Design and Implementation of Hand Gesture Controlled Wheel Chair for Physically Challenged People

K.Parvateesam, P.Satya Sruthi
1Assistant Professor, 2Assistant Professor
1Department of ECE
2Department of CSE
1Godavari Institute of Engineering and Technology(Autonomous), Rajahmundry, India
2Aditya College of Engineering, Surampalem, Kakinada, India

Abstract-- Physically handicapped people and the elderly are more reliant on others in today's world. However, in today's fast-paced society, everyone is highly busy, and there are few people to properly care for these people. They discover automatic wheelchairs as a convenient mode of mobility for these physically disabled people. Using the Gesture Control System, the proposed effort would manufacture a hand gesture-based wheelchair. Wheelchairs are used by those who are unable to walk due to physical limitations, injuries, or other disabilities. Using MEMS technology, this project will build a wheel chair control that is useful to physically impaired people with their hand movement or hand gesture detection. Driving wheel chair in domestic environments is a difficult task for people with arm or hands impairment.

Keywords—Hand gesture, wheel chair, SPO2 sensor, Arduino, MEMS technology.

I. INTRODUCTION

This Project is an advance approach of changing the physical gesture of hand into the electrical signal and then to process that signal into digital signal of appropriate magnitude and tube transmitted through the transmitter. This paper provides an instrumental solution to the people who have difficulty in moving or their body part as paralyzed, or they have lost their limb in an accident. This wheelchair is going to bring a paradigm shift between man and machine. Where this machine will be working on the user commands, we can also say its human machine interface. With the growth of technology there has always been an effort to use the technology for the betterment of mankind. Time and again the technocrats of the world had proved their metal in bringing the comfort to the people who are in need with the help of technology. Bringing the technology and economy parallel to each other is paramount aim of this paper. Also, to build a Hand Gesture Wheelchair which has sound technology but low in cost is the primary concern. Today in this modern era around 650 million people are suffering from physical disability. In order to make their life bit easier we decided to make a hand gesture-controlled wheelchair which will be working on the gesture of their hand. The wheelchair is wireless and has a range of 200 yards. It means a person can control his wheelchair from 200 yards away. The disabled people always find difficulties in moving from one room to another and even to do that the handicapped person was dependent on someone else who will push the wheelchair manually and take the handicapped person from one place to another. Now with the Hand Gesture Controlled Wheelchair the handicapped person is independent and he need not to ask for help from any other person to move his wheelchair. Just with the movement of his hand the handicapped person is able to move from one place to another without needing anyone’s assistance which also makes him self-dependent. Disability is a curse for a country particularly developing country. It is regarded as an embarrassment to the family the disabled people belong to. This negligence of the society makes a bar between the persons with disabilities and the others in the society on normal economic, social and political activities in their families, communities, essential services and education. According to World Health Organization (WHO), “More than one billion people in the world live with some form of disability, of which nearly 200 million experience considerable difficulties in functioning”. The number of persons with disabilities is so high that it requires special consideration.

II. HARDWARE COMPONENTS

The design of the system contains two sections. They are Transmitter section and Receiver section. The Transmitter section uses a simple arduino board to meet cost constraint MEMS accelerometer, RF transmitter and LED indicators. The receiver section have RF receiver, LED indicators. Buzzer. The transmitter section includes different types of sensors like temperature sensor, heartbeat sensor to detect any abnormal threshold ranges. Hence if the values are deviated then transmitter will send information to receiver and hence buzzer with LED indicators will be activated. The list of components used in the system are mentioned below.

- Arduino NANO V 3.0 Board
- Power supply (24 V Battery)
- LED Display
- Buzzer
- MEMS accelerometer sensor module
- Temperature sensor (LM35)
- Heartbeat sensor
- DC motor drivers (2 no)
- DC motors (4 no.)

**BLOCK DIAGRAM:**

**Transmitter for wheel chair movement:**

![Block Diagram of the wheel chair’s transmitter]

The above figure shows the transmitter section of the wheel chair. It is designed with hand gloves attached with MEMS accelerometer sensor. Based on the hand movement the sensor data will be transmitted to receiver for corresponding wheel movement.

**Receiver for wheel chair movement:**

![Block Diagram of the wheel chair’s receiver]
The receiver part contains RF receiver and decoder as shown in the figure 2.2. When Arduino identifies the data then it will activate the corresponding movement in wheels through motor drivers as shown in the figure 2.2. The possible directions are front and back. The left and right directions also possible with proper wheels movement. The entire arrangements are shown and discussed clearly in the results section below.

What is MPU6050?

MPU6050 is a MEMS-based 6-axis motion tracking device. It has an on-chip gyroscope and accelerometer sensors along with temperature sensor. MPU6050 is a digital device. This module is of very small in size, has low power consumption requirements, highly accurate, has high repeatability, high shock tolerance, it has application-specific performance programmability and low consumer price points. MPU6050 can be easily interfaced with other sensors such as magnetometers and microcontrollers.

Fig 2.3 : MPU-6050 Module

- **Calculations**

- **Note that** gyroscope and accelerometer sensor data of MPU6050 module consists of 16-bit raw data in 2’s complement form.

- Temperature sensor data of MPU6050 module consists of 16-bit data (not in 2’s complement form). Now suppose we have selected,

- Accelerometer full scale range of +/- 2g with Sensitivity Scale Factor of 16,384 LSB(Count)/g.

- Gyroscope full scale range of +/- 250 °/s with Sensitivity Scale Factor of 131 LSB (Count)/°/s. then,

- To get sensor raw data, we need to first perform 2’s complement on sensor data of Accelerometer and gyroscope.

- After getting sensor raw data we can calculate acceleration and angular velocity by dividing sensor raw data with their sensitivity scale factor as follows,

- **Accelerometer values in g (g force)**

  - Acceleration along the X axis = (Accelerometer X axis raw data/16384) g. Acceleration along the Y axis = (Accelerometer Y axis raw data/16384) g. Acceleration along the Z axis = (Accelerometer Z axis raw data/16384) g.

- **Gyroscope values in °/s (degree per second)**

  - Angular velocity along the X axis = (Gyroscope X axis raw data/131) °/s. Angular velocity along the Y axis = (Gyroscope Y axis raw data/131) °/s. Angular velocity along the Z axis = (Gyroscope Z axis raw data/131) °/s.
III. FLOW CHART

The above figure shows the flowchart of the system. The system starts with hand gesture sensor data. When gesture recognized then the wheels will be moved accordingly. The front and back, left and right movements can be controlled by hand gesture movement. The sensor called accelerometer sensor will produce different values in different directions. These directions will be considered as x, y and z directions. Based on these axes movements the wheels assigned its direction of rotation. Hence all directions will be possible to move.

Temperature and SPO2 monitor system

The patient’s body temperature and SPO2 levels can be monitored separately within the wheel chair at hand position. This module is equipped with battery and buzzer along with LCD display. When body temperature exceeds then buzzer will ring and when SPO2 level fall below the required level then buzzer also will ring. Here in addition to this by integrating GSM module them it will send message to responsible person about the patient’s body condition. Here the status can be observed in web page by integrating WiFi module in the system. So entire patient’s health conditions can be observed from wheel chair to webpage. With the help of IoT it is possible to monitor the health conditions from anywhere in the world.

Arduino Software (IDE)

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code,
a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Fig: 4.1 Arduino Software Programming console.

Fig 3.2: Home page of the Arduino IDE

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension. ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor. Additional commands are found within the five menus: File, Edit, Sketch, Tools, Help. The menus are context sensitive, which means only those items relevant to the work currently being carried out are available. The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store your programs (or sketches). The sketches in your sketchbook can be opened from the File > Sketchbook menu or from the Open button on the toolbar. The first time you run the Arduino software, it will automatically create a directory for your sketchbook. You can view or change the location of the sketchbook location from with the Preferences dialog.

IV. RESULTS

The functional operations are implemented in the Arduino IDE software. The functions are developed in such a way that they able to provide more accurate sensitivity and response in moving and direction change. The response time of the functions with respect to the sensors is tested for several times and designed and modified the program in order to achieve good results. The back() and front() functions are developed to control the direction of the vehicle both in forward and backward direction. Similarly, the functional commands left() and right() are enveloped to the control the direction of the vehicle in right and left direction. The functions reads the input signals from various sensors through analog inputs and sends output to output devices like motors to control the wheels rotation.
V. CONCLUSION

It has been designed to integrate functionality from all of the Hardware components used. Every module's presence has been carefully considered and arranged, resulting in the best possible operation of the unit. Second, the idea was effectively implemented employing modern integrated circuits and growing technology. The disabled person can maneuver the wheelchair right, left, front, and back with their hand movements. As a result, the project has been designed and tested successfully. This paper is implemented using many components; nevertheless, the project is only a prototype; if we develop this project into a commercial project, it will undoubtedly benefit all disabled persons who are unable to operate and drive a standard wheelchair on their own.

VI. FUTURE SCOPE

The hand gesture wheelchair has the ability to bridge the gap between man and machine. The design involves many features like patients' body temperature, SPO2 levels. But these are implemented separately with separate modules. But it is possible to design a single module with all these features can reduce circuit complexity and ease of use. Multiple modules for multiple features is not a desirable feature in any embedded system design. Further this hand 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.

REFERENCE


