Eye Tracking System for Disabled People

HATIM MADKHALI

Except where reference is made to the work of others, the work described here in this thesis is my own or was done in collaboration with my advisory committee.

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VITA

Hatim Madkhali, son of Fatmah Zaid and Mohammed Madkhali, was born on April 27, 1988 in Samtah, Jazan, Saudi Arabia. He joined Jazan University college of Computer Science and Information System in 2007. During the summer of 2009 and 2011 he held an internship at the Saudi Electricity Company. He Graduated from Jazan University with a Bachelor's degree in Computer Science and Information Systems in 2012. He then worked at Jazan University for approximately a year and half as a teachers' assistant. He joined the graduate program in Computer Science at Kentucky State University in January 2016. While pursing his master's degree, he held an internship at the IT department of Kentucky State University, working on the area of project management.

THESIS ABSTRACT

Eye Tracking System for Disabled People

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The power of the eye and the power of technology can make a huge difference for so many people. The rapid development of technology in our modern world makes it important for us to keep up with the fast progress of it. Nowadays, with the power of the eye and the power of technology, we have what is known as "Eye Tracking Technology." This technology allows us to literally see through others' eyes and this is my aim in this paper. Seeing three of my family members suffer from disability until death without being able to say a word made me think of using this technology to help disabled people express their feelings. This paper demonstrates how the eye-tracking technology helps disabled people to express their feelings using only their eye. Furthermore, this paper will also explain a software that I have developed to help disabled people express their feelings with the help of the Tobii EyeX tracker.

Keywords: Eye Tracking, Eye Gaze, Eye Movement, Human-Computer-Interaction, Eye Tracking Technology.

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Hatim Madkhali

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Introduction

Overview

The eye has a considerable measure of informative power. Eye contact and gaze heading are focal and essential prompts in human communication, for instance, in directing communication and turn-taking, building up the socio-enthusiastic association, or showing the objective of our visual intrigue \cite{kleinke1986gaze}. The eye has additionally been said to be a mirror to the spirit or window into the mind \cite{brigham2001eyes} \cite{ellis1998windows}. Gaze conduct reflects psychological procedures and can give indications of our reasoning and aims. We regularly take a gander at things before following up on them \cite{land1997knowledge}. Eye tracking alludes to the way toward tracking eye movements or the supreme point of gaze (POG) -- alluding to the point the client's gaze is engaged at in the visual scene. Eye tracking is valuable in a wide scope of use ranges, from mental research and medicinal analytic to ease of use studies and intuitive, gaze-controlled applications. At first, eye developments were principally considered by physiological reflection also, perception. Essential eye developments were sorted and their span evaluated much sooner than the eye-tracking technology empowered exact estimation of eye developments. The original of eye tracking gadgets was profoundly obtrusive also, uncomfortable. A leap forward in eye tracking technology was the improvement of the

primary "non-intrusive" eye tracking device in the mid-1900s \cite{wade2005moving}, in view of photography and light reflected from the cornea. It can be considered as the main progenitor of the current generally utilized video-based, corneal reflection eye tracking frameworks. The advancement of unpretentious camera-based frameworks \cite{morimoto2005eye} and the expansion of figuring force empowered assembling of eye tracking information continuously, empowering the utilization of gaze as a control strategy for individuals with disabilities \cite{ten1980eye} \cite{friedman1987eye}

I intend to use C++ with Visual Studio 2017 to create a software/ eye-tracking system for the disabled people. This software aims to make disabled people capable of using computers just like anyone else. The main goal of this software is to give these people the ability to express their feelings and communicate with others using only the naked eyes to control computers. I decided to use C++ because it is one of the most advanced languages in scientific computing thus suitable for the coding of such software.

In this paper, I trace the function of eye, pre-existing eye tracking systems, tracking systems for disabled people and how they work.

Eye Physiology and Types of Eye Movement

To see a question in this present reality, we need to fixate our gaze at it sufficiently long for the cerebrum's visual framework to see it. Obsessions are regularly characterized as delays of at

minimum 100 ms, normally in the vicinity of 200 and 600 ms. Amid any one obsession, we only see a genuinely limit range of the visual scene with high sharpness. To see the visual scene precisely, we have to always filter it with fast eye movement, purported saccades. Saccades are fast, ballistic bounced of 2 or longer that take about 30–120 ms each (Jacob 1995). Notwithstanding saccadic movements, the eyes can easily take after a moving focus on; this is known as (smooth) interest movement. The measure of the high-sharpness field of vision, the fovea, subtends at an edge of around one degree from the eye. The width of this district compares to a zone of around two degrees, which is about the measure of a thumbnail when seen with the arm broadened (Duchowski and Vertegaal 2000). Everything inside the fovea can be seen with high keenness yet the sharpness diminishes quickly towards the outskirts of the eye. The reason for this can be seen by looking at the physiology of the retina (see Fig.1). The focal point centers the light originating from the student on the focal point of the retina. The fovea is pressed with photoreceptive cells however the thickness of these cells diminishes quickly in the fringe zone. The fovea predominantly contains cones, photoreceptive cells that are touchy to shading and give keenness. In differentiate, the fringe territory contains for the most part poles, i.e. cells that are touchy to light, shade and movement. The staying fringe vision gives signals about where to look next and furthermore gives data on movement or changes in the scene before the watcher. For instance, a sudden movement in the outskirts can consequently rapidly draw in the watcher's consideration (Hillstrom and Yantis 1994). We just observe a little part of the visual scene before us with high sharpness at any point in time. The need to move our eyes toward the objective is the reason for eye tracking: it is conceivable to deduct the gaze vector by watching the "observable pathway".

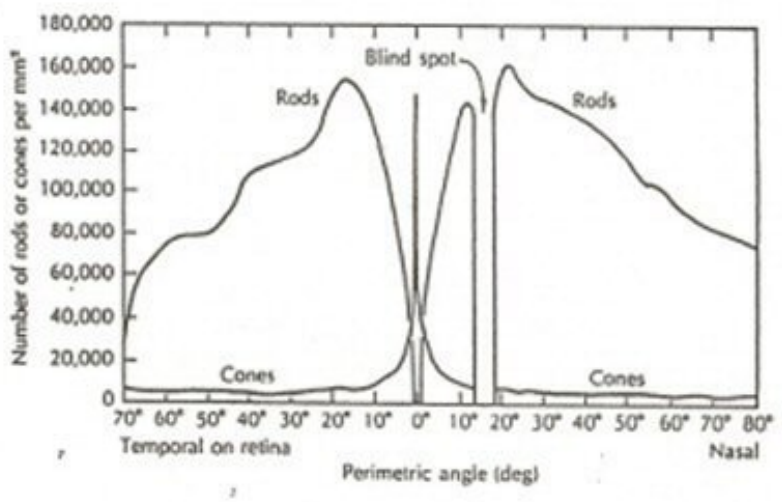


Fig 1: Distribution of rods and cones on the retina

Eye Tracking Techniques

While an extensive number of various methods to track eye movements have been examined previously, three eye tracking procedures have developed as the overwhelming ones and are broadly utilized as a part of research and business applications today.

These strategies are

(1) Video OculoGraphy (VOG), video based tracking utilizing head-mounted or remote noticeable light camcorders.

(2) video-based infrared (IR) pupil corneal reflection (PCR).

(3) Electrooculography (EOG).

While especially the initial two video-based strategies have a great deal of properties in like manner, all strategies have application territories where they are generally helpful. Video-based eye tracking depends with respect to off-the-rack segments and camcorders what's more, can

along these lines be utilized for creating "eye-aware" or attentive user interface that don't entirely require precise purpose of gaze tracking (e.g. about 4, Hansen and Pece 2005). Interestingly, because of the extra data picked up from the IR-induced corneal reflection, IR-PCR gives exceedingly precise purpose of gaze estimations of up to 0.5 of visual point and has hence risen as the favored system for logical areas, for example, ease of use studies or gaze-based cooperation, and business applications, for example, in showcasing research. At last, EOG has been utilized for a considerable length of time for ophthalmological contemplates as it takes into consideration measuring relative movements of the eyes with high transient precision.

Video-Based Tracking

A video-based eye tracking framework can be either utilized as a part of a remote or head-mounted setup. A run of the mill setup comprises of a camcorder that records the movements of the eye(s) and a PC that recoveries and investigations the gaze information. In remote frameworks, the camera is regularly based underneath the PC screen while in head-mounted frameworks, the camera is joined either on a casing of eyeglasses or in a different "protective cap". Head-mounted frameworks regularly additionally incorporate a scene camera for recording the client's perspective, which can then be utilized to delineate client's gaze to the current visual scene. The edge rate and determination of the camcorder significantly affect the exactness of tracking; an ease web camera can't rival a top of the line camera with high-determination and high example rate. The central length of the focal point, the point, and in addition the separation between the eye and the camera affect the working separation and the nature of gaze tracking. With vast zooming (huge central length), it is conceivable to get a nearby up perspective of the

eye however it limits the working edge of the camera and requires the client to sit genuinely still (unless the camera takes after the client's movements). In head-mounted frameworks, the camera is placed close to the eye, which implies a greater picture of the eye and consequently more pixels for tracking the eye. On the off chance that a wide point camera is utilized, it permits more opportunity of movement of the client additionally requires a high-determination camera to keep up enough exactness for tracking the understudy (Hansen et al 2012). Since tracking depends on video pictures of the eye, it requires an unhampered perspective of the eye. There are various issues that can influence the nature of tracking, for example, shifting light conditions, impressions of eyeglasses, sagging eyelids, squinting the eyes while grinning, or even substantial cosmetics (Goldberg et al 2003). The video pictures are the reason for assessing the gaze position on the PC screen: the area of the eye(s) and the focal point of the student are identified. Changes in their position are followed, broke down and mapped to gaze facilitates. In the event that lone the understudy focus is utilized and no other reference focuses are accessible, the client must remain completely still for a precise figuring of the gaze vector (the observable pathway from the client's eye to the perspective on the screen). Compelling the client to sit still might be awkward, in this manner different strategies for tracking and repaying the head movement have been actualized (e.g. Sugioka et al. 1996; Murphy-Chutorian et al 2009; Zhu et al 2005). Head tracking strategies are likewise required for head-mounted frameworks, in the event that one wishes to figure the purpose of gaze in connection to the client's eye and the environment (Rothkopf et al 2004).

Infrared Pupil-Corneal Reflection Tracking

Frameworks just in view of obvious light and understudy focus tracking have a tendency to be erroneous what's more, touchy to head movement. To address this issue, a reference point, a so called "corneal reflection" or flicker, can be included. Such a reference point can be included by utilizing anartificial infrared (IR) light source pointed on-or off-hub at the eye. An on-hub light source will bring about a "brilliant understudy" impact, making it simpler for the examination programming to perceive the student in the picture. The impact is comparable to the red-eye impact brought about by glimmer in a photo. The off-hub light outcomes in "dull student" pictures. Both will help in keeping the eye range sufficiently bright however they don't irritate review or influence student widening since IR light is undetectable to the human eye (Duchowski 2003). By measuring the corneal reflection(s) from the IR source in respect to the inside of the student, the framework can make up for mistakes and furthermore consider a restricted level of head movement. Gaze heading is then figured by measuring the changing relationship between the moving student focus of the eye and the corneal reflection. As the position of the corneal reflection remains generally consistent amid eye movement, the reflection will stay static amid pivot of the eye and alters in gaze course, hence giving an essential eye and head position reference (Duchowski and Vertegaal 2000).

Electrooculography-Based Tracking

The human eye can be demonstrated as a dipole with its positive post at the cornea and its negative shaft at the retina. Accepting a steady cornea-retinal potential distinction, the eye is the inception of a relentless electric potential field. The electrical flag that can be measured from this field is known as the electrooculogram (EOG). The flag is measured between two sets of surface

cathodes set in periorbital positions around the eye as for a reference anode (ordinarily set on the brow). In the event that the eyes move from the inside position towards one of these cathodes, the retina approaches this anode, while the cornea approaches the restricting one. This adjustment in dipole introduction causes a change in the electric potential field, which thus can be measured to track eye movements. As opposed to video-based eye tracking, recorded eye movements are normally split into one flat and one vertical EOG flag part. This part mirrors the discretization given by the terminal setup (Hori et al. 2006; Borghetti et al. 2007).

Electrooculography Applications

Eye movement qualities, for example, saccades, obsessions, what's more, squints, and additionally ponder movement designs distinguished in EOG signals (Q. Ding et al 2005), have as of now been utilized for sans hands operation of static human-PC and human-robot interfaces (Y. Chen 2004). EOG-based interfaces have likewise been created for assistive robots (W. S. Wijesoma et al 2005) or as a control for an electric wheelchair (R. Barea et al 2002). Such frameworks are expected to be utilized by physically impaired individuals who have greatly restricted fringe portability yet at the same time hold eye-engine coordination. These reviews appeared that EOG is an estimation method that is cheap simple to utilize, solid, and generally subtle when contrasted with head-worn cameras utilized as a part of video-based eye trackers. While these applications all utilized EOG as a coordinate control interface, our approach is to utilize EOG as a wellspring of data on a man's movement.

Eye Movement Analysis

A developing number of specialists utilize video-based eye tracking to study eye movements in indigenous habitats. This has prompted to vital advances on our comprehension of how the cerebrum forms undertakings (M. M. Hayhoe et al 2005). Eye movement examination has a

long history as a device to explore visual conduct. In an early review, Hacisalihzade et al. utilized Markov procedures to show visual obsessions of spectators perceiving a question (S. S. Hacisalihzade et al 1992). They changed obsession groupings into character strings and utilized the string alter separation to measure the likeness of eye movements. Elhelw et al. utilized discrete time Markov chains on arrangements of transient obsessions to recognize notable picture includes that influence the impression of visual authenticity (M. Elhelw et al 2008). They found that obsession bunches were capable to reveal the components that most draw in an onlooker's consideration. Dempere-Marco et al. displayed a strategy for preparing beginners in surveying tomography pictures (L. Dempere-Marco et al 2002). They displayed the appraisal conduct of area specialists in view of the flow of their saccadic eye movements. Salvucci et al. assessed implies for robotized investigation of eye movements (D. D. Salvucci et al 2001) . They portrayed three techniques in light of succession coordinating and covered up Markov models that translated eye movements as precisely as human specialists yet in altogether less time. These reviews meant to show visual conduct amid particular errands utilizing a little number of well-known eye movement qualities. They investigated the interface between the assignment and eye movements, yet did not perceive the undertaking or movement utilizing this data.

Eye Tracking mouse for human computer interaction

Human face is a dynamic question; it has a high level of changeability and different procedures have been proposed beforehand. This technology is planned to be utilized by physically crippled/Disabled individuals who are experiencing a considerable measure of issues in speaking with PC. This technology will help debilitated individuals to impart through their intentional movements like eyes what's more, nose movements (Paul Viola et al 2004)

A. Face Detection

In the current couple year extensive measure of research being completed in the field of face detection. Face detection is an inconceivable research in the PC world. Face detection techniques are grouped into two classifications: Feature-based Approach and Image-based Approach.

1. Feature based Approach

In Feature-based Approach we locate the facial components (e.g. Nose, eyes etc.) And confirm their execution by analyzing areas and separation from each other. Feature based Approach can accomplish rapid in confront discovery. Essentially it is known for is pixel precision and speed.

2. Image based Approach

This approach filters the picture of enthusiasm with a window that searches for appearances at all the scales and areas. By Hjelman‟s study the window checking calculation is generally just on thorough hunt of the info pictures for conceivable face areas at all scales

B. SSR FILTER

Toward the starting, a rectangle is filtered all through the information picture. This rectangle is partitioned into six fragments as appeared in fig 2.

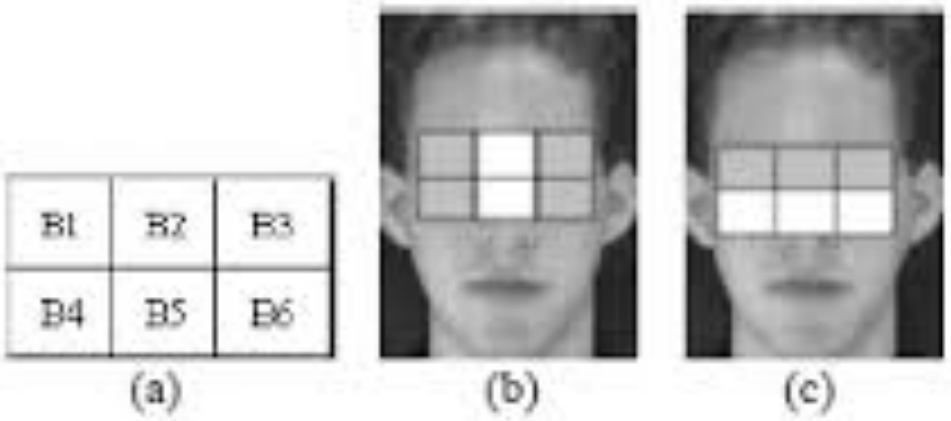


Figure 2: SSR Filter

The proposed SSR channel is utilized to distinguish the Between-the– eyes [BTE] in light of two qualities of confront geometry.

i. The nose region is brighter than the privilege and left eye region.

ii. The eye region (eyes and eyebrows) is moderately darker than the cheekbone territory. At the point when these i and ii attributes are fulfilled, the focal point of the rectangle can be a possibility for Between-the-eye

C. Necessary Image

The SSR channel is figured by utilizing middle of the road representation for picture called as "essential picture".

D. Bolster Vector Machine

SVM is a most extreme edge classifier: In "learning theory‟ there is a hypothesis expressing that keeping in mind the end goal to accomplish insignificant characterization blunder the hyper plane which isolates positive examples from negative ones ought to be with the most extreme edge of the preparation test and this is the thing that the SVM is about. The Samples of information that are nearest to the hyper plane are called bolster vector (Peter Tiňo 2003) The hyper plane is characterized by adjusting its separation amongst positive and negative bolster vectors keeping in mind the end goal to get the most extreme edge of the preparation informational collection.

Eye Movement Differences in Experts and Non Experts

In different spaces, for example, radiology, contrasts in inquiry techniques amongst amateurs and specialists have been discovered [Nodine et al 2000]. Nodine and Mello-Thomsrefered to a review that appeared an opportunity to hit an objective (i.e. a sore) was shorter for experienced mammographers than eyewitnesses with less understanding and preparing. In another refered to contemplate, experienced radiologists tended to utilize a circumferential examine design and abstained from checking the edges of the lung tissues, however less experienced onlookers were pulled in to the edges of the lungs. A conceivable reason for this conduct is the master information that sores are less inclined to be found in the edges of the lungs. Another review indicated contrasts in execution furthermore, eye movements amongst master and learner pilots who performed arrivals in a pilot training program [Kasarskis et al. 2001]. Typically, master pilots landed superior to anything learners, however they additionally found that stay times in specialists were shorter than tenderfoots demonstrating that specialists accumulated the required

data faster than beginners. The two gatherings too contrasted in the dispersion of obsession areas. Specialists fixated all the more as often as possible on the velocity pointer, yet less obsessions with the altimeter, amid landing. Then again, learners fixated all the more as often as possible on the altimeter. The specialists' obsession conduct is learned by their insight that the velocity pointer was more enlightening. These outcomes demonstrate that area information and experience influence execution and eye movements on a related errand. Learning what's more, hand-eye co-appointment capacity are both imperative in MIS, and we keep on looking at extra reviews on eye movement contrasts between subjects with various levels of aptitude close by eye co-appointment errands [Vickers 1995]. One case of eye movement contrasts is from Vickers who demonstrated eye gaze design contrasts between master and close master university level b-ball players in a foul shooting assignment. Specialists tended to end their obsessions prior in the shot recommending that the visual framework was utilized to program the engine framework. Tenderfoots, then again, utilized visual contribution to conform their shots until the ball was off the hand. In another game, Vickers likewise thought about eye movements of low and high cripple golf putters (Vickers 1993). Master golfers had a tendency to perform less eye movements between various areas to limit memory rot of separation signals. The eye gaze contrasts amongst low and high talented people propose that another approach to quantify ability could be to utilize eye gaze measures and practices in an eye-hand co-appointment errand. Laparoscopic surgery is a fascinating range of study to utilize eyetrackers as a result of the limitations on the visuomotor framework as portrayed. We estimate that there are eye gaze contrasts between learners with no related knowledge of laparoscopic strategies and specialists who have involvement with laparoscopic surgery (Vickers 1993).

Eye Gaze

These days, eye-trackers work with a camcorder in blend with an infrared Driven. The light from the LED makes a reflection on the client's eyeball. As the eyeball is an almost culminate circle, the reflection remains stable on a similar position, autonomous of the heading of the gaze. Picture acknowledgment identifies the focal point of the student a great many adjustment (i.e. taking a gander at the sides of the screen), the heading of the gaze can be figured utilizing the vector from the reflection indicate the focal point of the understudy. As the recognition of a dark understudy inside a cocoa iris is troublesome due to low difference, many eye-trackers utilize the white-student strategy: If infrared light enlightens the eye, the eye foundation (retina) mirrors the light and causes a white understudy to show up for the infrared camera gadget. To permit free head movement before the show, without utilization of a button rest, the eye-tracker can be consolidated with a head-tracker. Head-trackers are likewise video-based. Business frameworks consolidating both advances, for example, the Eye Tracker 1 and the Eye tracker 2 are still costly today, however work very well. One inborn issue of eye tracking is exactness. The eye always performs smaller scale saccades which brings about uproarious position information. Another impact emerges from the truth that the retina just has a little zone of high determination (fovea), which is around 1 level of visual edge. To see something obviously, the eye needs to move to bring the question of enthusiasm into this high-determination range, however not really into the inside. By and large desktop shows, the exactness is around 30 pixels, which is about the size of standard symbols and catches, however double the height of a line of content (Duchowski et al 2003).

Domains of gaze-improved application

Exploitation of offline analysis

In spite of the fact that our concentration is in intelligent applications, there are fascinating methods for utilizing eye gaze that depend on changing a picture disconnected, in light of information gathered while the picture was seen by a client or gatherings of clients. Such applications are identified with gaze-unforeseen showcases, which adjust the view progressively.

David Wooding recorded the gaze conduct of guests at the Telling Time display at the National Gallery in London while they were survey work of art. In light of the total obsession information of the purposes of interests, heat maps were made to highlight the regions that were of generally intrigue. This created a convincing representation of what gets the attention in those bits of workmanship. With more than 5000 members, it is likewise the biggest eye tracking study ever completed. Another disconnected application is to utilize eye gaze information for masterful rendering of photos (DeCarlo et al 2002; Santella et al 2004). This strategy produces pictures that better highlight the important components of a picture than conventional procedures that lone utilize shading division. A third illustration is the editing of pictures on little shows that don't permit the survey of all important substance without (Fan et al 2003).

Eye location and eye-contact detecting gadgets

The accompanying test frameworks exhibit that even without tracking the client's gaze heading, eyes can upgrade the cooperation considerably. Basically identifying the nearness of eyes or perceiving eye contact with an objective (with a gadget or with someone else) gives us an assortment of potential outcomes to set up the craved association.

Eye-R

Selker, Lockerd and Martinez presented Eye-R, a glasses-mounted, remote gadget, which can recognize the client's eye movement, and store and exchange the data utilizing outer IR gadgets. Eye-R comprises of an infrared emitter and a finder that is situated between the focal point and the eye. On a fundamental level, the emitter/finder unit can be mounted on any generally utilized match of eye glasses. Along these lines, even without a camera, Eye-R glasses can perceive the unpleasant eye conduct of a client: regardless of whether the eye is open or shut, squinting, winking, gazing, or looking around. On the premise of the perceived conduct the glasses can set up correspondence with an objective in the environment. The objective might be another match of Eye-R glasses, or a base station associated with a PC which assembles the data put away in Eye-R. The glasses were effectively utilized, for instance, to send business cards when a man (utilizing the glasses) gazes at someone else, and to raise data on a show when a man takes a gander at it (Selker et al., 2001; Selker 2004).

Eye-Bed

An arrangement of straightforward characteristic eye conduct signals was likewise used to help in Eye-Bed for controlling the mixed media scene anticipated on the roof over a bed. An eye tracker was set in a "light arm" over the leader of the individual in the bed. Cursor control was gone for with diverse directing gadgets; accordingly, the eye tracker was not utilized toward control choice of items on the anticipated picture. Rather, the regular conduct of eyes, for example, shutting and opening the eyes, looking (around), gazing at one place, furthermore, anxious squinting were utilized to adjust the displayed pictures to the watched condition of the client's consideration. Eye-R connected educating the encompassing items that the client is focusing on them. Nonetheless, without access to the data of the course of gaze it was hard to

decide the right target protest from a few hopefuls. Besides, measuring the gaze bearing of a moving subject is confounded. A fractional arrangement to these issues, created in the Human Media Lab in Queen's University, is presented beneath. EyeContact sensor was produced for distinguishing, not the correct bearing of gaze, but rather harsh eye contact with a protest (Selker et al 2002; Lieberman et al 2000).

Wearable EyeContact sensor, Attentive Cell Phone

The procedure for identifying the eye contact depends on two primary thoughts. Firstly, it uses the possibility of two arrangements of on and off-hub (adjusted at the same/distinctive hub with the camera) LEDs sending auspicious synchronized infrared light bars into the eye to create both brilliant and dim student impacts. The system encourages a powerful location of eyes from a substantial scale camera see. The specialists in Queen's University consolidated the procedure with the knowledge that the regular tracking of the corneal reflection point can be improved by recognizing just the eye contact with the camera, dismissing alternate places of the eye. That is, at the point when the corneal reflection point is situated close to the understudy focus, the eyes are taking a gander at the camera. In view of these two thoughts, an EyeContact sensor with an installed camera fit for finding the students in its field of view. At the point when set in closeness of the client's eyes, the gadget can recognize if the client is in eye contact with someone else. The idea was used to plan a situation of an Attentive Cell Phone. In the event that the client is occupied with a discussion, this data might be passed to the guest or the telephone can change the ordinary ringing sound of the approaching call to a less interruptive notice mode. The power of going to a discussion can be reasoned from the discourse action by means of amplifiers, however since the discussion is a corresponding activity, hush does not really infer that the client

is not socially dedicated. Subsequently, detecting the continuous eye contact gives profitable extra data of the client's condition of consideration (Morimoto et al 2000).

ECSGlasses, EyeBlog, Attentive Messaging Service

Eye-Contact Sensing Classes (ECSGlasses, Dickie et al., 2004b) are a cutting edge variant of the wearable EyeContact sensor. The camera and the now and again pivot IR LEDs are currently implanted into glasses. The on-hub illuminators creating the splendid student impact are situated around the camera on the scaffold of the nose, and the off-hub illuminators living close to the arms of the glasses create the dim student impact. ECSGlasses recognize when a individual is taking a gander at the wearer of the glasses. ECSGlasses incorporate a camera for recording video from the wearer's point of view. ESCGlasses were abused in the execution of an amended adaptation of the Attentive Cell Phone (Shell et al., 2004), EyeBlog, and AMS. EyeBlog (Dickie et al., 2004a) is an eye-contact mindful video recording and distributing framework that can consequently record eye to eye discussions. AMS (Attentive Messaging Service Shell et al., 2004) can convey the accessibility or nonattendance of the client to the "mates" on the client's amigo list.

EyeContact sensor gadgets, EyePliances, iLights

Much of the time giving voice orders to advanced family unit gadgets would be a characteristic method for cooperating with the encompassing technology. Tending to an objective gadget has been perceived as one of the fundamental correspondence challenges for future human-PC collaboration (Bellotti et al., 2002). It has additionally been demonstrated that the subjects tend to build up a characteristic eye contact with an objective protest of an order (Maglio et al., 2000).

Background

Eye-movement investigation has been utilized as a part of other fields, most prominently perusing and scene discernment, to concentrate subjective preparing (e.g., Rayner 1992; Rayner 1983). Nonetheless, overview configuration examines developed out of the questioner controlled domain, which has been basically centered around respondents' understanding of the talked dialect of surveys. Along these lines, the system by which respondents see data exhibited on paper surveys or over the Web, the eyes and their movements, has not gotten much consideration until as of late. Different explanations behind the absence of eye-movement in the review field are its cost and relative trouble. As others have noted, eye-movement inquire about requires particular information, gear also, aptitude to work the gear. Additionally, the information is tedious and hard to dissect (Ellis et al. 1998; Lohse 1996).

Paper questionnaires typically contain instructions to advance a respondent to a particular question as a result of their response to the current question. However, respondents often do not follow these instructions (e.g., Turner et al. 1992; Featherston et al 1990; Messmer et al 1982). Redline and Dillman (In Press) propose that a number of languages (visual, symbolic, and verbal) combine to affect respondents' perception and comprehension of branching instructions, and consequently, the navigational path of a form. Evidence for this assertion comes from a pilot study with college students in which these languages were altered in two distinct ways and tested against the Census 2000 branching instruction. The new designs were shown to decrease errors of commission (respondents answering questions they were instructed to branch) from 20.3% for the control to 7.4% and 9.0% for the experimental questionnaires. However, errors of omission (respondents not answering questions they were instructed to answer) doubled from 1.6% for the control to 3.7% and 3.3% for the experimental questionnaires.

History

A wide range of techniques have been utilized to track eye movements since the utilization of eye tracking technology first was spearheaded in perusing research over 100-year prior (Rayner et al 1989). Electroculographic methods for instance depended on cathodes mounted on the skin the eye that could measures contrasts in electrical potential keeping in mind the end goal to identify eye movement. Other recorded techniques required the wearing of vast contact focal points that secured the cornea (the unmistakable film covering the edge of focal point, eye movement then were measured by vacillations in an electromagnetic field when the metal loop moved with the eyes. These strategies demonstrated very intrusive, and most present day eye tracking framework now utilize video pictures of the eye to figure out where a man is looking (i.e. there supposed purpose of regard). Many recognizing elements of the eye can be utilized to induce purpose of respect, for example, corneal reflection (known as Purkinje pictures), the iris-sclera limit, and the evident student shape (Duchowski 2003).

Eye Tracking Technology

As technology advances it is essential for individuals to have the capacity to stay aware of the advance or the technology gets to be distinctly outdated. Once the PC turned into a family thing, organizations started examining how to make it more easy to understand. Makers of individual gadgets like PCs, telephones, and tablets all contend to make the most helpful item so they can remain on top of the market. This implies they need to remain one stage in front of new advancements. Once the touch control framework utilized for the iPhone got to be distinctly main stream, it rapidly spread to other gadgets. Voice control is additionally getting to be distinctly prominent in telephones and has as of now been utilized on PCs for handicapped individuals to impart. Organizations are searching for the following best, and most

straightforward technique for control for individual gadgets. Eye control resembles the most encouraging new technology that can in the end be utilized industrially for some individual purposes. Eye control is the technology that permits PCs to know where a client is looking (Tobii in brief). Eye tracking gadgets identify and track the components of the eyes and their movements. Gaze tracking programming then computes the eye gaze from the components in a procedure called gaze estimation (Research). There are four capacities that are critical to most eye tracking gadgets: association, alignment, synchronization, and information gushing (Duchowski). Association sets up a connection with the eye tracker gadget, then alignment figures out where the client's eyes are found and syncs the PC's show with eye movement by showing alignment focuses. A case of alignment would be a speck moving around the screen and the client's eye tailing it to tell the gadget how the particular eye moves. Synchronization advises the utilization of the eye tracker gadget's state, which is fundamental for the last capacity, information gushing, which permits the client to perceive what is occurring continuously. Eye tracking is a helpful gadget for some regions of study. "We may assume that on the off chance that we can track somebody's eye movements, we can take after along the way of consideration sent by the eyewitness" (Duchowski) which will give understanding into what the client was attracted to and how the client saw and deciphered whatever he or she saw. This sort of information can be valuable for web fashioners or publicists since they can put content or illustrations in specific spots of the site page where the PC screen would be well on the way to be seen. Not exclusively eyes tracking help in research, however it likewise makes it workable for handicapped individuals to impart on the off chance that they can't talk then again utilize an ordinary console. Eye tracking writing interfaces use on-screen consoles that track the onlooker's gaze to decide the letter they are concentrating on (Research). Criticism can be given to the client

through highlighting the letter or giving a sound reaction. A few interfaces utilize prescient content to offer likely word proposals that the client can pick.

Swedish firm, Tobii, is the world pioneer in eye tracking technology. Established in 2001 and as of now utilizing 300 individuals in six unique nations, Tobii endeavors to give their technology to numerous ventures including doctor's facilities, gaming, PC producing, diagnostics, and vehicle security (Tobii in brief). In his book Eye Tracking Methodology: Theory and Practice, Andrew Duchowski clarifies that while Tobii's table mounted eye trackers look like a basic level board show, a camera and infra-red LED optics are really implanted underneath the LCD screen. The camera and infra-red light are the equipment apparatuses required for the eye tracking gadget to "peruse" the client's eyes. Tobii normally requires two PCs that can share a console, show, and mouse through a switch and are associated with a 1 gigabyte Ethernet neighborhood (LAN). Tobii itself is viewed as the server and the intuitive application is viewed as the customer (Duchowski). The application controls the methods of eye tracking: sit without moving, aligning, and running. This simple exchange of control considers unproblematic advances and improvement of the program. In 2011, Tobii collaborated with Lenovo, a Chinese technology organization that creates note pad and desktop PCs. Together they made twenty Windows 7 model portable workstations with an inherent eye tracking gadget (Ziegler). This venture additionally propelled Tobii's technology by endeavoring to make it more attractive and business. Many individuals could try out the eye control programming and discovered it worked "phenomenally well" (Ziegler). Clients took part in a diversion in which the player could explode space rocks just by taking a gander at them. An advantageous element of the portable PC is the presence of a side menu bar at whatever point the client looks past the left of the PC screen. A member expressed, "It additionally worked extremely well and never came up when we didn't

need it to" (Ziegler). In March 2012, Tobii declared their new form of the eye control technology called the IS-2 Eye Tracker, which they publicize as "the littlest and generally dependable eye-tracking framework available" (Levine). Not just has the size been lessened by seventy-five percent, however the power utilization diminished by 40% in this new model (Levine). This is an unmistakable case of how far the eye control industry is coming in light of the fact that only a couple of years prior a portion of the fundamental grumblings about eye control technology were that it was excessively massive, as well costly, and utilized an excessive amount of force. Adjustment takes less time, at just ten seconds, and clients guarantee that inside a brief timeframe the eye control communication gets to b distinctly common. This is likely due to the change in the eye tracking programming, which can now move beyond past issues, for example, contact focal points, eye shading, eye wear, and outer light. Tobii's Chief Technology Officer, John Elvesjo, said the new eye tracker "takes into account precise eye tracking of nearly everybody inside fluctuating situations" (Levine). Tobii has obviously made extraordinary progress in its headways, however it is still not totally accessible to the general population and remains rather costly. The Gaze Group from the IT University of Cogenhagen, Denmark "concentrates on gaze tracking technology utilizing ease and off-the-rack parts, for example, webcams and camcorders" (Research). In April 2009 The Gaze Group propelled an open source eye tracker called the ITU Gaze Tracker (Research). The objective of this venture was to make a simple beginning stage for individuals who need to create eye tracking programming on the other hand applications and to give a reasonable contrasting option to individuals who wish to take a stab at utilizing eye looking communication technology. This is particularly useful for handicapped individuals who can't manage the more costly alternatives of eye tracking technology they requirement for correspondence. ITU Gaze Tracker is the main open source eye

control programming good with windows (Reasearch). All a man needs to do it download the product for nothing off of the Internet and buy a webcam what's more, an infrared light. By concentrating on the product and not equipment alterations, The Gaze Amass guarantees clients don't need to stress over conceivable costly equipment changes and redesigns. The Gaze Group has as of late been chipping away at another venture called Senseye, which permits clients to control parts of mobile phones with their eyes by utilizing front-confronting cameras on the telephones to track the movement of the client's eyes (Bryant). As of now, Senseye works for ninety percent of individuals who have tried it and the telephone can be held normally in a man's hand due to the stipend for little head movements. The Gaze Group is hoping to accomplice up with third parties what's more, furnish them with information helpful to assembling applications for telephones and in the end have the technology created straightforwardly into the telephones (Bryant). They suspect prototyping a gadget that can fit in the USB port of cell phones, empowering individuals to utilize eye tracking at whatever point they need (Bryant). Tobii is additionally widening their nearness and plan to utilize their new IS-2 Eye Tracker on PC screens, space machines, arcade amusements, and numerous different gadgets sooner rather than later. They additionally would like to accomplish full commercialization inside two years (Levine). While Tobii's progressions are critical, ITU's Gaze Group's work is similarly, if not more, imperative since it considers open source. Eye tracking can be costly and The Gaze Group guarantees that everybody who needs and needs to utilize the technology has admittance to it. The open source technology likewise takes into account different engineers to gain significantly more advances and ground. The Gaze Bunch maintains a strategic distance from equipment adjustments, which would make it harder for people in general to get to and upgrade the technology (Research) and they accentuates off-the-rack items that can without much of a stretch

be utilized with the open source programming accessible publically. Open source programming can really help the advance of another technology since it gives others a chance to share their thoughts and outlines. Progressions for example, eye tracking technology indicate how firmly connected people are getting to be to their technology. Before long individuals might have the capacity to control a whole machine with the squint of an eye.

Literature Review

1: Andreas Bulling, DanielRoggen, Gerhard Troster, in their paper talk about “It’s in Your Eyes - Towards Context-Awareness and Mobile HCI Using Wearable EOG Goggles”. In their work they depict the plan, execution and assessment of a novel eye tracker for setting awareness and mobile HCI applications. An accelerometer also, a light sensor are appended to the segment with the last indicating forward in line of occurrence light (see Figure). The Pocket is the core signal handling unit of the framework. It depends on a dsPIC smaller scale controller and contains two 24-bit analog digital converters (ADC), a Bluetooth and a MMC module and an EEPROM. EOG signals originating from the ADCs are prepared progressively and can either be transmitted utilizing Bluetooth or put away on the MMC. The EEPROM is used to store setup information and parameters for the flag preparing calculations. Four LEDs and two catches give a straightforward interface which permits the client to get to the essential usefulness of the gadget.

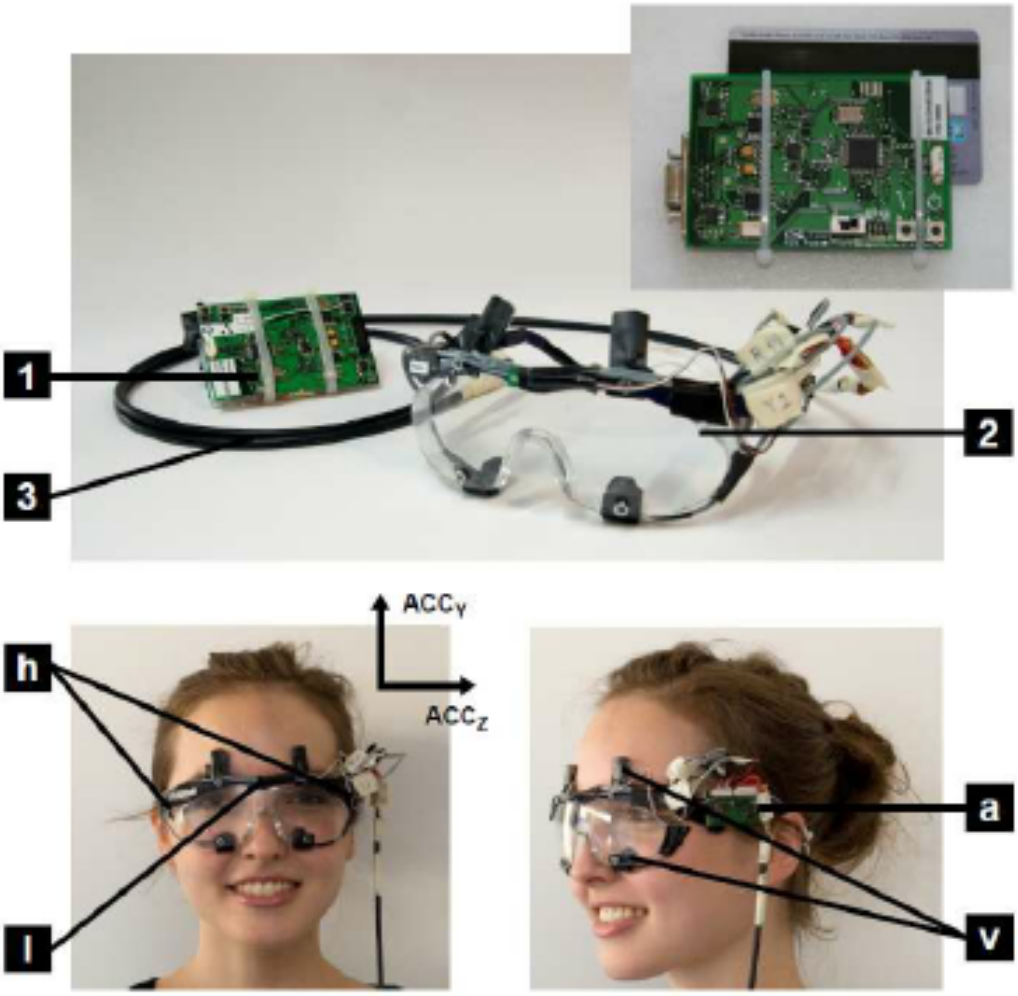


Figure . Parts of the EOG-based wearable eye tracker: the DSP (1), the Goggles (2) and the shielded core cable (3). The pictures at the bottom show the Goggles worn by a person with the positions of the two horizontal (h) and vertical (v) dry electrodes, the light sensor (l) and the accelerometer (a) with direction of its axes (ACC Y, ACC Z)

2: Arie E. Kaufman, AmitBandopadhay, and Bernard D. Shaviv, in their paper talk about an Eye Tracking Computer User Interface. They depict a modest eye movement controlled User interface for 2D and 3D communication. Which depends on electro-oculography (EOG) instead of the exceptionally costly reflectance based techniques. They said that they have assembled the

equipment and programming to show the practicality of EOG for human-PC communication. Their tests show that EOG gives the premise to a sufficient information communication gadget. Being exceptionally modest the framework is appropriate for some virtual reality frameworks and computer games and in addition for the impaired.

3: Ralf Biedert · Georg Buscher Andreas Denge, in their talk about the eye Book Using Eye Tracking to Enhance the Reading Experiences.

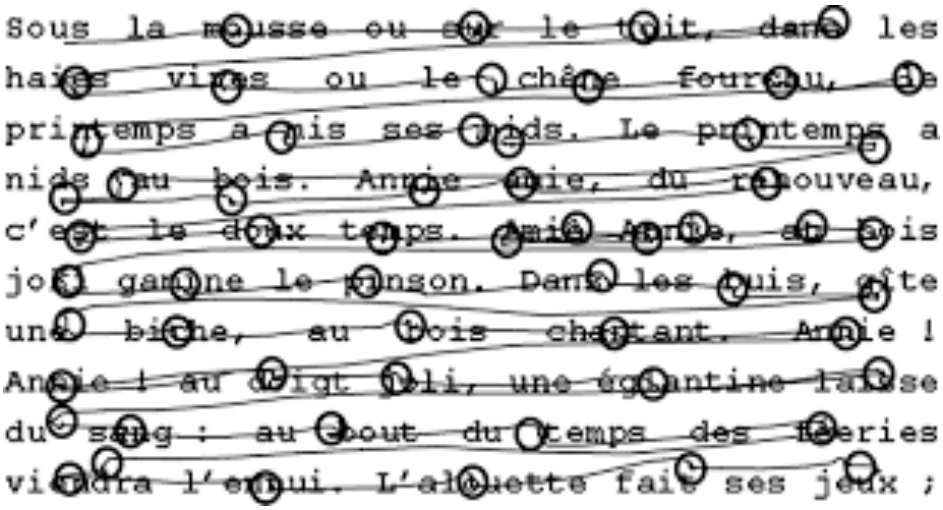
Reading Detection

Having this information on the physiological qualities of the human eye and how and why we control eye movements at the top of the priority list, it is conceivable to distinguish reading detection in view of the particular grouping of saccades included. Knowing when the client is reading and which content parts he or she is reading is exceedingly important data that can be utilized as verifiable input for the PC framework. Since reading detection frequently involves subjective procedures of comprehension in the client's psyche, a PC framework may utilize this data for evaluating the client's present topical interests and for giving help amid reading. In this way, utilizing gaze information for rather roundabout reading location also, not for direct association with a PC (making issues like Midas Touch) is by all accounts an exceptionally encouraging field of utilization. Since eye trackers of today have adequate tracking precision also, are moderately unpretentious in their application, it appears to be conceivable later on to procure data about what the client has read on the screen. What is for the most part implied by "perusing" can be very extraordinary. At the point when individuals take a gander at a guide, study an diagram of the most recent soccer brings about a daily paper, look over programming code to discover a blunder, these could be called "reading" as a rule. In view of the information

about eye movement conduct amid understanding, we composed a calculation that can identify such conduct. Since the two ideas "reading" and "skimming" exist in like manner dialect utilization, we additionally presented a usefulness that generally separates between them (Rayner et al 1989).

Reading Detection Algorithm

The general thought of the calculation is identified with an calculation by Campbell and Maglio (Campbel 2001) and thoughts by Beymer and Russell (Beymer 2005) and Initially, obsessions are recognized. Another obsession is identified if progressive adjacent gaze areas inside a period interim of 100 ms can be seen from the eye tracker. 100 ms is the base obsession length as per the writing. Gaze focuses are considered adjacent when they fit together around with a measurement of 30 pixels (look at Figs. grouping of crude gaze areas created by the eye tracker into obsessions. The width of the circles in Fig. relates to the obsession terms).Second, each move from one obsession to the next (i. e., every saccade) is grouped by its length and heading. This outcomes in components depicting saccades that happen pretty much frequently amid perusing or skimming, e. g., saccades to one side or left with various separations. A rundown of all conceivable components is given in Table . Third, scores related with the elements are gathered. With a specific end goal to separate between perusing what's more, skimming conduct, we apply two distinct sets of scores as appeared in Table, one utilized by a perusing indicator, and one utilized by a skimming identifier. At long last, it is resolved whether limits for "perusing" and "skimming" conduct are surpassed (Buscher 2008).



Saccade classification and detector scores			
Horizontal saccade distance x and direction in letter spaces	Feature name	Reading detector score s_r	Skimming detector score s_s
$0 < x <= 11$	Read forward	10	5
$11 < x <= 21$	Skim Forward	5	10
$21 < x <= 30$	Long Skim Jump	-5	8
$-6 <= x < 0$	Short Regression	-8	-8

-16 <= x < -6	Long Regression	-5	-3
x < -16 and y according to line spacing	Reset Jump	5 and line delimiter	5 and line delimiter
All other movements	Unrelated move	Line delimiter	

4: John L. Sibert and Mehmet Gokturk, Robert A. Levine, in their paper talk about, The Reading Assistant: Eye Gaze Triggered Auditory Prompting for Reading Remediation. They have built up a framework for therapeutic reading guideline that utilizations outwardly controlled sound-related inciting to help the client with acknowledgment and articulation of words. Our basic theory is that the generally inconspicuous help rendered by such a framework will be more compelling than past PC supported methodologies. They display a depiction of the plan and usage of our framework and examine a controlled review that we attempted to assess the convenience of the Reading Assistant.

Eye Movements in reading research

Eye movement amid reading has been researched for numerous years, and scopes of qualities for different eye movement measures have been built up for typical per users (Rayner et al 1978). Expanded content trouble forces a more prominent weight on psychological handling limit that is reflected in expanded length of obsession and different elements of eye movement. Amid grown-up reading, eyes move in a succession of stops or obsessions isolated by fast, discontinuous movements or saccades. The saccades are by and large rightward or dynamic, however in some cases might be leftward or backward. Factors that have been measured incorporate number of

obsessions, term of obsessions, area of obsessions in the line of content, number of dynamic saccades, number of backward saccades, and size of saccades (O'Regan et al 1990, Patchberg et al 1978, Taylor et al 1965, Rayner et al 1978). The normal dynamic saccade envelops around 7-9 character spaces, proportionate to around 2 degrees of visual point, which covers the evaluated degree of the foveal area of the retina (O'Regan et al 1990, Rayner et al 1978). The run of the mill backward saccade size is littler, around 3-4 letters. The quantity of backward saccades is around 10-20% of all saccades in talented perusers. These relapses are accepted to occur when there is trouble understanding the content, distortion of the content, or overshooting of the objective range. The normal obsession term for talented perusers is accounted for to be about 250 msec , however there are awesome individual contrasts. For a particular peruser, obsession span may go from 100 to more than 500 msec Experiments have investigated the impact of obsession position inside a word on obsession length (before the accompanying forward saccade). The length of an obsession is related with reading trouble, so that words that are more troublesome normally require longer obsessions for their IDs. The length of saccades might be affected by "unrefined visual intimations" (O'Regan et al 1990). For instance, the saccades entering or leaving longer words have a tendency to be longer. Stamped formative patterns in eye movement amid reading by kids additionally have been depicted. With expanding grade level in primary school, there is a diminish in mean obsession term and an expansion in mean saccade length. As indicated by McConkie and Zola "...research including eye movement observing can help in understanding the way of the mental procedures included in reading, how these create as one figures out how to peruse, and what preparing procedures or attributes are more basic in those kids who neglect to show typical advance in figuring out how to peruse. Eye movement information are valuable in dissecting all the while gathered information, for example, ...oral

reading conventions... (what's more, ...can be utilized for controlling exploratory controls amid continuous reading" (McConkie et al 1986).

5: TakehikoOhno, Naoki Mukawa ,ShinjiroKawato, in their paper, talk about Just Blink Your Eyes: A Head-Free Gaze Tracking System. They propose a head free, simple setup gaze tracking framework intended for a gaze-based Human-Computer Interaction. Their framework empowers the client to associate with the PC not long after subsequent to getting the client's attention flickers. The client can move his/her head unreservedly since the framework continues tracking the client's eye. Moreover, our framework just needs a 10 second adjustment system at the first run through of utilization. An eye tracking strategy in view of our one of a kind eye squint recognition and a modern gaze estimation strategy utilizing the geometrical eyeball demonstrate understand these points of interest.

Head-Free Gaze Tracking Method

Gaze tracking framework comprises of two segments; an eye situating unit and a gaze tracking unit. The eye situating unit recognizes the client's eye position in 3-D facilitates for controlling the gaze tracking unit, and the gaze tracking unit identifies and tracks the client's understudy and the corneal reflection picture (the Purkinje picture) to ascertain the gaze course

Eye Tracking from Eye Blink

The eye situating unit identifies the client's eye position by an eye tracking calculation. It identifies the client's eye squint from the contrasts between two progressive casings. Once an eye squint has been recognized, a layout picture of two-eye zone is made. At that point, the present eyes position is sought in view of the deliberate center position of two eyes and the already

recognized eye position. In light of the eye position got from the stereo picture, the 3-D directions of the eye is computed and sent to the gaze tracking unit. Notwithstanding when the framework loses the eye position, an eye squint of a client is utilized to re-track the present area of the eye. This squint based calculation works heartily against the variety of face hues, since it doesn't utilize the skin-shading data (Kawato).

6:Bing Pan, Helene A. Hembrooke, Geri K. Gay, Laura A. Granka, Matthew K. Feusner, K. Newman in their paper, talk about The Determinants of Web Page Viewing Behavior: An Eye-Tracking Study. The World Wide Web has turned into a universal data source and correspondence channel. With such a broad client populace, it is basic to see how web clients see diverse site pages. In light of an eye tracking investigation of 30 subjects on 22 website pages from 11 prominent sites, this examination expects to investigate the determinants of visual conduct on a solitary web page: regardless of whether it is controlled by individual contrasts of the subjects, diverse sorts of sites, the request of website pages being seen, or the job that needs to be done. The outcomes show that gender of subjects, the survey request of a page, and the collaboration between page request and webpage sort impacts online visual conduct. Errand direction did not altogether influence web seeing conduct. Scanpath investigation uncovered that the multifaceted nature of website page configuration impacts the level of scanpath variety among various subjects on a similar website page. The commitments also, confinements of this exploration, and future research bearings are examined. Beginning investigation into eye movement explore started in the early 1900s. In this area we surveys pertinent research in the estimation of visual conduct and furthermore look at important inquire about on eye tracking in the web setting [Rayner 1998].

Ocular Behavior Measurements

A few behavioral definitions have been broadly received in the investigation of visual conduct, including obsessions and saccades. Eye tracking research for the most part characterizes obsessions as a moderately still gaze which endures around 200-300 millisecond (ms), in which visual consideration is gone for a particular range of a visual show [Rayner et al 1998]. Saccades are persistent and fast movement of eye gazes between obsessions with a speed of 500 degrees or more. Saccades are speedy eye movements to coordinate a watcher's eye to a visual target. Data handling is stifled amid a saccade, however some fringe data might be accessible [Rayner et al 1998]. Obsessions have been connected to exceptional psychological preparing. As per Viviani [1990], in any event three procedures happen amid an eye obsession: encoding of a visual boost, testing of the fringe field, and getting ready for the next saccade. Rayner [1998] has demonstrated that eyes are pulled in to the most enlightening territories of a scene since they are physically unmistakable and enlightening. Additionally, Loftus and Mackworth [1978] have affirmed that the eyes are attracted to enlightening territories, which can be measured utilizing abide time inside an Area of Intrigue (AOI). Fitts et al. [1950] have likewise presumed that obsession recurrence in an Area of Interests (AOIs) means that is an indication of the degree of importance whereas fixation duration is an indication of the complexity and difficulty of visual display.while obsession length means that the intricacy and trouble of visual show. The way of the look assignment additionally impacts eye movement conduct [Rayner et al 1998]. Buswell [1935] found that diverse directions prompted to diverse groupings of obsessions despite the fact that every one of the subjects settled on the same imperative components in the photo [Buswell et al 1935]. Yarbus [1967] demonstrated that a watcher's eye movement was impacted by his/her

plan. Pelz et al. [2000] has demonstrated that the multifaceted nature of errands impacts obsession lengths. Hayhoe et al. [2002] showed errand particular obsession designs in characteristic situations and have demonstrated that there is an extensive level of normality between various subjects. The term scanpath was initially proposed by Noton and Stark [1971]. They characterized scanpath as a continually favored eye movement way when a subject is reexposed to a visual boost. The idea of scanpath has additionally been acknowledged as a grouping of obsessions and saccades and as a movement of consideration. Josephson and Holmes [2002] utilized groupings of Areas of Interest (AOIs) as scanpaths furthermore, utilized a string-altering technique to compute the distinctions between any two scanpaths. In any case, ebb and flow inquire about presently can't seem to create definitive discoveries relating intellectual procedures to the determinants of scanpath conduct.

Recent Research on Web Page Viewing Behaviour

A few reviews have as of late been led in regards to visual behaviour on site pages, including eye movement look into on news sites, examination of scanpaths on site pages, and visual behaviour when web clients were finishing assignments on a web-based interface page. Against the mainstream acknowledged perspective of “words generally can't do a picture justice", the Stanford Poynter Extend [1998], exploring reading conduct on news sites, presumed that content was oftentimes the principal passage focuses for a greater part of online news perusers. Rayner et al. [2001] detailed comparable discoveries in which watchers of print notices spent additional time on content than pictures. By examining eye seeing conduct of eight college understudies on three distinctive website pages, Josephson and Holmes [2002] demonstrated that the subjects have constantly favored scanpaths and they likewise exhibited that components of sites and memory may likewise be vital in deciding scanpaths. Goldberg et al. [2002] utilized eye tracking

strategies to test the execution of the subjects in finishing a few assignments on an online interface page. Their exploration illustrated that:

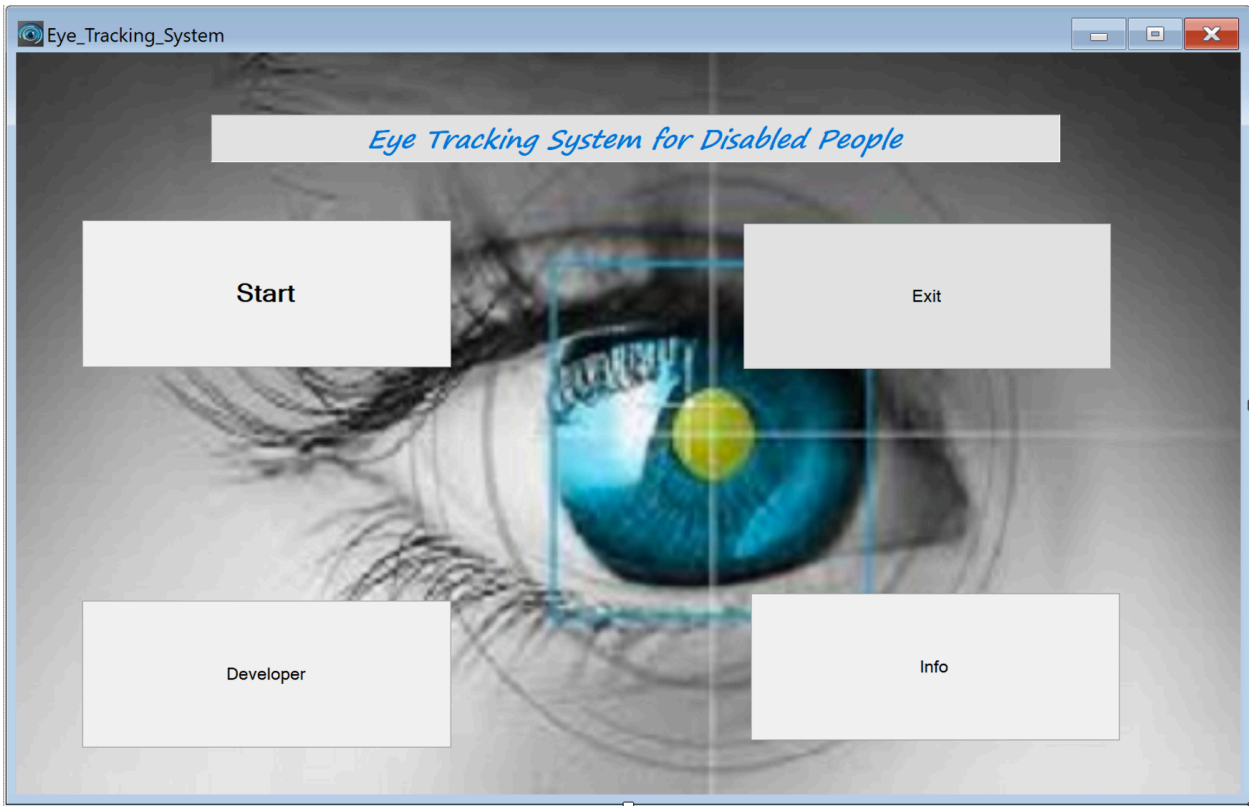
(1) there are more normal flat eye movements between various portlets on a page than vertical ones;

(2) the headers in a portlet were not for the most part went to before the body; and

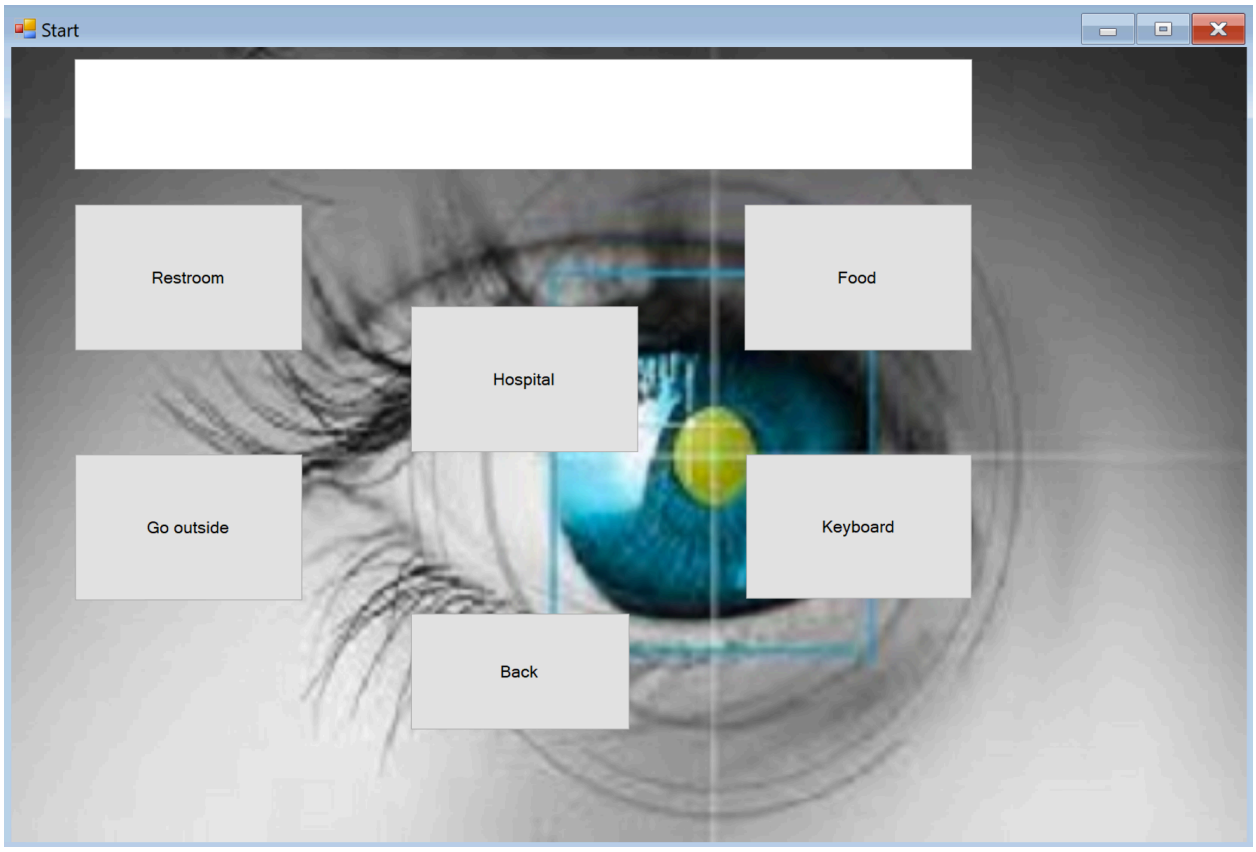
(3) that pursuits did not turn out to be more coordinated as a screen arrangement expanded.

Methodology

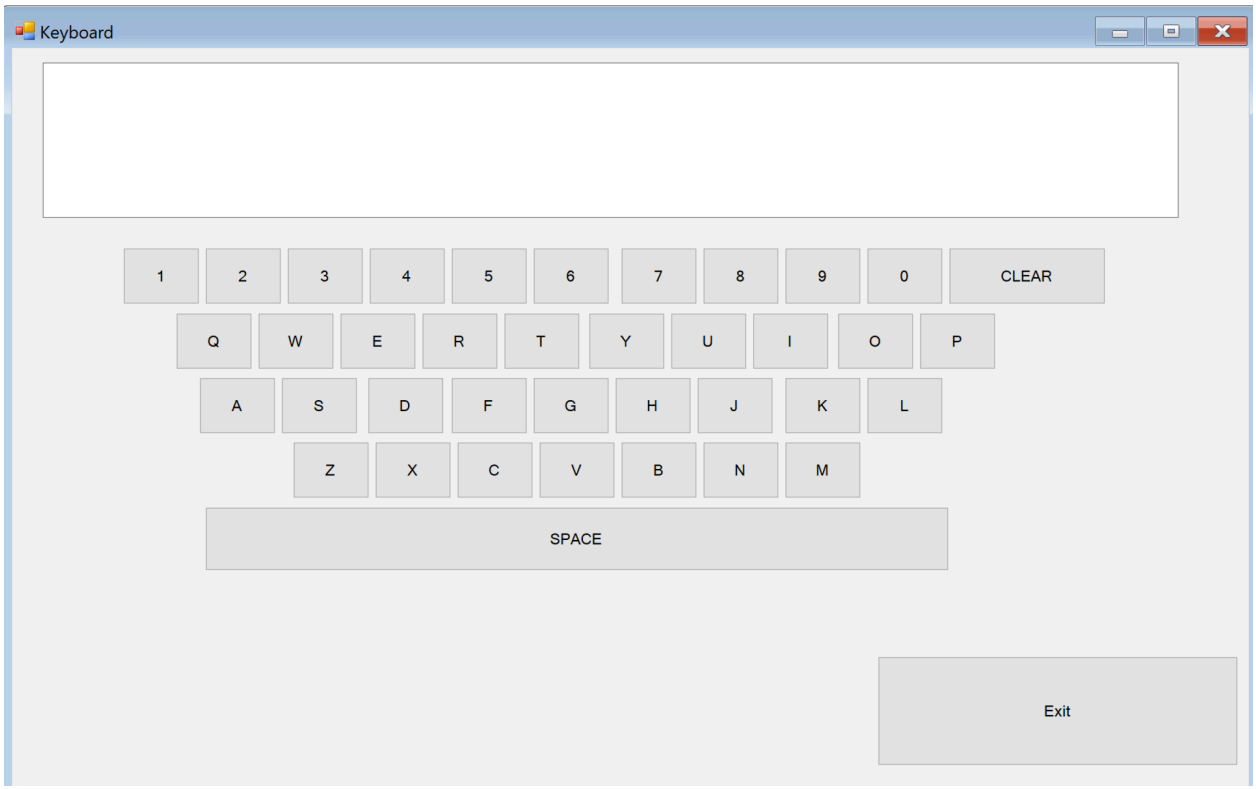
Seeing some of my family and neighbors suffering from disability and being unable to use any part of their bodes except their eyes made me think of taking advantage of the technology and the power of eyes that one has. After reading so much research, I found out that there are some hardware devices that can be used to track the people's eyes and make them capable of controlling their PCs using only their eyes. Therefore, I decided to develop a special software to help the disabled people to express their feelings using only their eyes and to do whatever they want using this software. In this software I focused on the very basic things that a disabled person may need, such as telling us if they wants to see a doctor, eats, goes to the restroom and other basic stuff. In my software, I decided to use C++ with visual studio to create the interface. The reason why I chose this language is that the eye tracker I want to use works only with Windows environment and reads only C, C++ and C\#. It is true that my software helps disabled people only with the basic things, but I added a feature to it that will make them say and do whatever they want. The feature is a virtual keyboard that I developed to allow them write whatever they want.



The software I developed starts with the screen above which give the user some options before they starts using it. For instance, in case the user wants to learn a little bit about the software and the way of using it then they simply can look at the button "Info" to open up a new window that has the most important information they may need. The button "Start" is the one that will take the user out from their disability to a new world that is full of power. The "Start" button will take you to another window where you can choose between seeing a doctor, ask for food, go outside or even open the keyboard and write whatever you want.



As you can see at the picture above there is a white bar above the buttons, in this bar will have a printed result for what the users want to do once they look at any button. For example, if the users looks at the button " Food " then in the white bar we will have the message " I want some food " and so on. However, let's say that the users want to choose a specific type of food or they want to sasy something that is not included in the buttons. In this case, all they have to do is to look at the "keyboard" button and they will have the virtual keyboard that I have created for them to allow them to say whatever they want through it.



The question now is how can the users use this software using only their eyes and this is the question I asked myself before. There are so many eye tracker hardware devices and among these devices I chose to use "Tobii Eye Tracker 4C". The result that I achieved using this device made me know that we can use it in two different ways. The first one is the gaze trace feature that this device allow me to use once I download its software.

This feature will track the users eyes and see what they are looking. By doing that the users can look at any button they want in the software that I created and the people around them will know what they want to say. However, the software I developed will not respond to the gaze and open the window under the button they look at. However, the good news that Windows has released a new feature in Windows 10 that is called "Eye Control" this feature works the hardware I picked in my research paper. Therefore, if you want to be able to control your PC and use the software I developed for disabled people, then you need to have this version of Windows along with the Tobii device.

Conclusion

Eye tracking is no longer a specialty technology utilized by specific research labs then again a couple select client gathers yet effectively misused in a wide assortment of controls and application zones. While picking an eye tracking framework, one ought to focus on the equipment's gaze tracking highlights and in addition the going with software and extra frill. Many eye tracking makers give distinctive models focused at various purposes. The frameworks may utilize a similar essential specialized standards of operation, however what makes a specific framework appropriate for a particular reason for existing are the applications (software) that use the crude eye information, e.g. software for recording and examining the gaze way, or assistive software that permit the eye to be utilized as a substitute for the mouse.

Issues to consider from the specialized part that influence the reasonableness of the framework for a particular reason include: spatial and worldly resolution (precision), camera point,

opportunity of head developments, resilience to encompassing light, resistance to eye glasses and contact focal points, probability to track just a single or two eyes.

There are four capacities that are critical to most eye tracking gadgets: association, alignment, synchronization, and information gushing (Duchowski). Association sets up a connection with the eye tracker gadget, then alignment figures out where the client's eyes are found and syncs the PC's show with eye movement by showing alignment focuses. A case of alignment would be a speck moving around the screen and the client's eye tailing it to tell the gadget how the particular eye moves. Synchronization advises the utilization of the eye tracker gadget's state, which is fundamental for the last capacity, information gushing, which permits the client to perceive what is occurring continuously. Eye tracking is a helpful gadget for some regions of study. "We may assume that on the off chance that we can track somebody's eye movements, we can take after along the way of consideration sent by the eyewitness" (Duchowski) which will give understanding into what the client was attracted to and how the client saw and deciphered whatever he or she saw. This sort of information can be valuable for web designers or publicists since they can put content or illustrations in specific spots of the site page where the PC screen would be well on the way to be seen. Eye tracking writing interfaces use on-screen consoles that track the onlooker's gaze to decide the letter they are concentrating on (Research). Criticism can be given to the client through highlighting the letter or giving a sound reaction. A few interfaces utilize prescient content to offer likely word proposals that the client can pick.

From the human variables perspective, the framework's intrusiveness, convenience, setup time and accessible client support are essential issues. For an impaired individual, an eye control framework is a method for imparting and communicating with the world and might be utilized broadly in fluctuating conditions. Along these lines, dependability, vigor, security, and mounting

issues must be deliberately considered, in expansion to convenience and general ease of use. What's more, one ought to have the capacity to tailor the framework to coordinate every client's capacities, needs and difficulties instigated by sickness (Donegan et al. 2009). With expanded accessibility, unwavering quality and ease of use of the cutting edge trackers, the attention on gaze assistive technology research is gradually moving from specialized difficulties toward the human perspective, showing a need to likewise consider client encounter (Mele and Federici 2012). A new development in both eye tracking exploration and application improvement is the move far from the research center to more regular versatile settings both inside and outside (Bulling and Gellersen 2010). It is hence that there is a high interest for frameworks that can work in differing versatile settings. Notwithstanding enhanced VOG and EOG based methods, likewise novel eye tracking methodologies are under scrutiny. Future eye tracking frameworks might be founded on technology and tactile frameworks that copy the natural detecting and eye structure. For instance, the supposed "silicon retina" demonstrates high potential for fast eye tracking that can give vigorous estimations additionally in encompassing light conditions (Liu and Delbuck 2010). The pixels in the silicon retina can nonconcurrently react to relative changes in force. This empowers quick and strong discovery of development furthermore, tracking of protest in shifting light conditions where conventional video and IR based eye tracking regularly fall flat.

Notwithstanding gaze bearing and eye development designs, likewise other eye-related estimations, for example, the student measure and even microsaccades can add to the elucidation of the client's passionate and intellectual state. Gaze conduct can likewise be joined with different estimations from the client's face and body, empowering multimodal physiological computing. Gaze-based client displaying may offer a stage toward really astute interfaces that

can encourage the client adroitly that supplements the client's regular conduct. Advancements in the technology open new zones for eye tracking, extending the extent of gaze-based applications. Current intriguing issues incorporate a wide range of portable applications and unavoidable frameworks where the client's visual conduct and consideration is followed and utilized for eye-based cooperation all around and whenever, moreover called unavoidable eye tracking and inescapable eye-based human-computer association (Bulling et al. 2010, 2012a, b; Zhang et al. 2013; Vidal et al. 2013). Other developing ranges incorporate, for instance, car industry (languor, consideration alerts, security), mindful navigation and area mindfulness, data recovery what's more, upgraded visual hunt human-robot cooperation, mindful keen coaching frameworks (e.g. Jokinen and Majaranta 2013; Nakano et al. 2012; Zhang et al. 2012). For individuals with extraordinary needs, versatile eye tracking may give more flexibility by 58 P. Majaranta and A. Bulling wheelchair control, tele-presence and tele-operation of technology (Wästlund et al. 2010; Alapetite et al. 2012).

Eye tracking is turning into an inexorably fascinating alternative even in conventional computing. Real technology organizations and the gaming business are beginning to demonstrate developing enthusiasm for installing eye tracking in their future items, for example, portable workstations and tablets (Tobii 2011; Fujitsu 2012). Vision based advances are as of now broadly utilized as a part of the gaming field, empowering players to utilize motions and full body development to control the diversions, and eye tracking is imagined to be a piece of future gaming (Larsen 2012). The buildup on brilliant glasses, (for example, the Google Glass) demonstrates that it is just a short time, when the main eye-controlled purchaser item will enter the market. More extensive utilize would mean lower costs. Subsequently, a leap forward in one field can give a lift additionally to different ranges of eye tracking

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