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Head Motion Controlled Robotic Wheel Chair

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Abstract: ***The challenging problem faced by the paralyzed people is their independent mobility. They need an external help to perform their daily activities. The main objective of this project is to provide an automated system for disabled people. The wheel chair will work based on the head movement of the user. The recognized gestures are used to generate motion control commands to the controller so that it can control the motion of the wheel chair according to the user intention. The head movement is the gesture which can be performed by the quadriplegic patients whose body parts below the neck is paralyzed. So the head movement is possible for the patients. The wheelchair includes the accelerometer sensor which detects the movement of head and the controller will process the signal and will transmit to the wheel chair for its navigation. The wheel chair is implemented in a cost effective way which reduces the complexity in the design. It is intended to be used as a human-friendly interface for elderly and disabled people to operate wheelchair using their head gestures rather than their hands. This autonomous navigation ensures safety, flexibility, mobility, obstacle avoidance and an intelligent interface for the users.***

Keywords: Accelerometer, Gestures, Head movement, Navigation, Quadriplegia**.**

I. INTRODUCTION

Rehabilitation Engineering is the application of engineering principles and technology in the field to uplift the people with disabilities. Quadriplegics are persons who are not able to use any of the extremities. The reasons for such decreased motion possibilities can be due to stroke, arthritis, high blood pressure, degenerative diseases of bones and joints and cases of paralysis and birth defects and the quadriplegia appears as a consequence of accidents or age. The robotic wheelchair supports through the movements of head. Head movements control is particularly useful for severely-handicapped people who have spinal cord injury or quadriplegia which cannot use their hands to control the wheelchair. This will be an effective method to eradicate the social problems faced by the physiologically challenged persons. This is directly interfering with the social relevance of the society. The mobility aid which will help to an extend for the challenged people for their locomotion. Usually these peoples are bedridden and difficult for their movements from their bed. It is very difficult to make them move from one place to another. The main reason behind the implementation of this project is to give a helping hand for the sufferings of the challenged people. They have no way to get rid of from the bed due to their lack of movements. Degeneration of nerve cells and muscle fibers can lead to the challenges. To defeat the challenges is the main objective of this project. By designing the wheelchair for the challenged people can reduce the sufferings of the patients to an extent. Powered wheelchairs play a vital role in bringing independence to the severely mobility–impaired and allow people to get on with their activities of daily living. Many people who suffer from mobility–impairments rely on powered wheelchairs to get out and about.

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II. BLOCK DIAGRAM

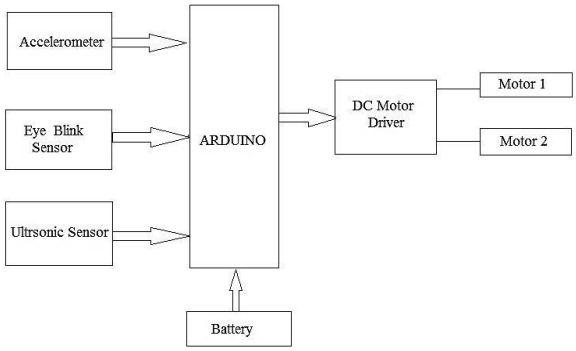

Figure 1: Overall architecture of robotic wheel chair

Fig 1 shows the overall structure of the assist systems that is composed of sensor design, the electronic module and the mechanical module. The sensor design comprises of accelerometer. The electronic module has Arduino microcontroller. And the mechanical module consists of driver IC and motors.

III. ACCELEROMETER

An accelerometer is an integrated device that measures proper acceleration, the acceleration experienced relative to freefall. Single- and multi-axis models are available to detect magnitude and direction of the acceleration as a vector quantity, and can be used to sense orientation, acceleration, vibration shock, and falling. Micro machined accelerometers are increasingly present in portable electronic devices and video game controllers, to detect the position of the device or provide for game input. It is a capable of measuring how fast the speed of object is changing. It generates analog voltage as the output which is used as an input to the control system. The accelerometer used in this automated system is ADXL345. It is a three axis accelerometer, which senses the tilt in two directions only. The supply voltage ranges from 2 to 3.6v.

IV. EYE BLINK SENSOR

The voluntary and non-voluntary motion can be identified by the eye blink movements. Eye blink sensor senses whether eye is open or closed. The eye-blink sensor works by illuminating the eye and/or eyelid area with infrared light and then monitoring the changes in the reflected light using a phototransistor and differentiator circuit.

5V (High) → L E D ON When Eye is close.
0V (Low) → L E D OFF when Eye is open.

V. OBSTACLE SENSOR

The obstacle sensor in the chair helps to stop the wheel chair if there is any wall or any other obstacles in front of the wheel. Here ultrasonic module SR04 is used to sense the obstacles in the path. The obstacle sensor is placed at the bottom of the wheelchair. The obstacle sensor stops the wheelchair completely and it must be reset to operate again.

VI. MOTOR

Motor receives power from the Motor driver IC. This power is utilized to do physical works, for example move the Wheel chair. DC motor orientation, speed and operation can be controlled with microcontroller. We can start it, stop it or make it go either in clockwise or anti clock wise direction. The speed of the Motor is controlled by the help of PWM (pulse width modulation).

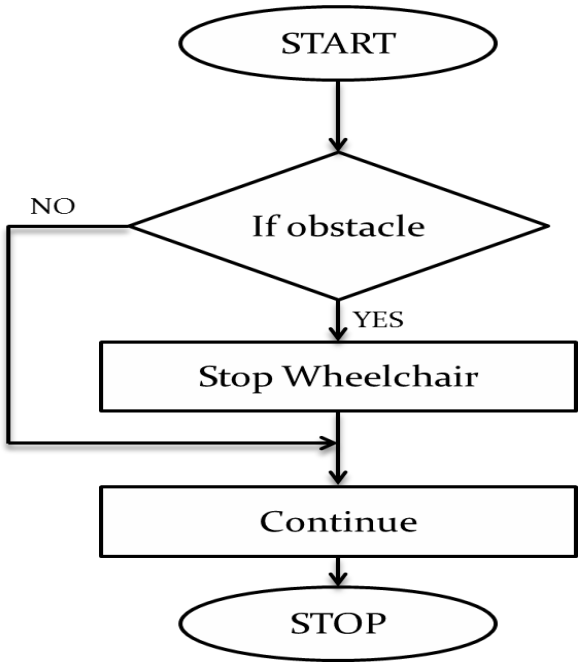

Fig 2: Flowchart Representing the Working of the Obstacle Sensor

VII. MOTOR DRIVER

L293D is a dual H-Bridge driver, so with one IC we can interface two DC motors which can be

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controlled in both clockwise and counter clockwise direction and a motor with fixed direction of motion. All I/Os are used to connect four motors. L293D has output current of 600mA and peak output current of 1.2A per channel. Moreover for protection of circuit from back EMF output diodes are included IC. The output supply has a wide range from 4.5V to 36V, which makes L293D a best choice for DC motor driver.

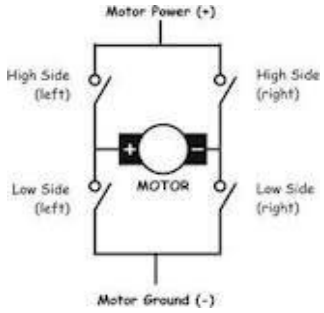

Figure 3: Driver IC

Driver IC has four switching elements within the bridge. These four elements are often called, high side left, high side right, low side right, and low side left (when traversing in clockwise order).

The switches are turned on in pairs, either high left and lower right, or lower left and high right, but never both switches on the same "side" of the bridge.

VIII.MOTION RECOGNITION

This robotic wheel chair allows the patient to have a control over four different directions namely the forward, backward, right and left.

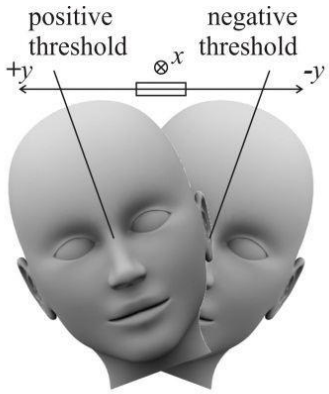

Figure 4: The position of the accelerometer relative to the head motion in right and left side.

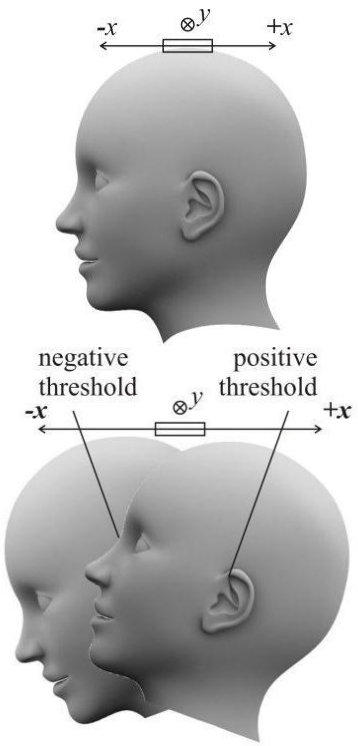

Figure 5: The position of the accelerometer relative to the head motion in forward and backward direction.

IX.ADVANTAGES

a. User Friendly
b. Helpful for the paralysis stroke people who don‘t have much stamina in the hands.
c. Reduces the human activity.
d. Reduces the physical strain.
e. Spontaneous output.

X.RESULT

The wheelchair that is controlled by the Accelerometer is successfully designed.

XI.CONCLUSION

This paper presents the model of a wheelchair that is controlled using accelerometer. The accelerometer is controlled by the head tilt motion and is used to steer the wheelchair. Along with making the movement and control of the wheelchair easy for a handicapped person we also try to give more independence to these people.

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