International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 07 | July-2016 www.irjet.net p-ISSN: 2395-0072

Eye monitered wheelchair based on pupil detection for people suffering from quadriplegia

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Abstract - *This paper describes an eye tracking system to control the wheel chair assembly. This is used for the people suffering from Quadriplegia. This is the disease in which the person is unable to move his 4 limbs. The project is describes in four stages as image capturing and detection, image processing using matlab software, sending control signals to the DC motor, wheel movements according to DC motor. The user's eye movements are captured using a webcam mounted on goggle. It captures 30 frames continuously and by using IR module with circular Hough transform algorithm in the matlab software, we detected user's pupil. It is processed in matlab software. The matlab output gives the signal to move the DC motor; this signal is given to motor driver IC L293D for further wheel movements. The basic idea behind this project is to make a physically handicapped person self-dependent & confident.*

Key Words: **Quadriplegia, Finding pupil location, Circular Hough transform, wheel chair assembly.**

1. INTRODUCTION

Generally people suffering from a disease quadriplegia, a disease caused due to injury to spinal cord, accidents and nervous breakdown, are not able to move any body part. The word quadriplegia is Greek word which means quad is four and pelage is inability to move. The person suffering from disease is totally dependent on others for his every work. But they are able to move their eyes, tilt head and blinking of eyes. This is great opportunity to detect their eye and head movements. In these days several wheel chairs are made for handicapped people who work by joysticks and voice commands but they do not work for the people suffering from quadriplegia as they are not much capable physically. So the idea is to make a wheel chair assembly working on eye movements of the person wearing a goggle with webcam continuously checking his eye movements and giving signals to wheels to move in desired direction. The PIC Microcontroller 16F877A is used.

1.1 Problem Statement

To design a wheel chair assembly with help of eye pupil movements of a person suffering disease quadriplegia to make them self dependent and rebuilt their self confidence and to make them move to in desired direction.

1.2 Objectives

- To detect eye pupil movement of a quadriplegia person.
- To move self dependently wherever he/she wants.

2. LITERATURE SURVEY

There are many people suffering from quadriplegia. According to a survey 11000 people suffer from the same in a 10000000 people. Before this a lot of previous works done on an electric wheel chair. They gave us idea for current work. The greatest work done is by Stephen Hawking for this. But it costs a lot; it is not possible for a common person to buy this chair. So we made an analysis for previous works. In 1st method it is proposed to control wheel chair. It goes to the desired goal point and user is allowed to look around freely while navigation. In second method by using eye movements and gaze direction are used to control the wheelchair but user has to carry lots of weight always with him. By using such ideas which are listed in the survey we designed an electric wheel chair for paralyzed people based on Pupil detection technology.

3. BLOCK DIAGRAM

The block diagram of overall system is as shown in fig 1.

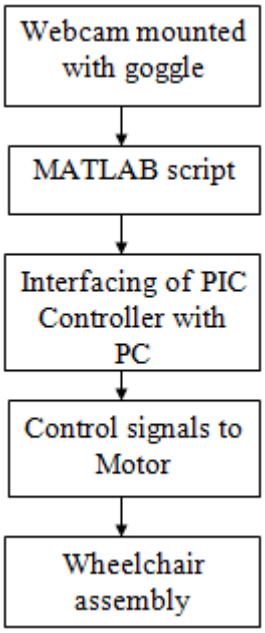

Fig-1: Block diagram of system

4. DESCRIPTION

The aim of the project is to develop a wheel chair that can be controlled by the pupil of the person sitting on it to move freely anytime & anywhere .This project consists of main three components:

A. Detection of eye movement.
B. MATLAB script.
C. PIC Microcontroller (16F877A) controlled wheel chair.

A. Detection of Eye movement:

An input is taken from goggle mounted with webcam. The webcam is connected to the person computer which is running a MATLAB. A webcam captures continuous snapshots of each 30th frame are taken from the points and are saved i.e. capture 1snapshots of each second & process it.

A further decision is based on the MATLAB & PIC Microcontroller (16F877A). Programming is done on the controller. The first part is to detect the eye movement & second part is of motor drive section.

Fig-2: Web cam mounted with goggle

B. MATLAB script:

We take continuous snapshots of each 30th frame. The frame size is too small and the color is too dark, so it is difficult to process, so it is converted from RGB (red, green, and blue) to grey frames. For the perfect result each frame to make darker region dark and brighter region bright. The MATLAB processed output gives us the person's eye is detected for the processing in MATLAB13.

We use the circular Hough transform algorithm. A circle having radius r and (a, b) is center then circle is described by

$$(x-a)^2 + (y-b)^2 = r^2$$

This equation is applicable for 2D point (x, y) is fixed. In the 3D space many conic surfaces are intersected and circle parameters are identified. They are divided into 2 stages. First stage is finding center of circle by fixing radius and second stage is find optimal radius in 1D parameters stage

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C. PIC Controller controlled wheel chair:

The control signal by the MATLAB is given to the controller. The RS 232 is used for interfacing between computer and controller. The controller gives the signal to motor driver IC L293D which is 16 pin IC. It consists of a set of two DC motors simultaneously in left and right direction.

Fig.-3: PIC Controller (16F877A)

The table-1 shows position of eye pupil and wheelchair movement for that position

Table-1: Position of eye pupil and wheelchair movement

Sr. no.	Eye pupil position	Wheelchair movement
1	Center	Forward
2	Top right	Right
3	Bottom left	Left
4	Top left	Stop

- For the right side movement of wheelchair right side motor stops and left side motor works.
- For the left side movement of wheelchair left side motor stops and right side motor works.

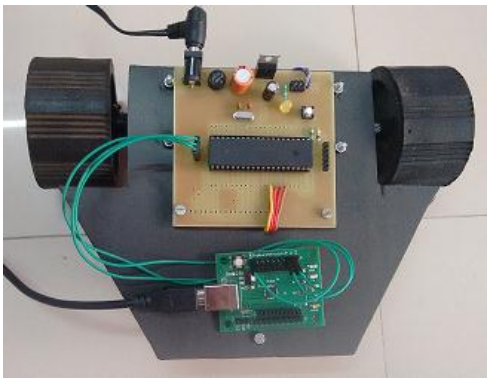

Fig-4: Wheelchair assembly

5. CONCLUSIONS

This project consists of eye tracking webcam, DC motors, PIC controller, image processing unit and hardware unit. The system works on the detection of pupil using webcam which is continuously starring at patient's eye. Image processing is done with MATLAB and the images are obtained. This system is set up for paralyzed or handicapped people especially for quadriplegia affected people. The combination of the hardware and software makes the life of paralyzed people self dependant. This system was designed and found to be working successfully.

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