Abstract

Eye Tracking has always been a complex job to perform but in field of technology it is having wide range of applications. There are number of barriers that have a stood such as robustness, real time precision, availability, intrusiveness and the most important price has always being a major factor in eye tracking. We place our focus on the implementation of the computer mouse which is designed to detect the relative position of the cornea with respect to the initially, calibrated center and calculate the attributes like angle and speed at which the movement of mouse cursor has to be initiated. Just imagine a computer to be controlled without mouse, our thesis provide user to control computer without a mouse using the movement of our eyes. The number of barriers can be overcome by using our thesis to track the movement of our eyes and using to control the Mouse cursor movements. The paper presents how we can control the movement of Mouse cursor by our eye movements by using Viola-Jones Algorithm. Our Simple thesis make our eyes to control the cursor as an application to be used as what one can called as virtual mouse and can be used to perform many more applications. Simplifying the process by using High end Software technology to track the movement of the eyes here we are using Matlab13 for eye tracking. This system provides fast and real time results with the accuracy of eye tracking were found to be approximately one degree of visual angle. It is specially designed for the Handicap people to use Computer or for controlling the wheelchair. The accuracy of eye tracking was found to be approximately one degree of visual angle. Eye tracking hence can make a revolution in the everyday life of people.
I. INTRODUCTION

Computer mouse is a device which usually everyone use now a days, and also it has gained very high demand and popularity in each and every field of technology because of its easy to use mechanism and simple methodology. This popularity started a new revolution in technology advancement and development of graphical user interfaced based operating system like Microsoft windows 95 and Mandriva (Linux based System) etc. The device convert the relative movement of mouse with respect to the base surface and obtain inputs the two-dimensional coordinates (X, Y) to the device controller to start the movement of cursor so that will start locating the objects placed. When the mouse is triggered or any firing of event or any activity is performed the mouse automatically generates signals whenever we press any button on mouse these events are already programmed so eventually they will occur when any click event is introduced. Talking about the Limitations and problems, the main limitation of this device is the lack of usability for the people who are with disabilities including limb paralysis, without hands and those who lose their limbs in any accidents or poor development of body due to deformity, birth defects. Such users face difficulties, problems and inability to hold or moving the mouse as how normal users perform it or use it. They face problems to use that mouse so overcoming to such problems we upgraded our mouse to a next level and named as eye tracking cursor or mouse.

The eye tracking systems give them enhanced usability by tracking the eye movements mostly it track the movement of pupil present in our eye and to capture the details of relative position of the pupil of the disabled users and use the co-ordinates information to move the mouse cursor on the screen and help them use computers easily in spite of their disabilities. We have used camera and high precision monitor mounted telescopic cameras so to capture every movement of eye and pupil. The camera detects the movement of the pupil after the calibration process is performed successfully with few training sessions and tests which records reference points given by the system especially the center of pupil. Once the training is performed the coordinates are recorded and then that coordinates are get plotted on our computer screen. This process is performed within a fraction of seconds for many times, process is so fast that we can have a continuous movement of cursor when we move our eye pupil. Depending on lightning conditions and environmental fundamentals high standards and fast response cameras and censor are used so that we can have continuous flow of data to our computer without any interrupt. Effective approach using usage of techniques like viola jones algorithm which conclude major part for tracking of eyes pupil coordinates and help them in plotting. the process is done by picking up the movement of eyes pupil and the reflected infrared light from the surface of the cornea which is considered as the reference point as cornea is considered as fixed point. There are many more methods like Hough man circle detection and KNN. This idea of eye tracking cursor or mouse will sourly help in many fields like medical, defense, gaming industries and research.
organization or industries. Our aim is to take the mouse to next level and make it so easy and comfortable to use.

II. PROCEDURE FOR EYE TRACKING
Here we have used Viola-Jones algorithm for circle detection to sense image of eyeball using a web-cam mounted on head gear to continuously take the input of the video frames to detect the center of eye and marking the center so that even if there are some delay we can monitor the center of eyes and this relative position is then feed to the cursor movement so that the cursor of mouse can be controlled through our movement of eyes. In our experimental setup we have used a web cam mounted on a head gear which is basically a sunglass on which using a flexible wire mounted the web-cam to take close up live video of the eye. Following figure shows the photograph of the hardware device we have used to perform experiments. Along with the web-cam we have used infrared LED’s to illuminate the eyes so as to provide proper source of light to capture a clear image of the eye so as to illuminate the eyes known as dark pupil illumination. This provides complete absorption of the IR rays into the cornea of the eyes so as to eliminate dark-pupil illumination. We have used infrared rays as compared to normal light so as to eliminate specular reflection caused when visible light is used instead. This causes clear image of the eyes so as to detect the center of the cornea so as to eliminate the errors caused due to reflections. We have used image acquisition toolbox in MATLAB enables the user to capture, trigger, preview configure the image acquisition properties, Image acquisition toolbox works on the principle that the application detects the movement in a scene by performing pixel-to-pixel comparison in pairs of incoming image frames.

III. EXPERIMENTAL TESTING

![Figure 1: Hardware Device Used](image)
Here we have used this kit to perform all experimental testing of this project and to perform all the simulations to get the desired results.-Our kit works on the principal of Viola jones Algorithm to detect the center of the eye.-We have the simulation results and performed this process successfully.

This image observed in simulation is the detected center of the eye. If nothing moves in the scene, pixel values remain the same in each frame. When something moves in the image, the application fig displays the pixels that have changed values. After the image is acquired using image acquisition toolbox now we move towards our aim to detect the center of the eye first we take out the region of eye from the
image in which we have to detect the center, crop the image of eye removing the side portions then find the co-ordinates of the center of the eye, remove the noise or any other objects in the image to find the center of the eye using viola-Jones algorithm. The complete block diagram of eye tracking cursor is as shown in fig.

![Figure 2: System Block Diagram](image)

There are two parameters extracted from the live video stream input for triggering mouse activities. First is the distance and the second is the position of the cell containing center of the eye. This information can be used to calculate the direction and angel with which the cursor moves. Once the center is located now mark the center as shown in the fig so as when the iris moves the center is marked as to avoid the delay cause due to movements now map the co-ordinates of this center with the cursor movements. When the mapping is performed now the user can control the cursor of the laptop with the movements of his eyes.

**IV. FLOW CHART & ALGORITHM**

![Flow Chart](image)
ALGORITHM USED
Viola-Jones algorithm is basically used for object detection framework and it is very first object detection framework techniques which provide competitive object detection rates in real-time. Basically this technique is developed for detecting variety of objects and further this technique gets expanded. To solve the problems in face detection. Algorithm can be developed in open-cv as well as Matlab. Basic problem is to detect the face and object, and as we know that it is very easy for human but it is very hard and difficult for a computer as computer required constraints and instruction so to make this task easy viola-Jones algorithm come to existence as Viola Jones requires full view frontal upright faces. Thus in order to detect all coordinated the entire face must be covered and pointed towards camera. Basically viola-Jones does the work of taking pictures of different objects and it convert them in coordinates system so that the computer can understand the data, once the coordinates are get plotted we can access the position and movement of any object and so on. Viola-Jones algorithm can applied on stilled objects as well as moving objects.in case of face detection our different objects like nose, ears, mouth are stilled but in case of eye the pupil moves here and there so for that viola-Jones algorithm can be applied and can detect the relative motion and position of eyes pupil. As viola-Jones algorithm face problems in detection of pupil in low lighting condition or in accurate and insufficient data. Detector used in this algorithm device are mostly effective in frontal images of faces.it can hardly cope up with 45 face rotation both around the vertical and horizontal axis. Highly sensitive to lightning conditions as pupil is black and cannot be recognize low light conditions.

Feature types and evaluation: -
The characteristics of Viola–Jones algorithm which make it a good and accurate detection algorithm are:

- Robust – very high detection rate & very low false- positive rate always.
- Real time – For practical applications at least 2 frames per second must be processed.
- Face detection only (not recognition) - The goal is to distinguish faces from non-faces.

Algorithm follows three stages:-

i.) Haar Feature Selection
ii.) Creating an Integral Image
iii.) Ada-boost Training

V. SIMULATION RESULTS
We have successfully processed the images using image acquisition toolbox and the viola jones eye detection algorithm was used to to detect the co-ordinates of the center of the eye from the live video stream. All the simulation was performed on a standard laptop with I3 processor clocked at 2.4 GHz having 4GB Ram and standard on board graphic processing. Detected the center of the eye using our algorithm & mapped with the cursor movements.
VI. CONCLUSION & FUTURE SCOPE

The Use of Viola-Jones algorithm in image processing proved to be practically successful with few trials and efforts. This technology has a wide range of use and have potential to take it to some new extents if worked upon without the use of high end hardware at some reduced cost which proves to be cost effective and useful for the handicapped people and lot of applications in wide range of industries ranging from medical research to advertisement industry to automobile sector.

Eye tracking has a lot of future scope where one can control the LCD in automobile with the movement of their eyes, stress free driving. It can also be used in medical industries while performing high end operations to control the pc or its various operation even it can be used by astronauts in space while in their spacesuits to control the various operations inside their suits. This technology has no limits to exceed.

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VIII. REFERENCES


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