEDERICO MANURI, ANDREA SANNA, and CHRISTIAN PIO PETRUCCI, is the current system that is being utilised for pupil detection. In order to gain a clear view of the pupil and determine what they are looking at, this algorithm isolates the pupil for detection using large machinery. ElSe (Ellipse Selection) and ExCuSe, two cutting-edge tracking algorithms that use morphological techniques, were compared to pupil detection after isolation and fitting (PDIF) (Exclusive Curve Selector). The collected results show that PDIF achieves equal tracking precision at a significantly lower computational cost than ElSe and ExCuSe.

Our goal is to develop a powerful algorithm that can read grayscale or colour images. In this, the area that the eye is gazing at is determined by measuring the brightness of the pupil. This would be accomplished by transforming regular colour images to grayscale images or frames. To identify the eyes and pupils, the image is next matched to earlier information and faces. Then When a face is found, the pupil and eye are located by looking for a circular contrast colour around the central areas. If the face cannot be recognised, the full input region is searched for the circular contrast colour zone. An alert will be displayed to the user if neither the face nor the pupil can be found.

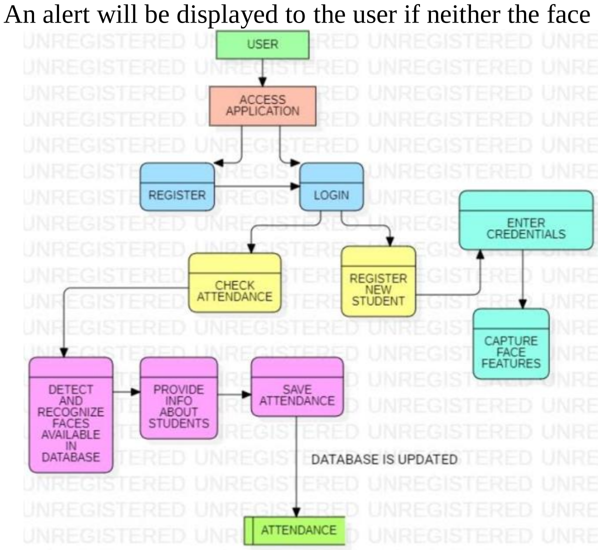

Fig.2: System architecture

Advantages:

- ❖ Both video and picture input are possible.
- ❖ The input might be in grayscale or colour.
- ❖ Heavy equipment is not required for the detection.
- ❖ This can be done using a straightforward camera attached to the PC.
- ❖ Lighting doesn't affect detection.

4. IMPLEMENTATION

The suggested method, InverTrac [Inversion and Tracking], will be transformed into a web-API that user-friendly and speeds the eye-tracking process, making it possible to easily integrate into any system (ex:- Linux, Android, Windows). As a result, regardless of the available technology, the system is able to track every type of coloured pupil in any situation.

The elliptical fitting is followed by a shape validation step, and if the elliptical shape cannot be accurately detected, many additional steps are carried out to improve pupil estimate.

4.1 MODULES:

- Tkinter
- OpenCV 4.2+
- OS

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A. Tkinter:

Python provides various options for developing graphical user interfaces (GUIs). Most important are listed below.

- Tkinter − Tkinter is the Python interface to the Tk GUI toolkit shipped with Python. We would look this option in this chapter.
- wxPython − This is an open-source Python interface for wxWindows http://wxpython.org.
- JPython − JPython is a Python port for Java which gives Python scripts seamless access to Java class libraries on the local machine http://www.jython.org.

There are many other interfaces available, which you can find them on the net.

Tkinter Programming:

Tkinter is the standard GUI library for Python. Python when combined with Tkinter provides a fast and easy way to create GUI applications. Tkinter provides a powerful object-oriented interface to the Tk GUI toolkit.

Creating a GUI application using Tkinter is an easy task. All you need to do is perform the following steps −

- Import the *Tkinter* module.
- Create the GUI application main window.
- Add one or more of the above-mentioned widgets to the GUI application.
- Enter the main event loop to take action against each event triggered by the user.

B. OpenCV 4.2+:

A collection of Python bindings called OpenCV-Python was created to address issues with computer vision. Python is a general-purpose programming language created by Guido van Rossum that quickly gained popularity, largely due to its ease of use and readable code. The programmer can express concepts in less code without sacrificing readability. Python is slower than languages like C/C++. However, C/C++ extensions to Python are simple, enabling us to write computationally intensive programmes in C/C++ and produce Python wrappers that may be used as Python modules.

Due to the actual C++ code running in the background, the code is just as quick as the original C/C++ code, and Python is also easier to code in than C/C++. The original OpenCV C++ implementation has a Python wrapper called OpenCV-Python. Numpy, a highly efficient library for numerical operations with a MATLAB-like syntax, is used by OpenCV-Python. Numpy arrays are translated into and out of all OpenCV array forms. Additionally, this makes it simpler to interact with other Numpy-using libraries like SciPy and Matplotlib.

C.OS:

Python's OS module offers tools for communicating with the operating system. OS is included in the basic utility modules for Python. A portable method of exploiting operating system-specific functionality is offered by this module. There are numerous functions to deal with the file system in the *os* and *os.path* modules. The OS module in Python has functions for adding and deleting folders, retrieving their contents, changing the directory, locating the current directory, and more. In order to communicate with the underlying operating system, you must first import the os module.

Instead of the environment as a whole, the operating-system module includes a set of functions for altering information unique to a given application. Any application can be started or stopped, and you can ask it questions to get information particular to that application.

5. EXPERIMENTAL RESULTS

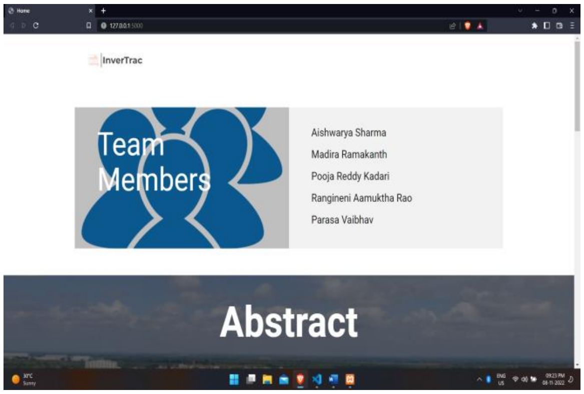

Fig.3: Home screen

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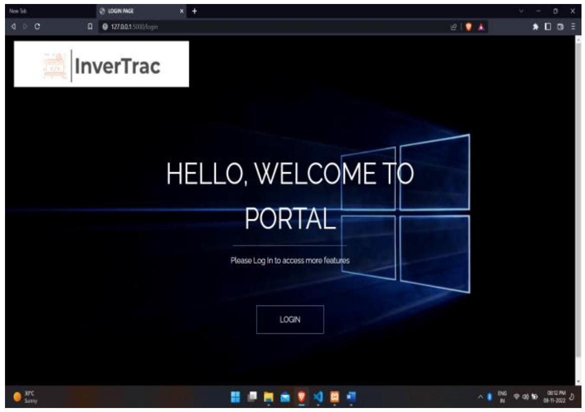

Fig.4: Login page

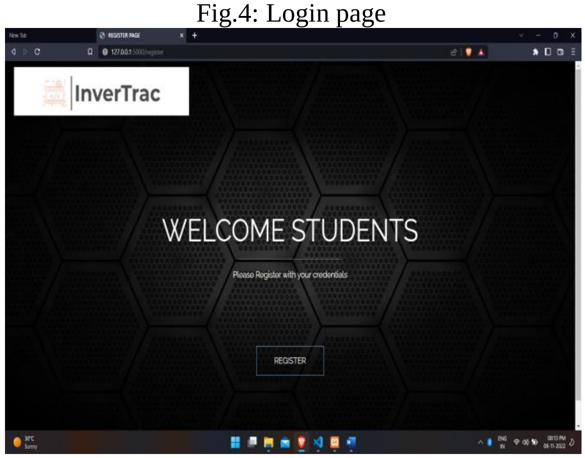

Fig.5: registration page

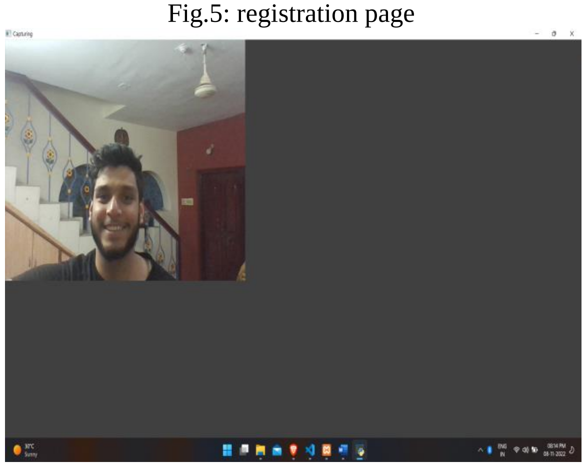
Fig.6: Registration applet

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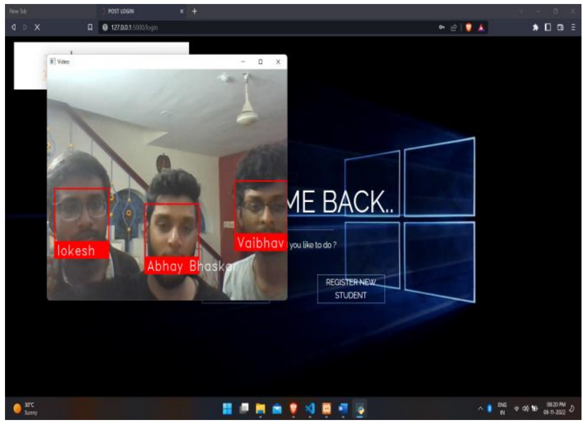

Fig.7: Attendance applet

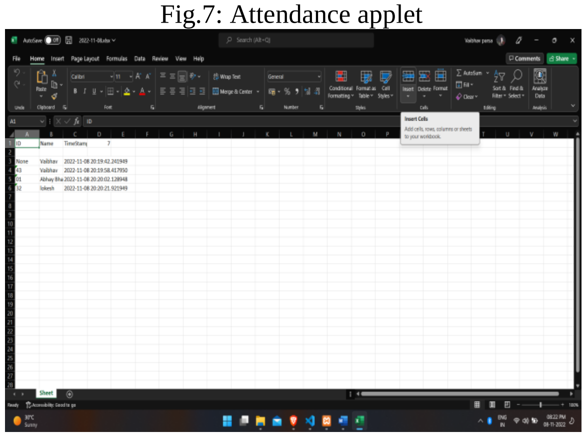

Fig.8: Excel output

6. CONCLUSION

In this study, we successfully developed a new algorithm that can recognise the pupil of the eye from any sort of eye image or video. The algorithm's effectiveness results from converting colour photos to grayscale, which enables us to quickly find the brightest point in the eye, which is where the eye is focusing. Later, this is transformed into a message, an image output, or occasionally even a video output. The outputs of the image and video allow us to manually test the algorithm's effectiveness. the device can communicate with the algorithm's message to reveal what the eyes are looking at and produce result according to the message.

7. FUTURE SCOPE

In order to develop a lighter and more efficient algorithm, we are attempting to boost the algorithm's efficiency, speed, and weight in the future. Additionally, we are working to develop effective means of inter-device connection so that we may traverse any computational device with ease and with less hardware than it is designed to have. This would reduce the need to carry around various gadgets in order to access a computational device and make using it easier.

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