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Eye Tracking System using Matlab

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Abstract: ***There are many people around us who suffer from diseases like paralysis, quadriplegia due to which they cannot move their hands and legs. People suffering from such diseases need a person to be with them all the time to understand their needs and assist them. So, for their aid we want to implement an EYE DIRECTIVE WHEEL CHAIR, which moves in the direction based on the movement of eye balls of the person, helping in mobility. For this project we are designing a system called EYE TRACKING SYSTEM. This system consists of a camera, which is mounted on the wheel chair, which captures the movement of the eye balls of the person continuously. And these images are processed by a simulation software called MATLAB. This directs the motion of the EYE DIRECTIVE WHEEL CHAIR. When the person looks in a direction, the angle of rotation of the eyeball is calculated using MATLAB by processing the images continuously captured by the camera. When the person moves his eye balls in left direction, it shows to move left. Similarly, if he moves his eye balls in right direction, it shows move right. It shows move forward when eye balls or looking straight. And in every other situation it shows stop.***
Keywords: paralysis, quadriplegia, mobility, simulation, MATLAB.

I. INTRODUCTION

People suffering from diseases like paralysis, quadriplegia cannot move from their place as their four limbs are immobile. People like them constantly need someone for assistance. They need wheelchairs for their mobility, along with wheel chair they also need a person for their aid. So, EYE DIRECTIVE WHEEL CHAIR can be a great help for people like them. People suffering from such diseases can still control the movement of their eyeballs which inspired us to develop eye- controlled electric wheel chair.

This eye directive wheel chair can make their lives simple and easy. With the help of eye directive wheel chair, they can move based on the movement of direction of their eye balls. This wheel chair is eco- friendly, cost effective, less power dissipation and also can be fabricated with few resources. A web camera is mounted on the wheelchair, which constantly captures images of the eye balls, which is connected to a laptop with whose help we can move the wheelchair in our desired direction. This wheel chair can move forward, left and right with our eye movements and we can start and stop by blinking.

EYE TRACKING SYSTEM is a part of the eye directive wheel chair. In eye tracking system, we perform simulation using the simulation software MATLAB, where the series of images captured by the web camera mounted on the wheelchair are read and then processed to give the direction in which the user is looking at.

Eye tracking is a method which measures the movement of the user's pupil by which we come to know two things. Firstly, we can know where the user is looking at any given instant and secondly, we can know the sequence in which the user's eyes shifted from one point to another. Eye tracking is the process of tracking the absolute point of graze i.e., POG which refers to the point where the person's graze is concentrated in the images. When the user is looking in left direction, then the images captured are processed and display the position of the eye ball exactly and the direction is determined.

II. LITERATURE SURVEY

A. Human Eye Tracking and Related Issues: A Review

In this paper, different methods of eye tracking are discussed and then compared. In this paper human eye anatomy and physiology is also discussed because before discussing eye tracking, we must also learn human eye anatomy and the different movements involved with the human eye. Eye movements are basically categorized into 2 categories.

1) Stabilizing movements
2) Saccadic movements

Stabilizing movements are the movements aimed at keeping the image on the retina or the eye in place, whereas Saccadic movements are the movements that shift the eye around the visual field, bringing things focused into the acute vision area. Eye tracking methods can be classified into 2 types. Electro-oculography, IR-reflection oculography, and head mounted video systems are all used to measure angular eye location relative to the head, they can be classified as one type. And those that use table-top video systems and the magnetic scleral search coil approach to determine eye position in relation to the environment as other type.

B. Survey Paper on Eye Gaze Tracking Methods and Techniques

In this paper, eye tracking and eye gazing methods and techniques are discussed. The measure of movement of eye is known as Eye tracking and the analysis of eye tracking information is known as Gaze tracking. The applications of gaze tracking are in robotics, psychological studies and cognitive science. Oculography is the recording of the eye position and eye movement. The different types of oculography methods are used in eye tracking. Those types are:

1) Electro-oculography
2) Scleral Search Coils
3) Infrared oculography
4) Video-based oculography

The data obtained from eye region and head position is used to obtain the direction of graze and we can detect the eye location from image data. The eye gaze tracking methods are divided into two types. One is feature based and the other is appearance based. In feature-based method, the local feature of eye that is less sensitive to variation in illumination and view point is identified. The gaze estimation accuracy decreases when pupil and iris features are not available correctly. In appearance-based method, they detect and track the photometric appearance. By mapping image data to screen coordinates, image content can be used to predict gaze direction, appearance-based methods are used.

III. PROPOSED SYSTEM

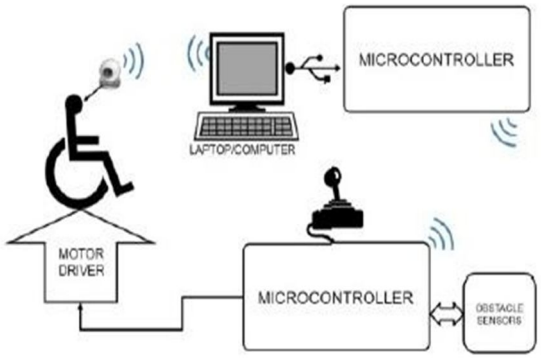

Fig.1 Block diagram of our proposed system

The above figure shows the block diagram of the proposed eye tracking system. The main components required are wireless camera, computer base station, micro controller and motor drive. In the image capturing module, the images acquired with the wireless camera are forwarded to the base station for further processing. In the microprocessor interfacing, the generated electric digital output from the base station is used to direct the motors of the wheel chair. Microprocessor also takes care of user input and the obstacles.

Firstly, the wireless camera and the laptop will track the eye movement. The microprocessor interfaced receives the output from the laptop, transforms it into signals to transmit it to the eye-directive wheelchair's wheel for mobility. And the pressure and object detection sensors connected to the microprocessor will provide required feedback for the proper working of the system. Lastly, the motor drivers are interfaced with wheel chair directly and these drivers drive the motors according to the information received from the microcontroller.

The need of our project is to continuously observe the frames and analyse them to assess the motion. On a per-frame basis, it's scarcely possible to do so much of processing. As a result, we make an effort to sample every 25th frame. As a result, every 25th frame is captured and processed as a snapshot. These snapshots were taken with the 'getsnapshot' command.

Because we don't need colour information to detect eye feature points, the image is later transformed to grayscale. In fact, the conversion facilitates detection. The image is then contrast stretched with the 'imadjust' command, magnifying the eye feature points important for the relevance by making darker parts even darker.

The Viola-Jones Object Detection Framework is used to detect faces. This algorithm was originally designed to detect faces, but it is now used to detect a wide range of objects. The technique is meant to work with the sum of pixels in the kernel. A face can be detected using the Viola-Jones technique by finding a rectangle. The enormous rectangle is then broken down into a series of smaller rectangles, each of which represents a distinct characteristic of a human face.

This algorithm was used by the 'cascadeobjectdetector on MATLAB to extract and detect the person's eyes. And the rectangle is plotted at the correct position of the eye to show the identified eye.

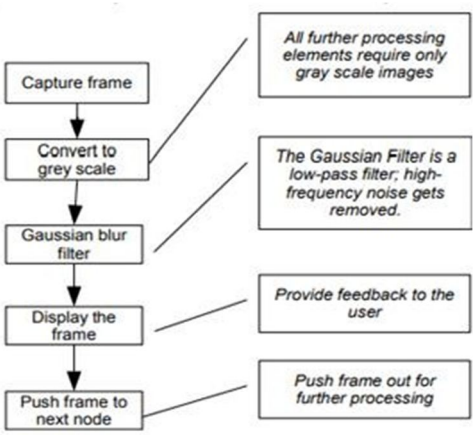

Fig.2 Processing Done on Captured Frame.

A. Image Processing

All we do at first is check to see if any ocular feature points have been discovered. If this isn't the case, set a flag and show it on the screen. To increase detection accuracy, we tried to ignore every other spot on the screen other than the person's actual eye. The rationale for this is that if someone other than a quadriplegic pass in front of the camera, the system should not be harmed. Certain items that appear to be eyes should be shunned as well. We took considered the eye's height and length in order to accommodate this. After repeated testing, we identify the height and length of a genuine eye, and confined it around the threshold, and rejected the area exterior to it.

IV. ALGORITHM

The Viola-Jones object detection framework was the first to be proposed for providing competitive object detection rates in real-time. Paul Viola and Michael Jones proposed it in 2001. The problem of face detection inspired this system, which can also be trained to recognise a range of object classes. The full view frontal upright faces are required by the Viola-Jones method. And, for the face to be detected by the framework, the full face should be facing the cam and not inclined to one side or the other. The characteristics of Viola-Jones algorithm are robust, real-time and face detection. These characteristics make the algorithm a good detecting algorithm. This algorithm has 4 steps:

A. Haar Feature Selection
B. Creating an Integral Image
C. Adaboost Training
D. Cascading Classifiers.

V. RESULTS

Fig.3 Result 1

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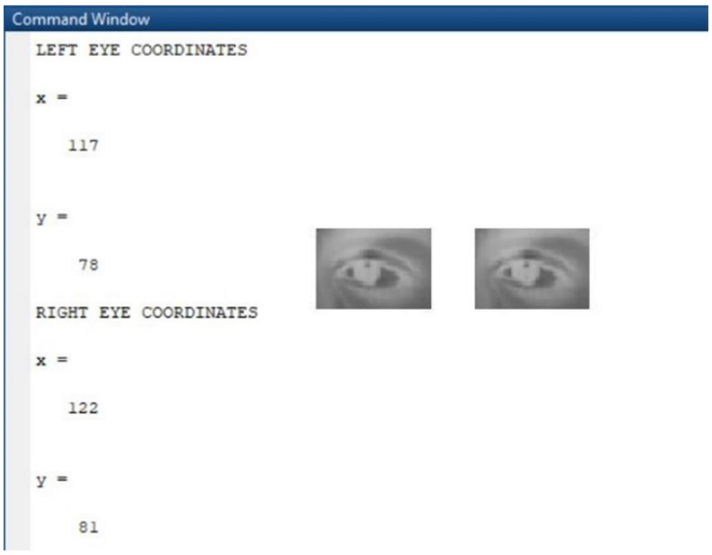


Fig.4 Result 2

Above figures illustrate the eye coordinates and the greyscale image of the eyes of the input image.

VI. CONCLUSION

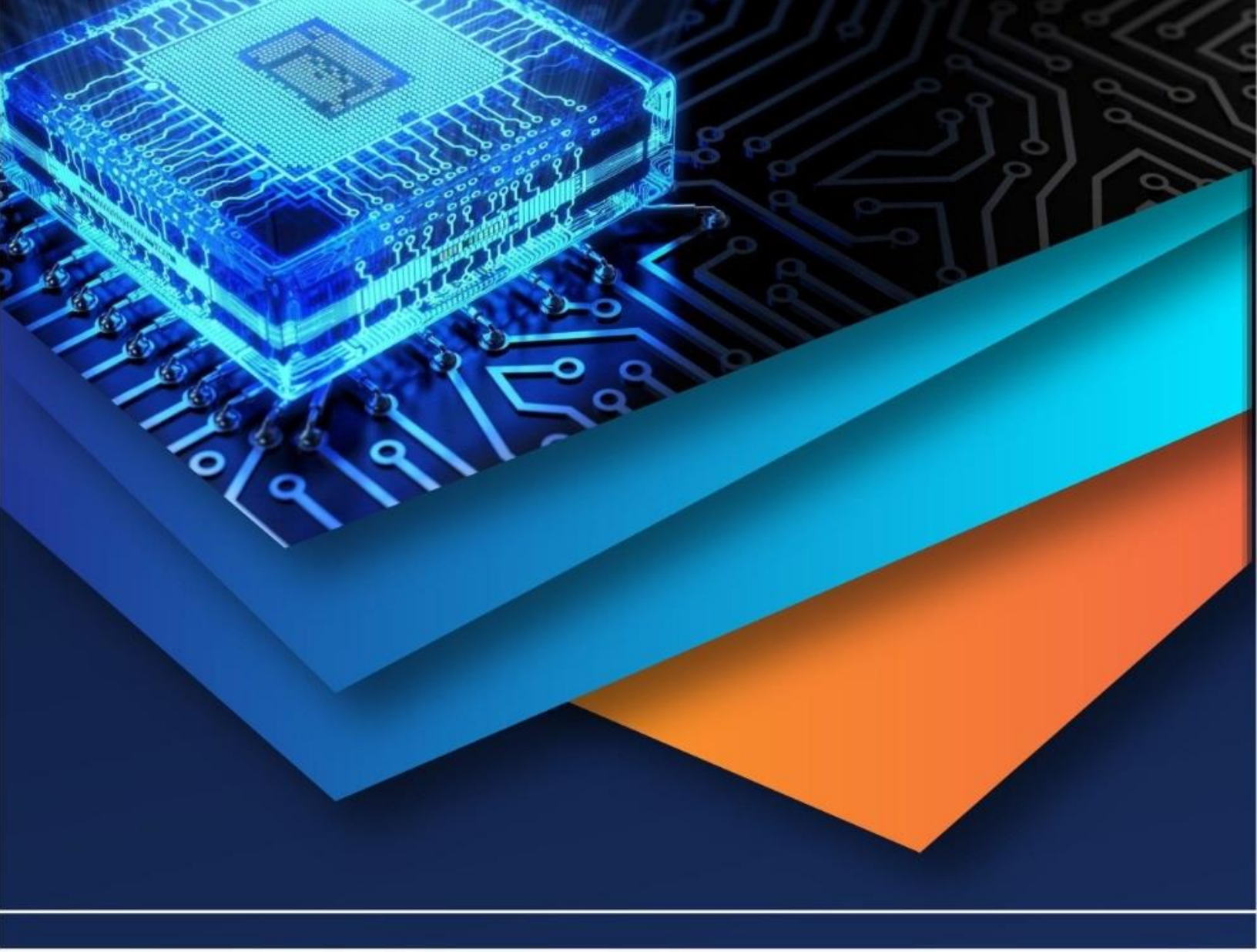
The eye tracking system works with the accuracy rate of 70-90%. The main aim of this project to contribute to the society in our little way possible by developing this system which can be a great help for people who lost self-mobility. This wheelchair can be controlled by the person's eye movements. The detection of pupil is done even on illumination if it covers the whole eye. This process works even in a little dark surrounding.

VII. FUTURE WORK

The simulations which we have done in this project can be extended in designing the eye directive wheel chair. The electric eye directive wheelchair can be design using this project.

REFERENCES

[1] K. T. V. Grattan, A. W. Palmer, and S. R. Sorrell (October 1986), Communication by Eye Closure-A Microcomputer-Based System for the Disabled', IEEE Transactions on Biomedical Engineering, Vol. BME-33, No. 10.
[2] Q.X. Nguyen and S. Jo (21st June 2012.)Electric wheelchair control using head pose free eye-gaze tracker, Electronics Letters, Vol. 48 No. 13
[3] Rory A. Cooper (July 1999) Intelligent Control of Power Wheelchairs', IEEE Engineering in medicine and Biology, 0739-51 75/95,
[4] Djoko Purwanto, Ronny Mardiyanto, Kohei Arai (2009), Electric wheelchair control with gaze direction and eye blinking', Artif Life Robotics, 14:397–400.
[5] Rinard et al. (Mar. 20, 1979)Method and Apparatus for monitoring the position of the eye', United States Patent, 4,145,122
[6] D. H. Ballard. Generalizing the hough transform to detect arbitrary shapes. Pattern Recognition.



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