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Wheelchair Controlled By Head Motion

HAMSA REKHA S D[1], SHEETAL N[2]

Assistant professor, Department of EIE, Dr. AIT, Bangalore, India[1]

Assistant professor, Department of EIE, Dr. AIT, Bangalore, India[2]

Abstract: The Head motion controlled wheelchair is propelled by means of an electric motor rather than manually. Quadriplegics are one of the many physically disabled people that require such wheelchairs. They have paralysis of all four limbs and the torso that may be caused due to spinal cord injuries, strokes or cerebral palsy. They have no control over their hand movements and cannot grasp things or perform motions that might allow them independence over their movements. The tilting movements of the head in the four directions- forward, backward, right or left-would cause the wheelchair to move in the signaled directions. Quadriplegics rely on power wheelchairs for mobility, but the hands-free controller systems currently available are obtrusive and expensive. Smart wheelchair is an innovation that has an intention to create a difference for the activities of the people who are restricted by movement. This is an idea to ease those patients, who cannot perform hand movements in a way that can move a wheelchair. In this paper, we discuss about the working model of a head motion controlled wheelchair using Internet of things (IoT). The movement of the head is detected by MPU6050 and the signal is transmitted to the microcontroller. Then controller processes the signal and motion of wheelchair is enablesthe navigation. The wheelchair was capable of moving left, right, forward and backward direction and it is capable of doing tasks like navigation, obstacle detection, etc. using sensors and intelligence.

Keywords: Head motion, Quadriplegics, IoT, Wheelchair.

I. INTRODUCTION

In this paper, we have attempted our best to correlate between the advancement of technology and the human requirement, for human ease. The main aim is to control wheel chair through human head direction. This wheelchair is mainly designed for Quadriplegics and especially those people who can't utilize their hand to drag their wheel chair on account of some incapacity. This system includes head motion module to recognize the motion of the user for controlling the direction of wheelchair.

Quadriplegia refers to the paralysis of the body from beneath the neck whichresults in paralysis, hence immobility of the hands, legs and the torso. Spinal cord injury, cerebral palsy and strokes can cause quadriplegia. When the spinal cord is injured the brain cannot properly communicate with it and so sensation and movement are impaired. The hands and legs of a quadriplegic patient can, therefore, not move at all and any small function such as grasping an object or moving around can therefore be impossible for such patients, only possible movement is through head. The Rehabilitation Council of India has noted that with a population of over 1 billion in our country, the prevalence of a quadriplegic disability is between 1.85% and 2.19%. Of these, 75% persons with disabilities live in rural areas. Using the tilt motion of one's head, the user (a quadriplegic patient) can movein a hassle-free manner. By making judicious use of components, our wheelchair aims to be pocket-friendly as well as effective in operation so that a maximum number of quadriplegic patients, especially from the rural areas, can make use of this system. Today in this modern era around world's 10 percent, around 650 million people are suffering from physical disability. We target planning a straightforward savvy wheelchair constrainedby head development which additionally incorporates patient monitoring frameworkand obstacle detection framework. This wheelchair incorporates MPU6050 sensor,ultrasonic sensor, pulse sensor, vibration sensor, battery, dc motor, GSM module and Arduino Microcontroller. MPU6050 which is used for perceiving the tilt. This sensor finds the tilt and alters the Course of the wheel chair relying upon tilt. The ultrasonic sensor assists with staying away from deterrents, utilizing nature data assembled during route. Observing is accomplished by vibration sensor and heartbeat sensor and the detected values is given to microcontroller. At whatever point the boundary surpasses the edge esteem, an alarm message is sent to the specialist's telephone utilizing GSM module. The normal result of the undertaking is the framework utilizes head development to control the wheelchair and patient Monitoring is achieved.

The prototype of the wheel chair is built using Arduino, chosen for its low cost, in addition to its versatility and performance in mathematical operations and communication with other electronic devices. The system has been structured and actualized in a savvy way so that if our venture is marketed the poor clients in developing nations will profit by it. This system has some valuable activity and give some headway in innovation, and most vital this may give some assistance to the debilitation individual.

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Unfortunately, day by day the number of handicapped people is going on increasing due to road accidents as well as the disease which leading paralysis. Among people with disabilities, percentage of physically handicapped person is most. A head motion operated wheel chair is developed which will operate automatically on the motion of head from the handicapped user for movement purpose. Use of head motion controlled wheelchair prompts a lot of freedom for people with a physical handicap who can neither walk nor operate a mechanical wheelchair alone.

II. PROBLEM STATEMENT AND OBJECTIVES

The aim of this paper is to make a hand gesture controlled wheel chair using accelerometer as sensor to help the physically disabled people in moving from one place to another just by giving direction from the hand. Today in India many people are suffering from disability, there are people whose lower half of the body is paralyzed. This Wheelchair will add on to the comfort and make the life of people bit easier.

Objectives:

1. The aim of this project is to design a Head Motion wheel chair for physically challenged person using Head Gesture.
2. It enables individuals with physical disabilities to independently navigate in their environment.
3. The Communication between the transmitter and receiver is achieved through Wireless Transmission over a Bluetooth Modules.
4. It includes safety features such as,

- Obstacle avoidance sensors, which can reduce the risk of accidents and injuries.
- Pulse Sensors will monitor the patients heart beat by sending an alert signal to the caretaker.

III. METHODOLOGY

This system comprises of 2 sections Transmission section and receiving section. The Head Gestures are converted into electrical signals by the MPU6050 (Gyro sensor)and Arduino Nano processes the incoming signals and sends it to the Bluetooth Module. In the receiving end , these signals are received by the Bluetooth module and sent to the Arduino for decoding . The Arduino , on receiving the signals , actuates the DC motors via the motor driver.

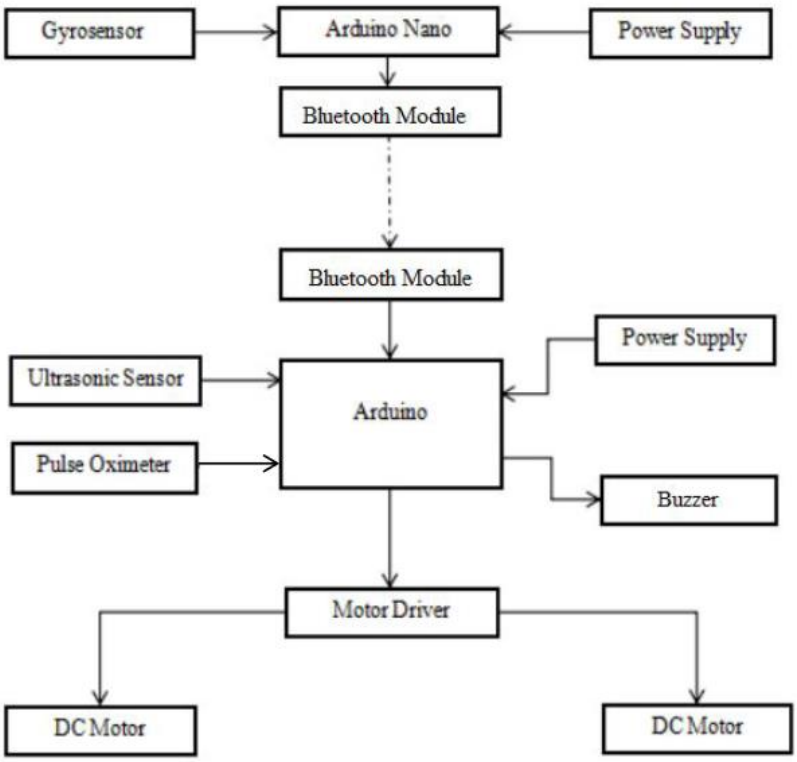

Fig1: Block Diagram of the System Prototype

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This System basically contains two sections, a transmitter section and a receiver section.

Transmitter Section:

The transmitter consists of an MPU6050 accelerometer sensor, an Arduino Nano, a Bluetooth Module and a battery. The battery is used to power the Arduino while the sensor and the transmitter can be powered from the Arduino. This is because, the Arduino can accept voltages from 5V to 12V while the sensors must be powered by a 5V supply. The components are placed on a hat.

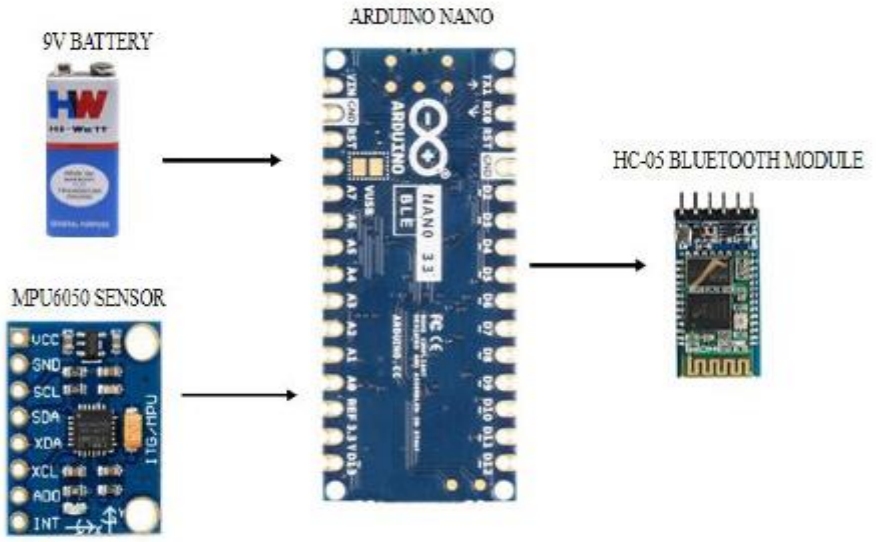

Fig 2: Transmitter Section

Receiver Section:

The receiver section consists of an Arduino Uno, a Bluetooth Module, an L298N Hbridgemotor driver, two DC motors and three 18650 Li-ion batteries. The batteries power the motor driver, the motor driver powers the Arduino and the Bluetooth module is powered by the Arduino. The motors along with their wheels, and the caster wheel should be attached to the bottom of the chassis. The HC SR04, Pulse sensor are placed on the top of the wheelchair chassis with the tape.

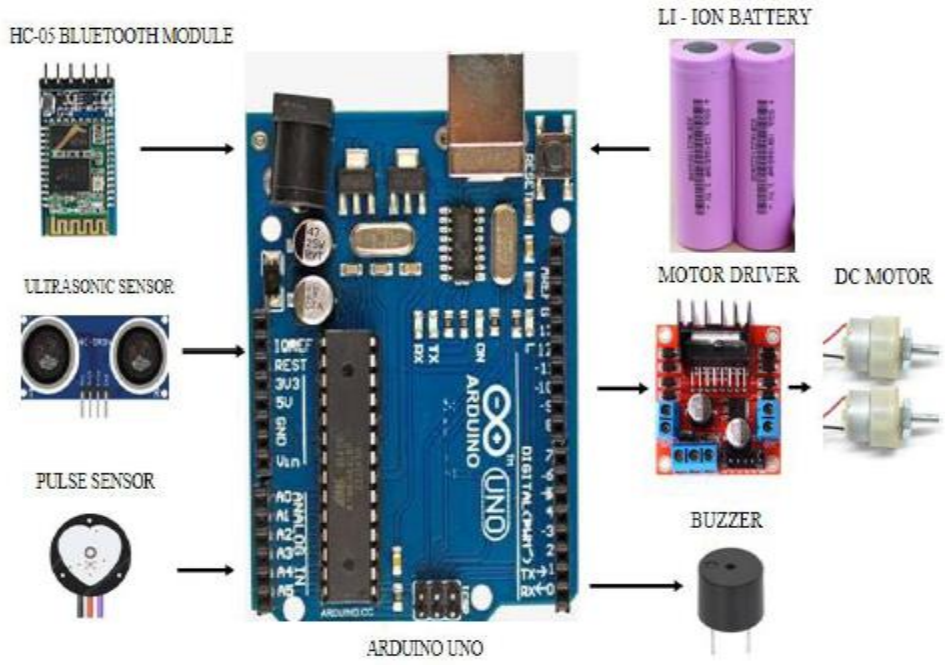

Fig 3: Receiver Section

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Flowchart of Transmitter and Receiver Section:

The Flowchart below represents the overall system mechanism. The inputs from the sensors are sent to Arduino and Data is transferred through Bluetooth Modules. The Arduino Program is designed in such a way that the readings from the Gyro sensor will guide the Wheelchair to move in particular directions. Ultrasonic sensor will detect the obstacle and stops automatically and the readings from Pulse Sensor and Vibration Sensor will helps in sending an alert message to the caretaker through GSM Module if Sensor crosses Threshold value.

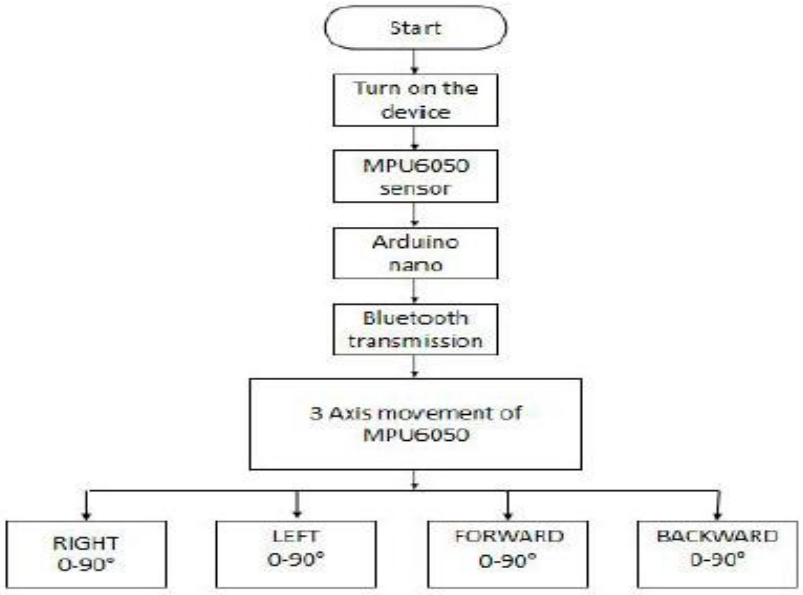

Fig 4: Transmitting section flowchart

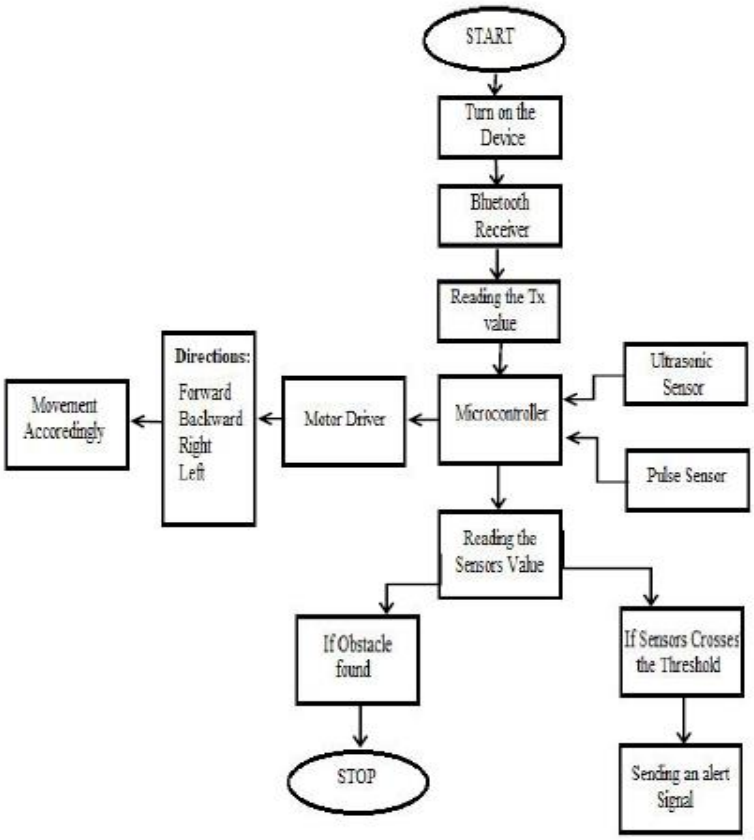

Fig 5: Receiver section flowchart

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IV. RESULTS AND DISCUSSIONS

The proposed framework is expected to make a financially savvy wheelchair to assist quadriplegic with people who think that it's hard to move freely. The structure uses head advancement to control the wheelchair. The tilt focuses made are distinguished and voltages are created by accelerometer. These voltages are taken by microcontroller which in this way controls the course of wheelchair.

This venture work was carried on to satisfy the prerequisite of older and impair individuals, giving the autonomous route utilizing head movement controlled wheelchair. It causes them to move effectively as like ordinary people do. The circuit works appropriately to the order given by the user and the wheelchair is moved in understanding to the head signal given by the individual. Head movement controlled wheelchair incorporates obstacle detection, which assists with distinguishing the hindrance and stops the wheelchair. Monitoring of the patient's well being condition is possible with the assistance of patient monitoring framework.

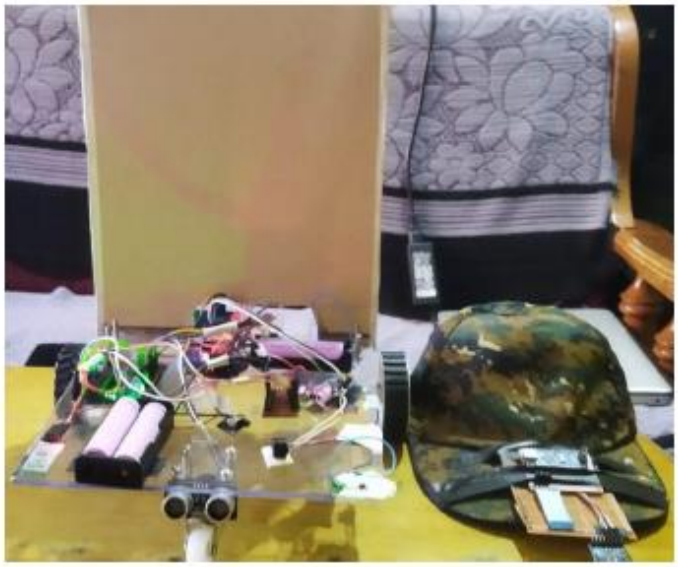

Fig 6: Prototype of wheelchair controlled by Head Motion

Fig 7: Transmitting section

Fig 8: Receiving Section

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V. CONCLUSION AND FUTURE SCOPE

This work elaborates the design and construction of Smart Electronic Wheelchair with the help of MEMS Module. The circuit works properly to maneuver because the command given by the user.

After coming up with the circuit that allows physically disabled to regulate their wheel victimization associate MEMS device application in their sensible phones and it's conjointly been tested and valid. The detection of any obstacle is with success controlled by the microcontroller. As the person switches on the circuit and starts moving, any obstacle that is anticipated to lie among a spread of four meters are detected by the unhearable device. This planned system contributes to the self dependency of otherwise abled and older folks.

Future Scope:
The Head motion controlled wheelchair has the ability to bridge the gap between man and machine. Further this Head gesture can be changed to speech and brain signal recognition which will be a battle winning factor for all those people whose whole body is paralyzed. We can further improve wheelchairs by making it with low cost and high accuracy which are operating with various different sensors. Output of various different purpose sensors can be applied to high frequency and accurate wireless transmitter circuit and can received at wheelchair circuit by receiver circuitry.

So that harmonics can be reduced and system becomes more robust and lossless.

Instead of using acceleration motion with head we can also use hand movement also to control wheel chair direction or we can use eye retina using optical sensor to move wheelchair in different direction. Using retina movement we would be able to drive a wheelchair. We can use voice command IC to interface our voice signals with microcontroller to move wheelchair. So, computer interfacing may not be needed. The voice stored in IC could be sufficient to analyze speaker's voice Command. Various safety measurements can also be installed on wheel chair like GPS system to track the wheelchair and its user.

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