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Eye Controlled Wheel Chair

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***Abstract* – To help paralysed people or patients suffering ALS, an eye movement controlled wheelchair provides a beneficial, efficient and advantageous solution for them to control their mobility. In this paper we describe a system that has a live acquisition feed of the eye. At regular intervals, the camera takes screenshots of the eye, after which the images are sent to a MATLAB script for pre-processing. The eye movement is detected using a camera which is attached to the wheelchair. This concept can be used for multiple applications, but this paper focuses the application to mobile and communication aid for handicapped patients suffering from quadriplegic and paraplegic diseases. The proposed system involves two stages; first eye movement detection and second, sending of control signals to the powered wheelchair.**

***Keywords* - wheelchair, eye-controlled, MATLAB, Digital image processing, Arduino, Hough transform, obstacle detection**

I. INTRODUCTION

About many million people in India suffer from limb and torso paralysis, with another million people suffering from paraplegia. In order to take care for different disabilities, various kinds of interface have been developed for wheelchair control: such as joystick control, head control. The idea is to develop a wheelchair capable of detecting these eye movements and power the wheelchair to move in a particular direction based on this. Another development to this wheelchair will also be its unique quality of obstacle detection which will make the wheelchair come to a standstill when it detects obstacles in a particular range. Already existing technologies like tongue controlled wheelchair, joystick controlled wheelchair, sip & puff based, EOG based and EMG based have various limitations while implementation on a practical level – like constant contact with the patient's skin. The eye movement controlled wheelchair is an advantageous and more useful project compared to these other variations.

II.LITERATURE REVIEW

Significant research has been conducted in the development of eye-movement based wheelchair control for people suffering from quadriplegia. One such technique has been described in where EOG was measured using electrodes attached to the face, and was used for wheelchair control. Another method is to use a contact lens with a magnetic coil or mirror in the eye. Again, this is quite intrusive. A different approach is to capture eye images with a headset as in. The most popular image processing method for tracking eyeball uses Hough transform. We experimented with this technique to understand its shortcomings.

1.Implementing Hough Transform:

The Hough Transform is a feature extraction technique that can be used to isolate the characteristics of a particular shape within an image. Using live acquisition technique, the camera captures images of the eye for a specified frame interval. The image is then converted from the RGB format into gray scale for further thresholding and transformation purposes. Here, only a specific part of the face i.e. the eye is captured and the image can be directly considered for processing. Now a binary image of the eye is created by defining a threshold value. If the grayscale value of a pixel exceeds the threshold value then it is set as white(1), else as black(0). The thresholding technique used here is a canny edge detector because it detects the strong edges well and produces a high SNR ratio. After edge detection, the Hough transform is used to detect all the circles in the eye region and to find the local maxima cells within a given radius to identify the pupil.

2. Shortcomings of Hough Transform:

The major disadvantage of image processing methods like the Hough Transform is that its efficiency is dependent on the quality of the input data. A denoising filter has to be used before the application of Hough Transform. The results vary with the size of the pupil and lighting conditions. The thresholds applied vary with different individuals. It fails on individuals wearing spectacles.

III. DESIGN AND SPECIFICATIONS

In Image Capturing Module, images are captured using wireless camera and are sent to the base station (computer/ laptop) for further processing. In Microprocessor Interfacing, the generated electric digital output from the base station is used to direct the motors of the wheelchair[03]. Microprocessor also takes care of the obstacles and the user inputs. The system's functional block diagram shown fig Wireless camera: Eye of the

user is captured with a pin hole wireless camera which transmits the images to the base station wirelessly. Computer Base station: The images received from the camera are processed using Open source Computer Vision library and the gaze movement is sent to the chair via X-Bee communication. Microcontroller: They are used to maintain wireless communication protocols and on the receiver side, it also takes care of obstacles and manual user inputs. Motor Driver: They provide the high current required to drive the motors.

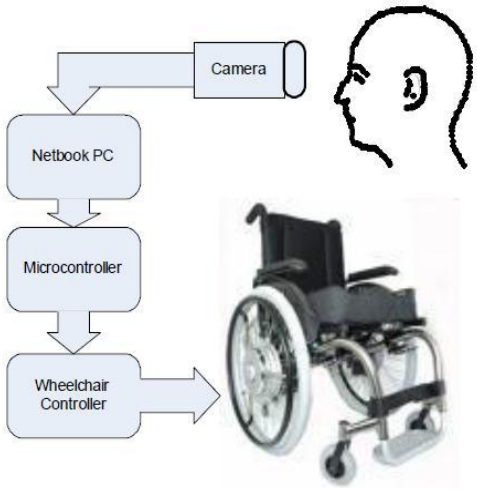

Fig 1. Block Diagram.

1. Hardware Description:

1.1 Arduino:

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world.The project is based on a family of microcontroller board designs and also by several other vendors, using various 8-bit Atmel AVR microcontrollers or 32-bit Atmel ARM processors.

These systems provide sets of digital and analog I/O pins that can be interfaced to various extension boards and other circuits.Theboards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino platform provides an integrated development environment (IDE) based on the Processing project, which includes support for C and C++ programming languages.

1.2 Digital Camera

A digital camera (Logitech C310) of a high resolution and higher fps is used to take a live feed from the eye which has to be digitally processed for further actions.

1.3 Motors

2 high torque, 45 rpm DC Motors are used to carry the load of the apparatus.

IV.SYSTEM DESIGN

A camera mounted on a helmet, takes images of the eye and digitally processes the image in MATLAB by using a specific algorithm where the pupil region of the eye is detected and based on the position of the pupil, a command is serially sent to the microcontroller where the motor performs different operations based on a decision based system.

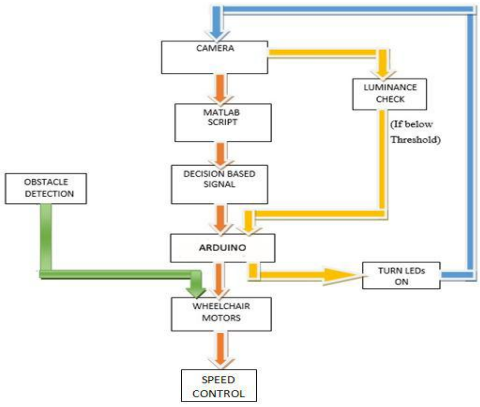

Fig 2. Flow Chart.

1. System Overview

This system is designed using WebCamera, Ultrasonic sensor, Arduino and Motor driver IC as shown in Fig 1. Eye pupil of patient is detected by Webcam and then processed using MATLAB software. Image acquisition toolbox is used for eye pupil detection. As per the movement of eye pupil, command to the Motor driver IC L293D is given through Arduino using serial interface.

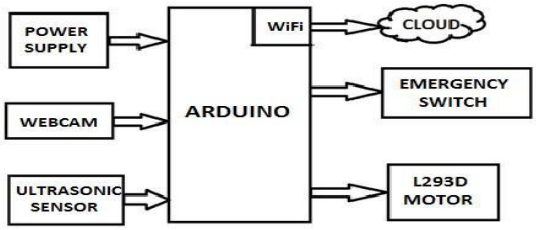

Fig 3. Block diagram of system.

Wheelchair is moved forward, backward, left or right according to the signal given by Arduino to the motor. If any obstacle comes on the path of wheelchair, it can be detected by ultrasonic sensor and wheelchair can be stopped immediately.

2.Working

For eye pupil detection, MATLAB program is designed such that, it monitors and reacts to eye movements. Based on a series of snapshots taken and thereafter processed, the motion of the patient's eyes are detectedand decision

to move the wheelchair in a particular direction is taken and communicated serially to Arduino Uno. Arduino receives the data, analyse it and send thecontrol signal to motor driving circuit, based on the location of eye pupil. This will decide motor to move either in forward, backward, left or right. Approximately one snapshot is taken every second and processed and based on the position of the feature points in previous snapshot and current snapshot, a movement is detected and this is communicated to the wheelchair assembly via the serial port. Ultrasonic sensor is used to detect obstacle in the path of the wheelchair. If any obstacle detected by ultrasonic sensor, it immediately stops the wheelchair. An additional camera is used which captures an image at the time of any kind of problem and sends that image to the responsible person using IOT.

V.EXPECTED RESULT

The position of iris and pupil will be detected and are produced using viola jones algorithm . After that they are processed using MATLAB. Then decision will be taken by Arduino for the given input image. As per the pupil movement motor will be moved either in LEFT, RIGHT, FORWARD and BACKWARD direction.

VI.CONCLUSION

This hardware along with the software can prove to be an effective system to make the life of the paralytic patients independent. The critical part of the system is image processing at real time which can be addressed byusing better high end image processing software. The most effective thing about project is, it eliminates the need of assistant for the patient. The aim of this system is to contribute to the society in a small way by setting out an idea for a system which could actually better the lives of millions of people across the globe.

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