SMART WHEELCHAIR WITH OBJECT DETECTION USING DEEP LEARNING

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Abstract – *This paper describes a new method to control the wheelchair for disabled people using image processing. The statistics propose that there are around 40 cases per million suffering from quadriplegic and paraplegic diseases. The great person Stephan Hawking have been experiencing this phenomenon. Our project is helping to make lives from this type of phenomenon. In our project, an eye control device based on image processing is designed to be used as an intelligent mobility aid for the paralyzed. In our proposed system ultrasonic is used to detect any obstacle in the path of the wheelchair. Depends on the eyeball movement the wheelchair will be moved. The camera is mounted on a wheelchair for capturing the eye movement. The captured eye images send to PC and controlled by MATLAB, which will send to Arduino circuit to manipulate to control the motors and allow to move the wheelchair in particular direction. The proposed system mainly work on two different stages; first to detect the eye movement and second, sending control a signal for movement to the wheelchair.*

Key Words: **Arduino, Automatic wheelchair, eye movement detection, servo motor, MATLAB.**

1.   INTRODUCTION

Eye gesture controlled wheelchair is a very important device for the physically disabled, paralyzed patient and mentally handicapped people. The normal people driving wheelchair is difficult but for the patient who is unable to walk or handicapped are driving wheelchair is too difficult than normal people, they required a large amount of energy using physical strength, to turn the wheels. Eye gesture wheelchair is the main device for the patient with severe disabilities or also for the elderly. The ability to move freely in anywhere is highly valued by all patient/people. Nowadays there are many different techniques used for controlled wheelchair such as Electrooculogram (EOG), Electrocardiogram (ECG) and Electroencephalogram (EEG) based, eyeball sensing techniques.

In Quadriplegia, paralysis patient can move his eyes only. In order to help that type of people "Eye gesture controlled the wheelchair using Arduino" comes into existence. With the help of this techniques, different forms of the wheelchair can be controlled. To control the whole wheelchair system we used Arduino controller with laptop or PC interface with the small camera is attached to the wheelchair for continuously capture the eye movement.

2.   PROBLEM STATEMENT

A clinical survey shows that in every year 9-10% of people severely disabled in accident cases. The Disabled person having some difficulties are comes in handling and operating the wheelchair. That means that they required a large amount of energy, motor skill and strength to operate the wheelchair that used in the existing system. Our main motto is to design or to develop the product user-friendly, which requires no training.

3.   LITERATURE REVIEW

The existing system uses input devices such as keyboard, mouse, joystick and other input devices for interaction with automated devices need among hand gestures. In this paper, an input device is a human eye only, which is proposed for a handicapped person. The existing system and their drawbacks for handicap person are categorized below;

(1) Eye gesture controlled intelligent wheelchair using Electrooculography (EOG), which utilizes potential from user's body action. In this system, intelligent techniques used the movement of eyes retina and that resulting signal is called electro-oculogram.

    Limitation of this method is it requires human effort to navigate devices which is difficult for the patient with deformities.

(2) Voice Controlled Intelligent Wheelchair, This paper developed the voice-controlled wheelchair which uses the voice command as the interface.it has 3 part 1] Running until next command is input

2] Turning or rotating

3] Stopping.

It uses two type of verification commands to prevent the wrong reaction.

    Limitation of this paper is the speed of speech, background noise, speaking style, and accuracy.

(3) Implementation of Head and Finger movement Based automatic Wheel Chair. This system uses the head and finger to move the wheelchair. The type of artificial aid physically

disturbs people in order to move or in order to guide the wheelchair.

Limitation of this paper is various condition should be checked by patients, it proves the burden to the user and less accuracy.

(4) Sensor Based Automated Wheelchair. This system uses an ultrasonic sensor to detect any obstacle in the path of the wheelchair. In this system, they used MPLAB IDE for programming to move the wheelchair in any direction.

Limitation of this paper is the movement is depends on the accelerometer tilt section. Less accuracy.

(5) Eyeball Gesture Controlled Automatic Wheelchair Using Deep Learning. In this system, they use eyeball gesture for the movement of the wheelchair with the help of the camera. A Camera captures the images and sends to the controller for movement in the direction to the servo motor.

Limitation of this topic is moderate accuracy and misclassified cases.

4.   DESIGN MODULE

We use a small chassis as a wheelchair to test our system working start to end. Arduino controller is used to controlling this chassis.

The system contains five main parts:-

1)   A small webcam and PC interface is used for tracking the movement of the user's eye.

2)   The Arduino board, take input from PC and convert the digital output to the electric signal.

3)   L293D, a dual half bridge motor driver IC, which uses the signal from Arduino to control DC motor.

4)   A DC motor is attached to the wheels.

5)   The ultrasonic sensor used to detect any obstacle in the path between the wheelchairs.
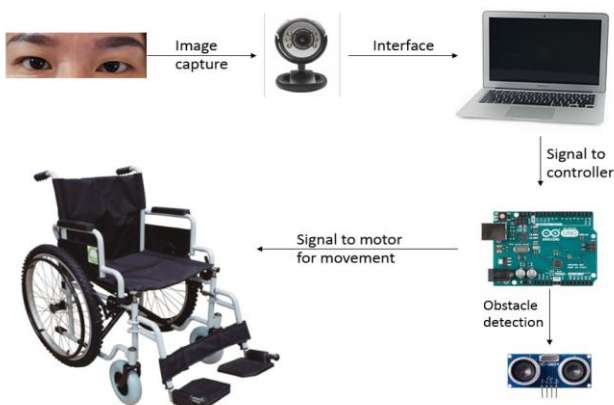

Fig -1: Design Module

In this system, there is mandatory to capture eye images and extract the images into the frame and interface with our machine or PC. If the extracted image and the reference image matches then system sends the signal to the microcontroller for following the requested command. Motor driver can directly move the wheelchair in the desired direction and that control by Arduino. The image processing is done by MATLAB library is used to detect the eye movement.

4.1.   HARDWARE DESCRIPTION

A) **Arduino**

Arduino is the main part or brain of our system. Arduino is a simple microcontroller board that used to make computers that drive all the function and creative projects alike.

B)   **Camera**

The Camera is used for capture the eye images and send that data to the main system or in PC.

C)   **USB Cable**

USB is a serial communication interface through which we can send or information transmission from one to another at a time.

D)   **Ultrasonic Sensor**

As name indicates, it measure distance by using ultrasonic waves. Sensor emit the data from waves and reflect back to the target. Ultrasonic sensor measure the distance to the target by measuring the time between emission and reception.

5.   PROPOSED METHODOLOGY

According to the tracked location of the eye, in the direction is found to be based on motion. On the basis of this direction system determined, the command is sent to the motor control device via Arduino. With the help of below flow graph we can easily understand the work of this system:-
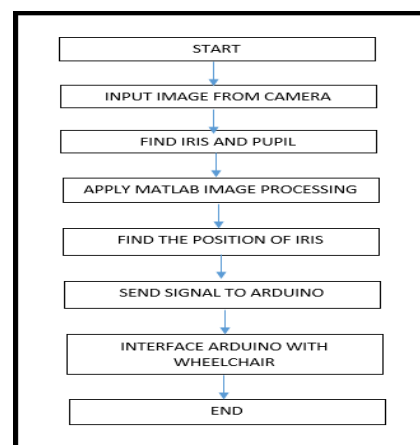

Fig -2: Flow graph of the system

6.   ADVANTAGES

▢   Less expensive than the conventional wheelchair.

▢   Obstacle detection using the Ultrasonic sensor.

▢   Front wheels drive to provide high maneuverability.

▢   Smooth operation.

7.   CONCLUSIONS

In this system, we present an innovative idea in a regular or ordinary wheelchair by adding some new features like motor mechanism and make it easy to use for handicapped people or quadriplegic and paraplegic diseases people. The main Aim of this system is to help the handicapped people to move everywhere freely, with the help of eye gesture control wheelchair.

The future scope is to develop a mobile App based wheelchair with some additional facility like disable person can do their many works with the help of that mobile App i.e., appliances operation getting up from his position.

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