International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Gesture Controlled Assistance

Alkesh Panchal[1], Aarya Brahmane[2], Shubham Panchal[3]

[1, 2, 3]Electronics & Communication Department, Birla Vishvakarma Mahavidhyalaya Engineering College, Vallabh Vidhyanagar, Anand, Gujarat, India. 388120

Abstract: ***Wheel Chair is a mobility device designed for movement of patients, and physically challenged people from one place to another with the help of attendee or by means of self-propelling. This project involves the design of an electric wheelchair for domestic use. The redesign of manual wheel chair was considered for this project. Focus is laid on different parameters such as form, functionality, technology and architecture of the product. Market study was carried out to know the cost analysis of the existing product. The driving module was tested to evaluate the performances and the results showed that the developed system was helpful in increasing the mobility of persons with quadriplegia.***

Keywords: gesture controlled, wheelchair, automation, quadriplegic patients

1. Introduction

The dependency of differently abled people on others has always been a problem. We thought to improve this situation and came up with this idea. This project presents a new gesture controlled wheelchair with many advantages such as reduced complexity, easy controlling, low cost and great reliability compared to other conventional wheelchairs.

A motorized wheelchair or electric-powered wheelchair is a wheelchair that is propelled by means of an electric motor rather than manual power. Motorized wheelchairs are useful for those who are not able to impel a manual wheelchair or who may need to employ a wheelchair for distances or which would be tough in a manual wheelchair. They may also be used not just by people with conventional mobility impairments, but also by people with cardiovascular and fatigue based conditions. Electric wheelchairs have enhanced the quality of life for many people with physical disabilities by offering mobility. The selection of power will rely on many factors; including the kind of surface setting the chair will be driven over, the need to settle thresholds and curbs, and clearance widths in accustomed environment. The most fundamental job of the chair is to take input from the user, usually in the form of gesture, and decipher that motion into power to the wheels to move the person in the preferred direction. The operation for the mode selection is a sensor attached hand-glove.

2. Objective

- The aim of this project is to analyze and prototype a motorized wheelchair based on extensive fact findings and research on existing models, technology used, market scenario and customer requirements.
- The final design should also enable people to convert a normal wheelchair to one that can be powered using a battery and controlled by gesture.
- The model will be of great help to quadriplegic and severely injured patients.

3. System Detailing

3.1 Hardware Required

3.1.1 DC Motor

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line.

3.1.2 Rechargeable Battery

A rechargeable battery, storage battery, secondary cell, or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times, while a non-rechargeable or primary battery is supplied fully charged, and discarded once discharged. It is composed of one or more electrochemical cells. The term "accumulator" is used as it accumulates and stores energy through a reversible electrochemical reaction. Several different combinations of electrode materials and electrolytes are used, including lead–acid, nickel cadmium (NiCd), nickel metal hydride (NiMH), lithium ion (Li-ion), and lithium ion polymer

Figure 1: Rechargeable Battery

3.1.3 Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

Figure 2: Arduino Nano

3.1.4 Arduino Lilypad

The LilyPad Arduino 328 Main Board is an Arduino-programmed microcontroller designed to be easily integrated into e-textiles and wearable projects. It offers the same functionality you find in other Arduino boards, in a lightweight, round package designed to minimize snagging and profile, with wide tabs that can be sewn down and connected with conductive thread

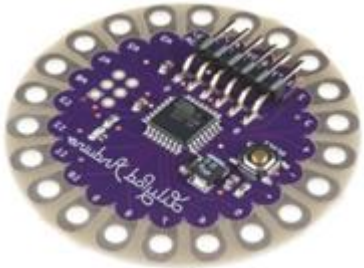

Figure 3: Arduino LilyPad

3.1.5 Gyroscope Sensor (MPU 6050)

Gyroscope sensor is a device that can measure and maintain the orientation and angular velocity of an object. These are more advanced than accelerometers. These can measure the tilt and lateral orientation of the object whereas accelerometer can only measure the linear motion. Gyroscope sensors are also called as Angular Rate Sensor or Angular Velocity Sensors.

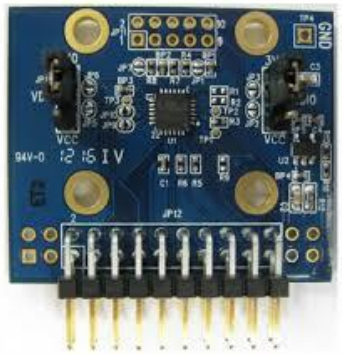

Figure 4: Gyroscope Sensor

3.1.6 Bluetooth Sensor (HC-05)

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.

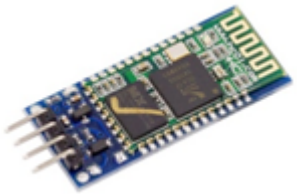

Figure 5: Bluetooth Sensor

3.1.7 Ultrasonic Sensor (HC-SR04)

The module works on the natural phenomenon of ECHO of sound. A pulse is sent for about 10us to trigger the module. After which the module automatically sends 8 cycles of 40 KHz ultrasound signal and checks its echo. The signal after striking with an obstacle returns and is captured by the receiver. Thus, the distance of the obstacle from the sensor is simply calculated by the formula given as

Distance = d,
Time = t,
Speed = s.
d= (t x s)/2

Figure 6: Ultrasonic Sensor

3.1.7 Raspberry Pi

Raspberry Pi is the brain of the system. It is connected with all the sensors. It is connected with raspberry pi camera and buzzer. It is for future scope and trial on our project. It is mainly for object detection, and obstacle avoidance.

Figure 7: Raspberry Pi

3.1.8 Pi Camera

Figure 8: Pi Camera

Pi Camera will take live recording of the path. It will detect any obstacle in the path and will buzz a buzzer thus warning everyone around the wheelchair. It is for future scope and will not be directly implemented on the project,

3.1.9 Motor Driver (RKI-1341)

Add raw power and simple connectivity to your robotics applications with this 6V - 18V compatible 20A capable Dual DC motor driver. It is ideal for application where two motors are required for up to 20 Amperes of current during startup and during normal operations. It comes with a simple TTL/CMOS based interface that can connect directly to the IOs of an MCU. It has a breaking feature that can guarantee immediate halt on the shaft of motors in highest power applications and also includes protection circuitry to avoid any electrical fluctuations affecting the normal operation of an MCU.

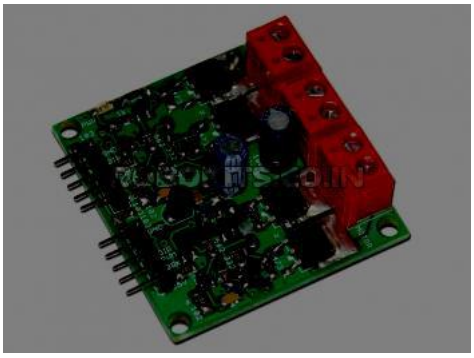

Figure 9: Motor Driver

3.1.10 Buzzer

A buzzer or beeper is an audio signaling device which may be mechanical, electromechanical, or piezoelectric . Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Figure 10: Buzzer

4. Design Description

The driving module consists of a motorized driving mechanism, embedded control boards, and an easy-docking mechanism, which can together be used to convert a manual wheelchair to an electrical wheelchair. The core of the easy-docking mechanism will comprise of the snatch locks and yokes, with which the driving module can be attached in front of a manual wheelchair and firmly fixed on the wheelchair frame.

4.1 Frame Design

The frame consists of a chassis that carries two motorized locomotion units, a support for two electrical gear-motors, two idle triple wheels units and a battery pack. The chassis consists mainly of two tubular structures, connected by means of crossbars; two triangular tubular structures on the front support the triple wheel units. Connection points are hinges for the linkage mechanism. The triple wheel units consist of a spider, rotating around a central axis, with three idle wheels placed at its vertices. Four medium sized wheels were chosen instead of normally used big wheel and small wheel combo. Since required torque will be less and also weight will be reduced. Efficiency of motor is improvised without using gear system, thus saving cost and time of manufacturing. Our prototype is made up of wooden ply, since it gives near-to-same result and with less weight. The seat is a tubular structure carrying a chair and a pivoting wheel. The seat consists essentially of two rectangular structures, connected by means of crossbars, a chair support and a pipe that ends with a pivoting wheel. Connection points, in tubular structure, are hinges for the linkage mechanism. The seat can move relative to the frame.

Figure 11: Basic ply Model

5. Working Description

This project introduces an automated system is to be developed to control the motor rotation of wheel chair based on head movement of physically challenged person. In order to facilitate these people for their independent movement, a gyroscope sensor(MPU 6050) based transmitter is fitted on persons head. Depending on the hand movements we drive the motor fitted to the wheel chair. The wheel chair can be driven in any of the four directions i.e. left, right, forward, and back. The automated wheelchair is based on simple electronic control system and the mechanical arrangement that is controlled by microcontroller. This automatic wheel chair can be used for people who have various other disabilities to sit on the chair and just hold the accelerometer and move it over to control the vehicle movements.

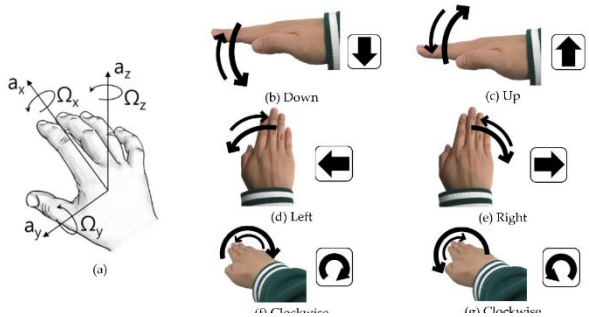

Figure 12: Hand Gestures

5.1 Object detection

We have used tensor flow lite on raspberry pi for object detection. Object detection will not directly be used in our project, but it will help to detect objects in a moving wheelchair. And provide a base for futuristic cheap technologies which will buzz a buzzer or stop the wheelchair on detecting an object in very close proximity.

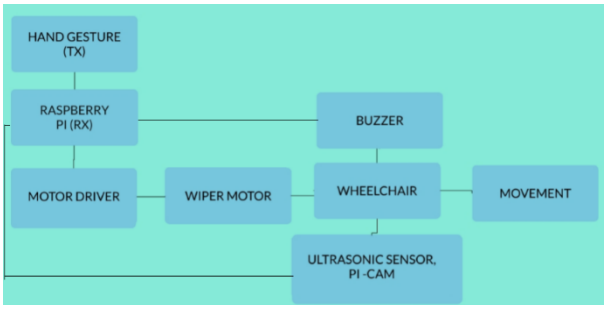

Figure 13: General Block Diagram

6. Conclusion

Gesture control wheelchair will be of great help to quadriplegic patients and once the object detection system will be successfully developed and implanted it will create a base for the futuristic self -driving cars.

References

[1] Head Gesture Controlled Wheelchair for Quadriplegic Patients(International Conference on Computational Intelligence and Data Science)
[2] Accelerometer Based Hand Gesture Controlled Wheelchair(International Journal on Emerging Technologies)
[3] WIRELESS GESTURE CONTROLLED WHEEL CHAIR USING IMAGE PROCESSING
[4] Head-Motion Controlled Wheel Chair Direction Using ATMega328p Microcontroller(International Journal of Advanced Research in Computer and Communication Engineering)
[5] IMAGE PROCESSING BASED HAND GESTURE CONTROLLED ROBOT ON RASPBERRY PI(International Journal of Engineering & Science Research)

Author Profile

Alkesh Panchal is pursuing engineering in Electronics from Birla Vishvakarma Mahavidyalaya Engineering College, V.V.Nagar, Gujarat. He is an avid project maker and works with various microcontroller board.

Aarya Brahmane is pursuing engineering in Electronics from Birla Vishvakarma Mahavidyalaya Engineering College, V.V.Nagar, Gujarat. He is interested in embedded electronics and is working on a project using Microcontroller.

Shubham Panchal is pursuing engineering in Electronics from Birla Vishvakarma Mahavidyalaya Engineering College, V.V.Nagar, Gujarat. He likes finding solution of everyday problems and ideates out of the box.