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Cursor Control through Eye movement

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***Abstract*-**Eye tracking system has a suitable design which controls any devices which has digital screen with the eyeball movement and gesture without any help of required hardware. This technical concept has a potential to abolish and replace the standard mouse with the human eyes as a new way to interact and communicate with computer and also intended to replace standard computer screen pointing devices for the use of disable and handicapped people or as an alternative for using mouse which is very easy to use for faster input process. The system makes use of a PC webcam in order to detect eye movement. The system continuously scans camera input for pattern similar to the eye. Once the eye is detected, the system locks it as an object. The eye moment image is captured and transmitted by Raspberry Pi 3 model b and Microcontroller in order to process with OpenCV to derive the coordinator of the eyeball. The approach we described and defined is a real-time, non-intrusive, quick and cost-effective method of tracking facial features with the help of IR sensors.

Keywords—human computer interaction (HCL), Eyeball movement, OpenCV, Python, Raspberry Pi

I. INTRODUCTION

As computer technology advances, the importance of human-computer interaction becomes very much apparent. We all know people with disabilities are unable to use computers. eye movement control systems are mostly utilized by those who are impaired. By incorporating this eye-controlling mechanism into our computers Physically challenged people will be able to utilize computer resources without any external assistance. Human-Computer Interface (HCI) is mostly concerned with the use of computer technology to establish a human-computer interface for the efficient utilization of technology. There was a need to discover appropriate technology that allows human-computer collaboration. The importance of human-computer communication cannot be overstated. As for that reason, there is a need to develop a mechanism for disseminating an alternate mode of human-computer communication for people with disabilities, giving them an equal opportunity to participate in the Information Society and digital world.

Human-computer interfaces have piqued the interest of scholars throughout the world in recent some years. For physically challenged people, a human computer interface is an implementation of a vision-based system are for eye movement detection. face tracking, Face detection, eye detection, and real-time interpretation of a sequence of eye blinks are all incorporated in some proposed method for managing a nonintrusive human computer interface. In such system the mouse is no longer used to interface with the computers. instead, human eye motions are used. The user's eyes were used to simulate mouse clicks, allowing him to run the cursor and fire events when he blinks. The tracking mechanism works by estimating where the feature will be in the current frame based on its previous. To make the application more accessible to everyone which is with moderate resolution and frame rate as the capturing device. Improving existing avenues is the main purpose of this research in the eye gesture tracking system. Particularly for helping physically disable people. For enabling them to use computers and programmable controlled systems like eye tracking system and with the help of that such individuals could still take on their responsibilities, improve the quality of their lives. It may help them to take a step forward to be financially independent. Also, they could continue with their day-to-day tasks often without the need for anyone. Now adays, mostly eye tracking systems use real-time video-based tracking of the eye pupil. We have adopted the same technique and technologies and improved upon them developing a more accurate system which we can use in daily bases.

II. LITERATURE SURVEY

Vandana Khare, Gopala Krishna, Sai Kalyan Sanisetty the paper title is “Cursor Control Using Eye Ball Movement” [1], a few people and groups are unable to use computers because of disability. In that case, providing computer operating method that is easily accessible makes a lot of sense. Using human eye as a suitable replacement for computer operating hardware. An IP camera was utilized to capture an image of an eye for movement of cursor in this paper. We use a Raspberry Pi for identification of pupil since it can handle the cursor, and in that task, an Eye Aspect Ratio (EAR) is measured, which corresponds to the snaps of the eye (left or right blinks) using the Python programming language and Open-source Computer Vision module. The major purpose of this methodology is to improve the computing experience of physically

challenged people by assisting them in overcoming challenges such as mouse usage and making the human-computer interface more user friendly.

V.Manjuarasi, M.Yesodha, G.Renuka the title of the paper is "CURSOR control using eyeball Movement with raspberry [2] Some people are unable to use computers because of disability. Not only for making the computer-human interface more interactive but also for the physically disable the concept of eye controllers is really useful and by including a control system and eye tracking system they will be able to operate the computer without the help of another person. This is particularly very useful for people who can move their pointers with their eyes. By using camera, the image of eye movement is captured in this research. Determining the position of the pupil's center is the first step. Then after that depending on the pupil the pointer moves in different direction. In this process they used a Raspberry Pi and Raspier for image loaded on the Raspberry Pi. Aditya Dave1 and C. Aishwarya Lekshmi paper's title is "Eye-Ball Tracking System for Motor-Free Control of Mouse Pointer" [3]. In this field of image processing have resulted in different type of high-quality feature detection techniques. But still there is a constant need for new algorithm and an equal number of applications of such algorithms in order to achieve their full potential and also use by the general public. For developing a robust eye ball tacking system for directing the mouse cursor, this system uses a combination of Viola-Jones, Kanade–Lucas–Tomasi (KLT), and also Circular Hough transform algorithms. The system's feature is the ability to represent clicks. A single click is represented by one blink, and a double click is for two blinks in a very short period of time. There are some other methods that were tried but failed to track characteristics are also described in this study. computer dependence has risen so dramatically fast in recent years, this technique and technologies can help people with motor difficulties browse through their files on their computer. Different algorithms excel for different things. So, rather than creating one algorithm extremely complex for all parameters, combining the best features of all three methods greatly simplifies the program and provides a better result than any of the three alone.

III. EXISTING SYSTEM

In existing system interaction between computer and human is carried out with eye blink-detection and eye-tracking. But in this concept human computer interface HCI system exists which helps in tracking the direction of eye particularly pupil. The particular movement in any direction shows positioning of mouse cursor. These systems that detect. The Pupil position from an image provides and input modality to computer user with physical disabilities. The main drawbacks of existing systems are that affects users Eyes and many time cause problems in vision and it's not able to detect short blinks.

A group of MIT [4] students proposed a system titled as "The sixth sense", the system is based on human-computer interaction. They used different gestures mainly eye and face gesture to make system more interactive with users. The system tracks all the head movement, so that it can be projected on walls or any other smooth surface and it can be used anywhere. The main problem is that, it doesn't provide accessibility to the physically challenged people nor does it produce a system that can easily interact with other compatible devices.

A pupil detection technique is proposed in 2015[5] by using circular Hough transform algorithm in which the system detect the pupil center coordinates of a person by using this algorithm. The main problem was this system doesn't take real time data for analysis and it takes a lot of time for processing. it first captures the body edges and its position then after that it moves to head and face and then it finally try to find pupil of eyes for capturing without tracking process which consumes a lot of time.

IV. PROPOSED SYSTEM

This eye tracking system is direct select vision-controlled computer-human interaction system. This is the real time gaze determination software that control the computer pointer by detecting users face using IR sensors and by tracking the eye. Movement of mouse pointers using interfacing of human biometrics and computer system. it's primary user can be anyone adult, children and most importantly physically challenged people like cerebral palsy, spinal cord injuries, brain injuries paralyzed etc. It can be easily used in homes, workplaces, schools a person can create speech, corporate phones, play games and operate computer mouse without any movement and access internet and also email. [4] The main advantage is hand free computing and facilitating physically challenged people using the computers by controlling Mouse cursor through eye moment like user can control any Mouse events right click, left click, double click and scrolling.

The proposed system is using a Raspberry Pi 4B Camera with 18 megapixels (360 pixels- interpolated 18M pixels still image resolution, interpolated 1.9M pixels video resolution) to Record the Footage of the user for iris Detection [5] For tracking and for gaze Duration estimation. The first Footage Frame is used for the initial face location and the eye position detection. If any one of the above given detection fails to Execute, then go to the next frame and then restart the above detection processes. If iris Detection or tracking is failed, the processes of eye detection restart on the given present Live Footage. These procedures will be continued until there are no more Footage frames left. The Summarized steps are then described in subsections given.

V. DESIGN AND IMPLEMENTATION

Algorithm

Input: *digital video input from camera.*

Output: *Cursor Movement Triggers.*
Step 1: Camera receives the input from the eye.
Step 2: input videos from the cameras will be break into frames.
After receiving frames, it will check for lighting conditions because cameras require.
Step 3: sufficient lights checkup and error detection and error message display.
Step 4: The captured frames in RGB mode are converted into Black 'n' White.
Step 5: Images (frames) from the input source are analyzed for Iris detection (center of eye).
Step 6: Mid-point is calculation.
Step 7: Mouse Cursor movements are triggered.
End.

System Architecture

The system is divided and categorized into three simple Stages:
1)First is the Face detection and tracking Position component
2) Second is the Eye Iris tracking component
3) Third is Gaze to screen with Mapping coordinates.

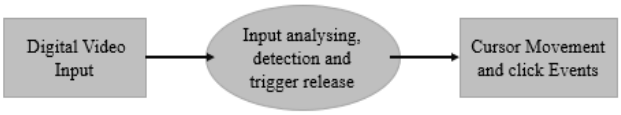

Fig 5.2.1: Level 0 DFD of the System

Fig 5.2.2: Level 1 DFD of the System

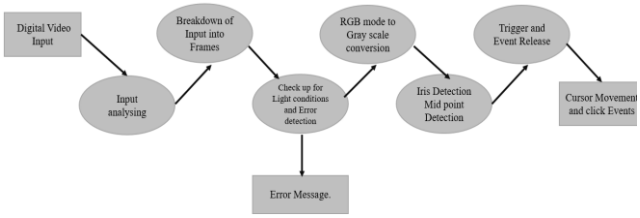

Fig 5.2.3: Level 2 DFD of the System

DATA SET COLLECTION
Data set collection is raw Data received into the system which is the real time Footage of the user. We use the Raspberry Pi 4B Camera provided with the correct lighting Conditions and uses a trained system model to train the system with various Sample Footages. [6] Here we use the unsupervised learning method so we can bring a defined clarity on table to train the system. Due to time bounding, we use a pre-trained model called 63-point-landmark detector that has a big variation of trained Footage Frames.

Eye Detection
There is no Specific technique to track the movement of the eyes. the selection of the technique and actual demands of the application is important. During the Process of analysis phase of this Project research, two technique Approach were analyzed: the Limbus tracking and Pupil tracking. Every technique and particular process has its own Merits and demerits.
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Limbus Tracking
Limbus Tracking defines a way of tracking the eye Position using the limbus. The limit boundary between the white sclera and darker iris of the eye is known as the limbus. As the sclera is white color and the iris is darker shade, this boundary limit can easily be visually Differentiated as well as its position can be tracked. This technique is based on the position coordinate and structure of the limbus in relation to the head, therefore the head must be kept stable to adjust the apparatus or must be fixed according to user's head position. This technique gets severely affected by the eyelid movement or blinking of the eye often covering all or part of the limbus. This makes its uses very constrained to horizontal tracking of x axis. Usually, this technique does not involve the use of infrared sensors.

Pupil Tracking
Pupil tracking is a technique of gaze detection that is openly used in conjunction or combination with different forms of tracking. There are several vigorous points for this; however, the main advantage is the Feature of the “bright spot”. Like the situation associated with red eye error when taking flash photographs at dark Scenario, pupil detection to form a higher intensity bright light spot that is easy to deal with image processing can be used with the help of infrared sensors. [7] This bright spot appears when infrared rays are reflected off of the pupil and enlarged by the eye lens. more visible than the limbus, a higher resolution is achieved. and more likely, as the pupil is never covered by the eyelid on blinking, x and y tracking is more likely convenient as comparatively to Limbus tracking Approach. The Disadvantage is that the difference in contrast Level is lower between the pupil and iris intensity of light than between the iris and sclera Intensity - thus making the border detection Harder to be achieved.

Eye Region Detection
The exact position of the pupil is known by using horizontal and vertical integral projection. These projections divide the whole picture to homogenous subsets. The arbitrary threshold is used in the proposed method.[8] The noise can be removed by using Gaussian filter. The strong pixel value is based on minimum gradient point. Eye Region Detection The exact position of the pupil is known by using horizontal projection and vertical integral projection. These projections divide the

whole picture to homogenous subsets. The arbitrary threshold is used in the proposed method. The noise can be removed by using Gaussian filter. The strong pixel value is based on minimum gradient point.

Flow of Operation

1.The subject/user is Positioned in front of the PC. Opening adjustments are made. The program is made to run and the Footage is obtained.
2.The Footage is broken in differentiable frames of images.
3.The frames or image are then converted into Greyscale accordingly for further Processing part.
3.Every frame then converted to array and size of the image is extracted from the discrete Frames.
4.The size of image and array data stored of the image are fed to the dll library via the library call function node III.
5.The direct link library delivers efficacy with detected size of the eye and the face from the obtained real time footage video.
6.The size of the face and eyes are Processed to develop an array of Objects, and the array is fed to the get results function of the dll.
7.The get result function make the Point coordinates of the detected ROI of eye and the face available.
8. To process in math script to increment or decrement the coordinate position of the cursor The generated coordinates are used.
9.The coordinates which is supplied as input from image data to the user32.dll to set cursor position function suitably using call library function called as node-III function.
10.According to the Provided or given coordinate values the cursor moves to the exact coordinate position of the face.
11.The left click is Executed when the Left eye is detected closed within given duration of time. Similar to the previous condition the right click is Executed when Right eye Blinks
12.It is accomplished by verifying the number of eyes detected and its movement and actions and the related hexadecimal value which is Fed to the mouse event function of user32.dll for execution.

VI. CONCLUSION

This system facilitates the hand free cursor control to reduce the dependency on the typical Mouse. The main aim is providing means of cursor control to disable people and a new attractive option for existing paper. From the process implemented we can conclude that the cursor can by control by our eyeball movement that is without any use of hands. This will be very helpful for people who has disability in using physical parts of the computer. In this technology can be enhanced in future by inventing and updating more events of computer and by making computer human interaction simpler. As a human computer interaction software this technique and Technology has very wide future scope like driving car with eye moment and like operating other digital applications with different body part..

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