Eye Scrutiny Detection and Tracking System

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***Abstract* - This paper describes a real-time contact-free eye-gaze tracking system that bases its accuracy in a very precise estimation of the pupil centre. The eye camera follows the head movements maintaining the pupil centred in the 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. Four infrared light sources, synchronised with the shutter of the eye camera, are used to produce corneal glints. Its special shape has been exploited to allow the optimisation of the image processing algorithms developed for this system. Special care has been taken in limiting the illumination power and working way below the dangerous levels. After a calibration procedure, the line of gaze is determined by using the pupil-glint vector. The glints are validated using the iris outline with the purpose of avoiding the glint distortion due to the changes in the curvature on the ocular globe. The proposed algorithms determine the pupil centre with sub-pixel resolution, minimising the measurement error in the pupil- glint vector. A distinct form this has been broken for permitting the optimization of processing the image procedures which were established for this product. Subsequently a standardization formula, a link of stare is resolute through making the use of the user flash vector. The vertical and horizontal points of the eyes have been authenticated by making use of iris summary which has the need of eliminating the glint falsification owed the differences in warp on ocular sphere. These suggested processes define user center having fill in-pixel firmness, reducing a quantity mistake in user flash vector. There three main phases which have a significant role in this project. They are mouth recognition, eye blink detection and face movement detection which play important role in moving the mouse cursor.**

***Index Terms* - Pattern recognition, image processing, eye-tracking, gaze-tracking.**

I.INTRODUCTION

Advances in 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- oculography using pairs of electrodes placed around the eyes or the sclera 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 [1]. Research on head-mounted eye trackers advanced in the 1960s and gaze tracking developed further in the 1970s with 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 limited availability of computers, eye tracking was mainly limited to psychological and cognitive studies and medical research. The application focus towards general purpose human computer interaction was 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, virtual reality and web-advertisements. Eye gaze information is used in a variety of user platforms. The main use cases may be broadly classified into (i) desktop computers (ii) TV panels (iii) head mounted (iv) automotive setups (v) handheld devices. 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 exa tracking setups usually comprise of 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, oculomotor measurements virtual and augmented reality applications. Real time gaze and eye state tracking on automotive platforms 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 smart phones or tablets, the front camera is used to track user gaze to activate functions such as locking/unlocking phones, interactive displays, dimming backlights or suspending sensors. Within each of these use cases there exists a wide range of system configurations, operating conditions and varying quality of imaging and optical components. 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 a still a difficult task. In order 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. The aim of this work is to gain a realistic overview of the diversity currently existing in this field and to identify the factors that affect the practical usability of gaze tracking systems. Further, this review highlights the need for developing standardized measurement protocols to enable evaluation and comparison of the performance and operational characteristics of different gaze tracking systems. In this paper, first the diversity and standardization issues in different aspects of eye gaze research are discussed and then the idea of a performance evaluation framework is proposed. This framework includes several planned and ongoing experiments that are aimed at practical evaluation of any gaze tracker. Our goal is to encourage further discussion and additional contributions from researchers in this field.

II.RELATED WORK

Several types of eye movements are studied in eye gaze research and applications to collect information about user intent, cognitive processes, behavior and attention analysis. These are broadly classified as follows:

1. Fixations: These are phases when the eyes are stationary between movements and visual input occurs. Fixation related measurement variables include total fixation duration, mean fixation duration, fixation spatial density, number of areas fixated, fixation sequences and fixation rate.
2. Saccades: These are rapid and involuntary eye movements that occur between fixations. Measurable saccade related parameters include saccade number, amplitude and fixation-saccade ratio
3. Scanpath: This includes a series of short fixations and saccades alternating before the eyes reach a target location on the screen. Movement measures derived from scanpath include scanpath direction, duration, length and area covered
4. Gaze duration: It refers to the sum of all fixations made in an area of interest before the eyes leave that area and also the proportion of time spent in each area.
5. Pupil size and blink: Pupil size and blink rate are measures used to study cognitive workload.

Table I presents the characteristics of different eye movements and their applications. B. Basic setup and method used for eye gaze estimation Video based eye gaze tracking systems comprise fundamentally of one or more digital cameras, near infra-red (NIR) LEDs and a computer with screen displaying a user interface where the user gaze is tracked. A typical eye gaze tracking setup is shown in Fig. 1. The steps commonly involved in passive video based eye tracking include user calibration, capturing video frames of the face and eye regions of user, eye detection and mapping with gaze coordinates on screen. The common methodology (called Pupil Center Corneal Reflection or PCCR method) involves using NIR LEDs to produce glints on the eye cornea surface and then capturing images/videos of the eye region.

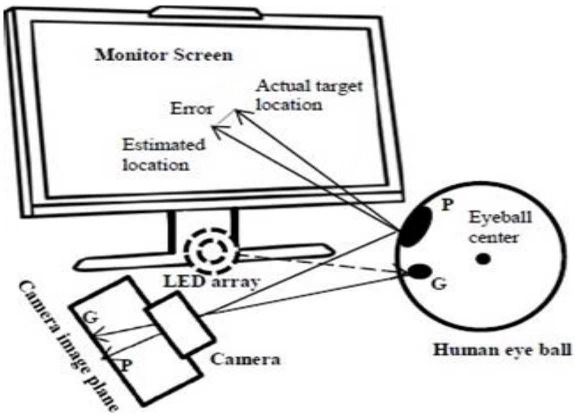

Fig1 Architecture

Gaze is estimated from the relative movement between the pupil center and glint positions. External NIR illumination with single/multiple LEDs (wavelengths typically in the range 850+/- 30 nm with some works such as [33] using 940 nm) is often used to achieve better contrast and avoid effects due to variations induced by natural light. Webcams are mostly used; those operate at 30/60 fps frame rate and have infrared (IR) transmission filters to block out the visible light. The user- interface for gaze tracking can be active or passive, single or multimodal. In an active user interface, the user's gaze can be tracked to activate a function and gaze information can be used as an input modality. A passive interface is a non-command interface where eye gaze data is collected to understand user interest or attention. Single modal gaze tracking interfaces use gaze as the only input variable whereas a multimodal interface combines gaze input along with mouse, keyboard, touch, or blink inputs for command.

III.PROPOSED SYSTEM

Building an eye stare chase software which cannot be interferer and supports pictures that are taken through standard high-quality cameras and presenting arts period chase and study is the chief object of this research. The method of analyzing a photo that provides attention and describes the stare movements through computation of the path outlined by apprentice center or collection of horizontal and vertical points that are generated from eye. Victimization movement of eyes will management movement of pointer and perform right and left clicks besides mouse scrolling.

Today line of gaze determination has become important source of many studies, through apps from many kinds' areas including,

- Doctors study on determination of oculography.
- Depiction of car driver's character.
- It is also used for building computer gadgets for the people who are physically disabled

V.RESULTS ANALYSIS

A typical eye tracking setup comprises of the user, gaze tracker and the tracking environment and each of these components may influence the overall eye tracking performance. A schematic diagram of such a setup and these factors are listed in below figures. The proposed experimental framework aims to test impacts of these factors on a tracker's accuracy. A typical "experiment" consists of the following steps: a user is asked to sit in front of the eye tracker and their eyes are

Fig 2 Main Index Page

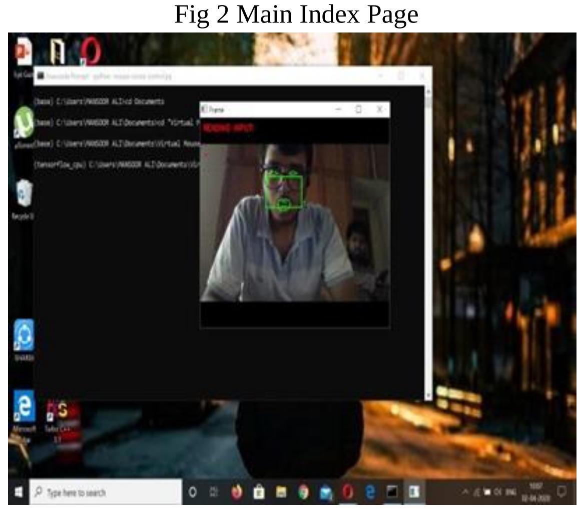

Fig 3 Moving cursor to left direction

calibrated for a session. The user is presented with a graphical user interface when the tracker records their gaze coordinates as the user gazes at several points on the screen. The gaze error in degrees is calculated from the shift between ground truth and tracked gaze locations. Some evaluation experiments done and planned with commercial eye trackers are presented here. Preliminary results can be found.

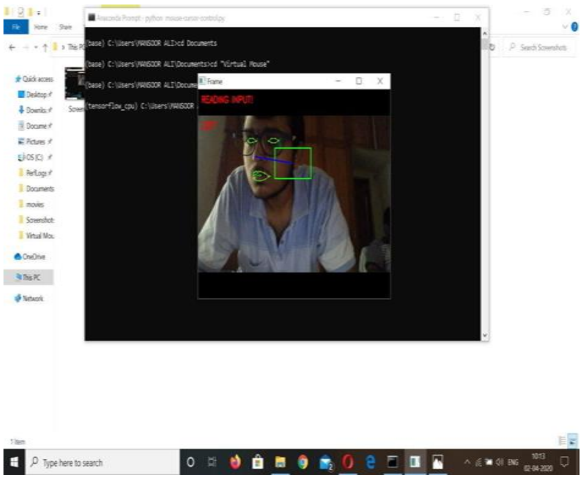

Fig 4 Moving cursor to right direction

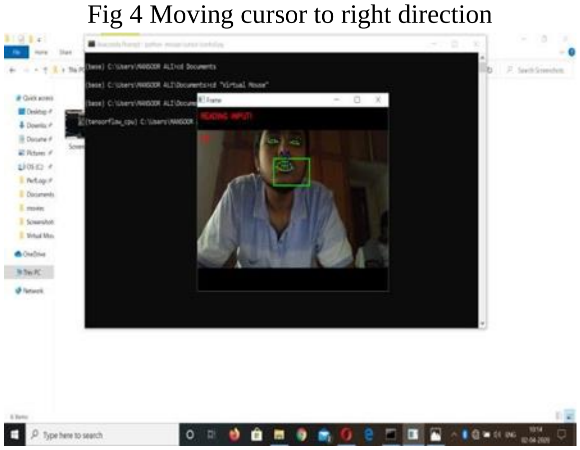

Fig 5 Moving cursor to upward direction

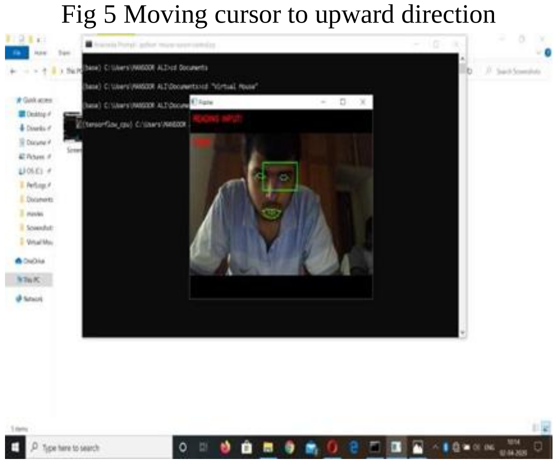

Fig 6 Moving cursor to downward direction

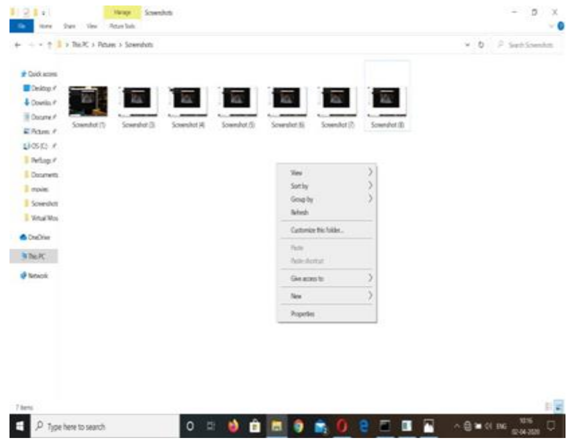

Fig 7 Mouse right click

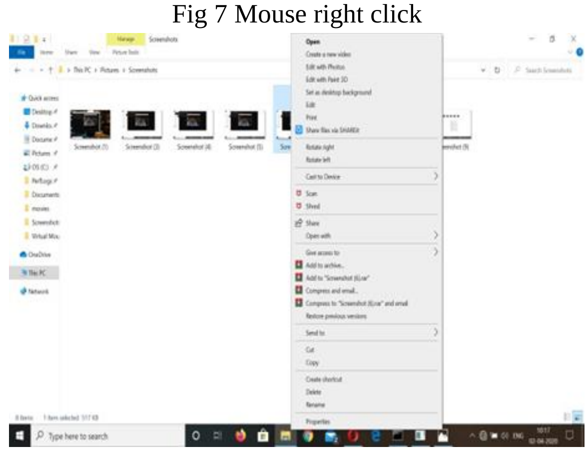

Fig 8 Folder Selection

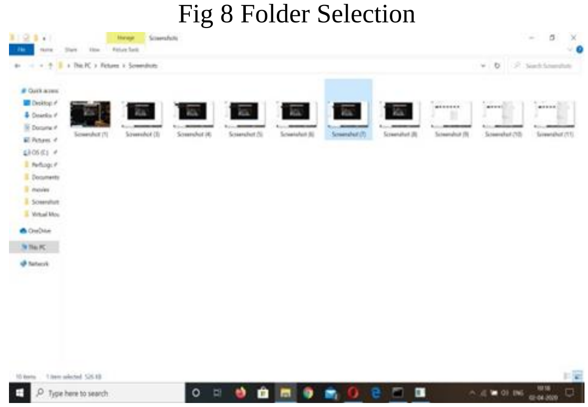

Fig 9 File Selection

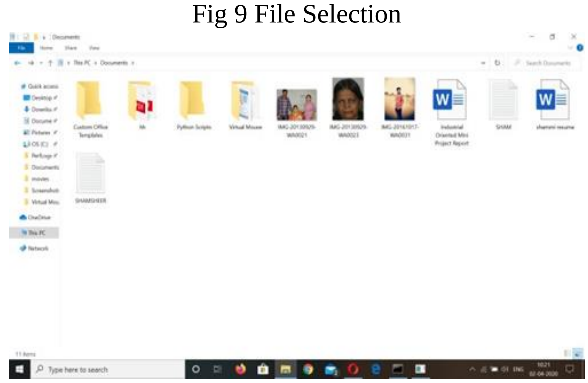

Fig 10 Going back to previous page

We perform the test operation to find the bugs and errors in a software. Testing is a process of finding all type of errors, weakness or faults in a product that going to be launched in the market. It is use to check the working of the product practically, and weather it is matching the user requirements or not and also to check whether it is working properly or not. Testing also help in finding whether the software is applicable to all kinds of people or it is unsafe for certain ages. Testing help you know that is the software can be accepted by the user or not. There are many testing methods and every test has its own priorities and demands.

VI.CONCLUSION

Eye gaze estimation is an interdisciplinary area of research and development which 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 hardware resources and increasing demands for human computer interaction methods. In this paper, 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. Currently gaze based HCI systems are capable of achieving high speed input and control operations, leading to their implementation in a variety of user platforms and applications, which were discussed in Section IV. Typically, gaze tracking systems at present are capable of determining 3D point of gaze in real time with unconstrained head movement and achieve around 0.5 degrees of angular resolution. However, limitations arising due to gaze tracking camera quality, random illumination changes, user wearing glasses and platform vibrations are not well characterized in contemporary eye gaze research. The literature review also raises a major question with respect to the consistency and accuracy that can be obtained from the gaze estimation systems when they operate under real world conditions, if they are not properly evaluated. A variety of factors may affect eye gaze tracking in different platforms, making their performance unpredictable and ultimately questioning their usability in present and future applications. Effects of head movement, user distance and viewing angle, display properties of the setup are still poorly studied, as discussed in Section V. In their presence, practical system performance may differ significantly from expected values and eye gaze may lose its applicability in different consumer use cases. Further, there is a clear lack of homogeneity in gaze performance metrics as pointed out in the tables of Section V. Some performance measures used, for example: detection rate or accuracy percentage is difficult to interpret physically and the variety in reporting formats makes inter-comparisons between different systems and algorithms impossible. Keeping these in mind, the concept of a performance evaluation framework is proposed that will provide practical performance estimates of gaze tracking systems and adopt a uniform set of accuracy metrics for specifying performance. This is an on-going research activity and the details of the evaluation methods to be included in this framework are currently under development for different gaze estimation platforms and will be included in a subsequent paper.

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