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Automated Wheelchair Controller System using IoT

Rajath. V[1], Swetha Shekarappa. G[2], Senbagavalli. M[3]
[1, 2] *Department of Electrical & Electronics Engineering, Alliance University, Bangalore, India*
[3] *Department of Information Technology, Alliance University, Bangalore, India*

Abstract: ***The require of numerous paralyzed, disabled and dazzle people groups are fulfilled with manual wheelchair, but it finds troublesome to the impaired people groups to depend upon others continuously and indeed manual wheelchair makes troublesome to function through the joystick. There is a computerized based inquire about going through the wheelchair improvement but through of our framework we utilized sensors and insights-based algorithm which minimize the human exertion conjointly it makes the debilitated individual to function effortlessly without challenges. Our objective is to design and execute a wheelchair with different conceivable outcomes for the impaired people to function a wheelchair through voice acknowledgment, touch show conjointly mechanized GPS tracking moving wheelchair through line taking after. Where debilitated people can effectively connect with wheelchair through any one of these sources conjointly the wheelchair is adjusted without falling utilizing accelerometer sensor conjointly impediment recognizing sensor has been introduced for the security.***
Keywords: GPS Tracking, Sensors, Motors, Voice Recognize, Arduino.

I. INTRODUCTION

The wheelchair gadget is impelled physically within the showcase by the crippled people which is difficult sometimes to function additionally within the showcase numerous wheel chairs are accessible with the fundamental plan changes like situate estimate, flexible backrests and stool pedals So that it does not changes the way of the impaired individual. So, the point of our venture is to form the crippled individual to utilize wheel chair automated through the voice, touch and GPS controlled. So, through this highlight a crippled individual can work his claim wheel chair without anyone's back additionally our framework gears up for all the angles. Obstacles can be detected by sensor so that it dodges collision and move concurring to the client command conjointly it employments straightforward human dialect for controlling of wheel chair additionally the accelerometer sensor has been built up inside the chair so that it equalizations the wheel chair in x- pivot and y-axis. We utilize a straightforward equation to calculate the accelerometer tilt and set a condition to adjust the wheel chair. The sensors and calculation utilized make the wheel chair user-friendly and it complies concurring to the client command and make the debilitate individual free of others. According to NSO overview they secured 1.8 lakh family units over India in 2018 gave the report has, approximately 28.8% of individuals had debilitated certified and where 3.7% had leaved alone without a legitimate needs and remaining individuals are so subordinate on the care takers additionally impaired people can be of different problems as appeared within the insights concurring to Indian government.

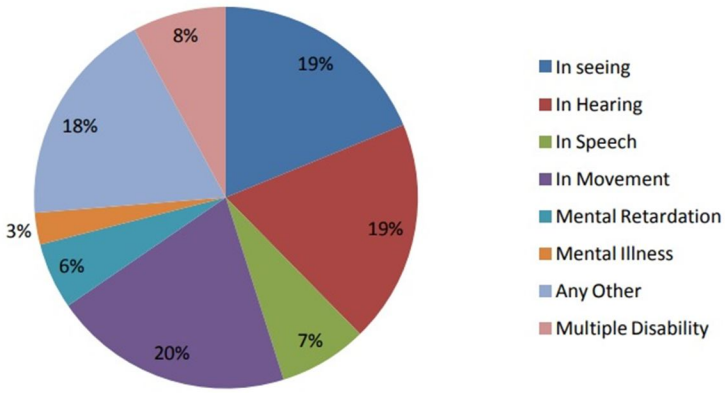


Figure 1. multi-inability people groups

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So, concurring to over measurement our framework can help paralyzed, hearing crippled, seeing crippled, discourse debilitated and having multi-inability people groups to be free of others by computerized client inviting system. There are distinctive sorts of wheelchairs as appeared below



Figure 2. Types of wheelchair system

A. Electrical based wheelchair which can be driven by the lower impaired person.
B. Controlling the wheelchair utilizing joystick.
C. Wheelchair depends upon the situate plan and four side adjusted wheel.
D. Wheelchair depends upon the consolation of situate, ottoman and worked through joystick.

From all these four kinds of wheelchair it depends upon the joystick and plan of seats and comfortless and it can be utilized as it were by certain people groups. So, our framework is built with all the highlights required for the crippled individual and make them self-dependent. To characterize the reason of this subject it is fundamental to know around the results and benefits of this computerized wheelchair. To begin with, this wheelchair can be utilized for numerous applications like ancient age homes, physically incapacitated people, in businesses as robot to carry basic merchandise etc.

The useful result for crippled individual in our framework is like expanded portability, where people groups who cannot utilize upper body arm for the manual wheelchair as well as joystick wheelchair can utilize our framework through voice acknowledgment additionally dazzle people can effectively travel to wanted area through our framework and discourse debilitated people can utilize touch show introduced and they can work in all the angles. Through our framework it increments the crippled people's capacity to live autonomously and be flexibility within the space of community. The impediment confronted by the impaired person's forces critical financial and social taken a toll, but our framework fetched lesser than the showcase price. Over a long time, the wheelchair has been changed from manual to electrical wheelchair, but our approach is to create the wheelchair mechanized so that it increments the chance of self-dependent conjointly our framework to expend less control.

Our commitment is to create computerized through the touch show where rather than joystick it makes simpler for the client and through the voice acknowledgment where it'll be totally valuable for the paralyzed clients and at long last, GPS based consequently moving wheelchair. This GPS strategy approaches like line taking after robot where, when set an area through the utilize of IR sensor it takes after the line concurring to google outline but, the dark line ought to be drawn as of now to utilize this work. Where dark line demonstrates '1' for the IR sensor. So, the dark line ought to be drawn along the side of person on foot so that there will be a partitioned way for the debilitated people to utilize this computerized wheelchair.

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II. BLOCK DIAGRAM WITH EXPLANATION

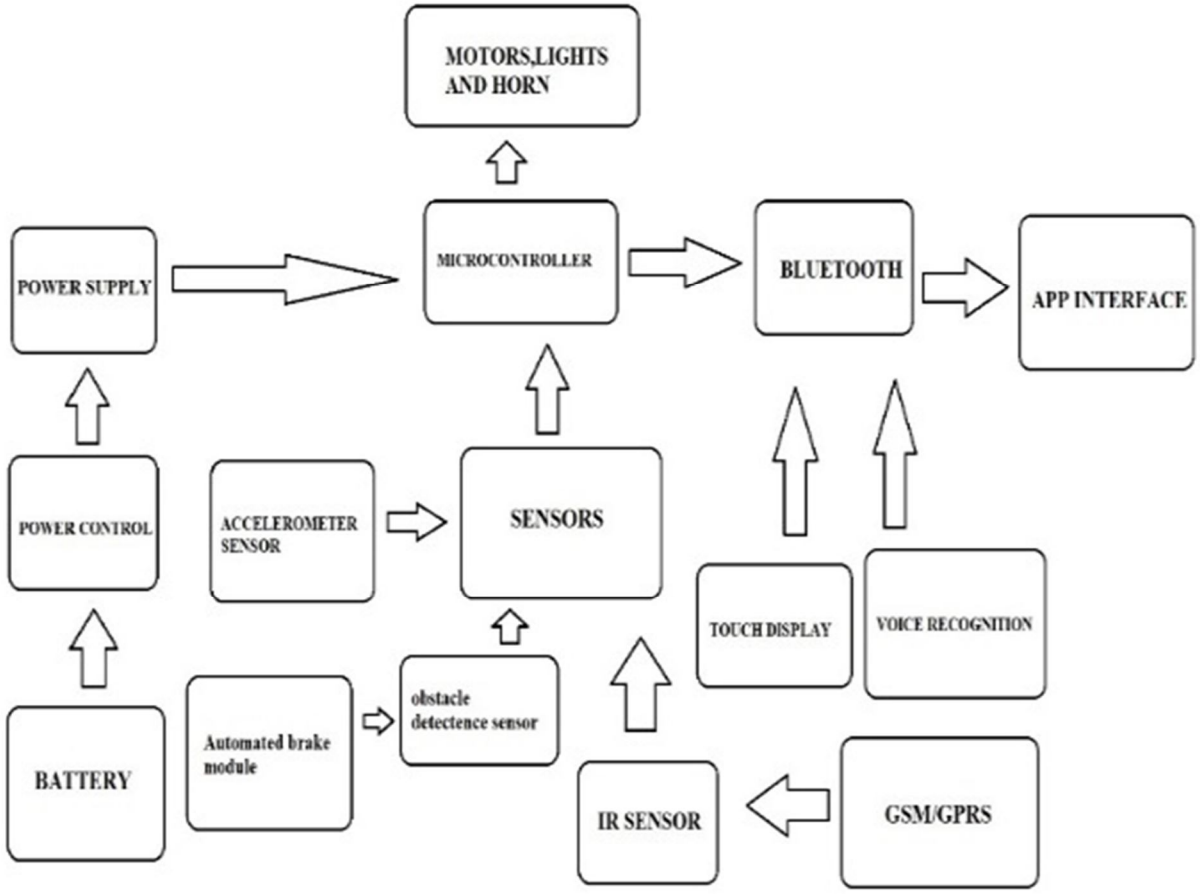


Figure 3. Block diagram of the automated wheelchair

The Piece Chart over may be an essential format of the equipment plan that will be utilized for the computerized wheelchair. The control supply will comprise of battery which is associated to microcontroller and it act as a central organize of dispersion of control supply. The sensors are associated to microcontroller and interfaces with the android application through the Bluetooth. Here, IR sensor interfaces utilized with GSM where it acts as a line following wheelchair through the Google outline additionally, we utilized touch show to control the wheelchair in all the 360 degree conjointly we have interfaces voice acknowledgment module so that through the typical human commands the wheel chair can be controlled through Bluetooth android application. Accelerometer sensor is used in this plan to adjust the wheelchair without falling or tilting additionally to control the speed of the wheelchair and impediment discovery sensor is utilized to urge free from the coincidental issues. There are a few uncommon highlights like head light and back light and horn for the wheelchair. So that they can move out exterior in night times too and typically the essential layout of the equipment required for the framework.

III. DESIGN

The robotized wheelchair framework concentrates on parameters line adjust, speed, voice acknowledgment and naturally moving wheelchair in spite of the fact that GPS back and IR sensor. Person sensors have their claim flag conditioning sheets, after the flag conditioning microcontroller collects the information and analyze the clients input and prepare the analyzed information and makes the framework to run consequently additionally it has a deterrent evasion sensor so that wheelchair analyze and act concurring to the information to urge freed of inadvertent issues and lights have been actualized for the night times. Arduino computer program has been utilized to program all the sensors and coordinated it.

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A. Hardware Tools

1) Arduino Mega2560: A computer, another Arduino board, or other microcontrollers can all be communicated with using Arduino. The ATmega328P microcontroller supports UART TTL (5V) serial communication via the advanced stick (Rx) and advanced stick 1 interfaces (Tx). This serial connection is channeled over USB by an ATmega16U2 on the board, which appears as a virtual com harbor to program on the PC. The ATmega16U2 firmware uses normal USB COM drivers and does not require any additional drivers. In either scenario, a.inf record is necessary on Windows. The Arduino computer program has a serial screen that allows you to send and receive simple printed data to and from the Arduino device.

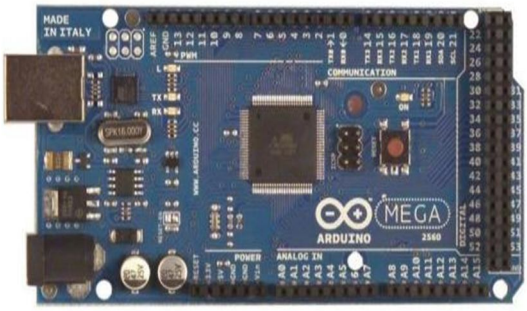


Figure 4. Arduino MEGA 2560

On the Arduino board, there are two RX and TX LEDs that can flicker when data is communicated via the USB-to-serial chip and USB connection to the computer (not for serial communication on pins and 1). A program on a computer. The serial library allows serial communication on any of the programmable pins on the Uno. I2C (TWI) and SPI communication are also supported by the ATmega328P. The Arduino software comes with a Wire library that makes using the I2Cbus a breeze.

2) Voice Recognition Module V3



Figure 5. Voice recognition module

V3 is one of the most small and user-friendly speech recognition modules on the marketplace. This module can be used in two ways: through the serial port or via the built-in GPIO pins. The V3 board can hold up to 80 voice commands, each of which is 1500 milliseconds long. This one won't convert your orders to content; instead, it'll compare them to a previously recorded collection of voices. As a result, there are no language barriers to using this item. You can record your command in any language you want, and any sound can be recorded and used as a command. So, you want to get it ready by letting it recognize any voice commands it has heard recently. If you use the module's GPIO pins, the package will provide outputs for as many as seven of the 80 instructions. You'll select stack 7 commands into the recognition system for this technique, and the recognition system will transmit yields to the GPIO pins if any of these voice commands is detected. We don't have to worry about the limited functionalities because we're using it with the Arduino.

The device requires an input voltage range of 4.5 to 5 volts and draws less than 40 mA. If used under ideal conditions, this module can provide 99 percent accuracy in recognition. The amplifier chosen and the turbulence in the area have a significant impact on the module's implementation. It's preferable to use a mandible with a lot of assorted variety and try to keep the hubbub down in your foundation while providing directions to get the most out of the module.

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Table 1: Specification table of voice recognition v3 sensor

Voltage: 4.5-5.5V
Current: <40mA
Digital Interface: 5V TTL level UART interface
Analog Interface: 3.5mm mono-channel microphone connector + microphone pin interface
Recognition accuracy: 99% (under ideal environment)
Support maximum 80 voice commands, with each voice 1500ms
Maximum 7 voice commands effective at same time
Easy Control: UART/GPIO
User-control General Pin Output

3) L293D Driver

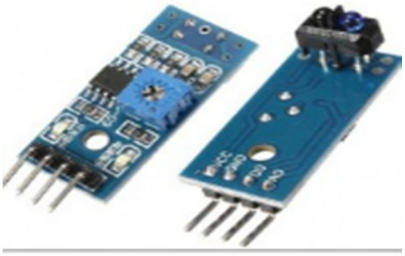


Figure 6. L293D Driver

The L293D is a 16-pin engine driver IC that can control two DC engines in any direction at the identical instant. At voltages ranging from 4.5 V to 36 V, the L293D is designed to provide bidirectional drive streams of up to 600 mA (per channel). There are also speed control pins, and the speed is controlled using the PWM method. The azimuth of DC engines is controlled by four inputs.

4) Bluetooth HC-05



Figure 7. Bluetooth HC-05

HC-05 Technical Specifications

a) Characteristics

- 3.3V~5V Supply Voltage
- 1mm-8mm Detection of distance
- when objects detected LOW Digital Outputs are obtained
- On-board display. The results are displayed using an LED.
- Modify the intensity with the on-board potentiometer.
- On-board LM393 chip.

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5) TCRT 5000 IR Module



Figure 8. TCRT 5000 module

To differentiate light and segregate, this IR intelligent sensor uses a TCRT5000. It emits infrared light and then determines whether or not it receives a response. Because this sensor can detect whether a layer is white or black, it is frequently used in line following robots and automatic data logging on utility metering. The gauging removes range in size from 1mm to 8mm, with a central point of 2.5mm. There's also a potentiometer on board to adjust the vitality. When the modular interfaces with the controller, the infrared diode will radiate infrared light indefinitely. If the communicated infrared light isn't absorbed or the strength isn't great enough, the module will be in the off state, and D0 will give rationale Tall and the flag will display Driven off.

a) Characteristics

- 3.3V~5V Supply Voltage
- 1mm-8mm Detection of distance
- when objects detected LOW Digital Outputs are obtained
- On-board display. The results are displayed using an LED.
- Modify the intensity with the on-board potentiometer.
- On-board LM393 chip.

6) GSM/GPRS Module



Figure 9. GSM and GPS module

GSM SIM 800A module is known as Worldwide Framework for Versatile Communication which is utilized to set up communication between the client and the framework. GSM bolsters active and incoming calls and messages. This is often the advanced framework has an capacity to exchange the information within the rate of 64 kbps to 120 kbps. The recurrence ranges of GSM 800a is from 806.2-821.2 of uplink and 851.2-866.2 downlink in Mhz.in GSM module AT commands are utilized to control MODEM's. AT commands are requires to procure the service. GPS is the group of 24 well-spaced satellites that circles the soil and makes the people groups to pinpoint their geological area with ground collectors. The area exactness numerous not be correct but it'll be inside 10-100 meters. The GPS comprises of three fragments isolated as, The space portion, The client fragment and the control fragment.

The space section is the group of 24 well-spaced satellites that circles the soil with 11000 naval miles. The client portion is the collector section to get the topographical area of the framework or a client and the ultimate thing is the control portion where it comprises of different ground stations controlling the satellites. GSM and GPS are interfaces together so that the wheel chair follows the Google map through the line drawn within the person on foot. It'll be recognized through the IR sensor and keeps up the adjust and speed of wheel chair consequently.

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7) Accelerometer Sensor

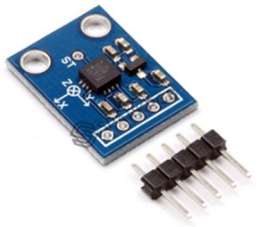


Figure 10. ADXL 335 sensor

ADXL335 may be a little, lean, moo control, total 3-axis accelero-meter with flag conditioned voltage yields. The item measures increasing speed with a least full-scale extend of ±3 g. It can degree the inactive in tilt-sensing solutions, enhancing the speed of gravitation, as well as energetic speeding up coming about from movement, stun, or vibration. ADXL335 is 3v3 consistent device; it's fueled by a 3.3v source additionally creates 3.3v crest yields. It has three yields for each pivot i.e., X, Y & Z. Since these are analog outcomes, a microcontroller with an ADC is required.

a) Characteristics

- It has 3-axis small sensing
- 4 mm × 4 mm × 1.45 mm low profile package and Low power: 350 µA (typical)
- Operates on Single-supply of 1.8 V to 3.6 V
- Shock survival of 10,000 g
- With the a solitary capacitor per axis, BW modulation has good thermal constancy.

8) DC Motor: An electric motor operated by direct current is called DC motor and a DC motor converts Direct Current electrical energy into mechanical energy.



Figure 11. DC motor with electromagnetic brake

a) Specification of DC motor

- MY1016ZL.
- 24V working voltage.
- 3A Starting Current
- 36Nm Rated Torque
- Noise: <60DB.
- >1100W motor output.
- un-load 75 rpm or 120rpm operating speed
- 40:1 Reduction Ratio.
- end face Installation structure.
- Function type: wheelchair.
- Protection form: IP44.
- Insulation class is E.
- DC Power supply type.
- Works on Permanent Magnet DC.

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B. Software and Application Tools

1) *Arduino Software:* The Arduino integrated development environment (IDE) is a cross-platform tool (for Windows, macOS, and Linux) written in the Java programming language. This is designed to enter in programs and convert them to Arduino-compatible sheet. The code written for the IDE is also released under the GNU Common Open Permit, form 2 with the aid of 3rd party organizations and other vendor progress sheets. The Arduino IDE supports the C and C++ programming languages by employing unique code organization rules. The Wiring project provides a program library for the Arduino IDE that includes many common input and gain strategies. User-written code, on the other hand, necessitates two fundamental capacities, for starting the outline and the most program circle, which are collated and associated with a program stub primary () into an executable file official program with the GNU device chain, which is additionally included with the IDE conveyance.



Figure 12. Arduino software

2) *Bluetooth RC Controller*

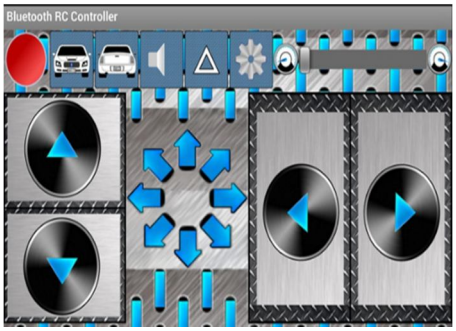


Figure 13. Touch based RC controller application

This is android application-based software where it can be used to control the wheelchair through touch display. Bluetooth act as an intermediate between the application and motor drivers. By user input through touch, wheelchair can be operated, and Bluetooth is connected through the particular port and connection is established.

3) *Arduino Voice Controller:* This is an android application to control the dc motors through voice command and connection is established through Bluetooth device by selecting to single supporting com port. This software uses common human languages to operate the devices.

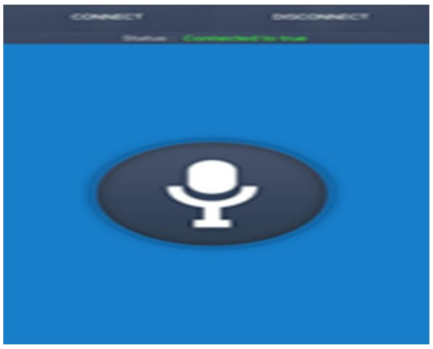


Figure 14. Voice controller application

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4) Simulation Tool

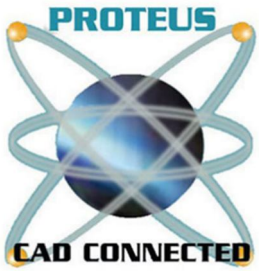


Figure 15. Proteus 8 professional software

This is proteus 8 simulation software for real time execution through simulator and it can be connected to the Arduino IDE software through the ino.hex file and libraries should be loaded for executions of components through Arduino code.

IV. WORKING, OBSERVATION, ANALYSIS AND OUTPUT

A. Interfacing ADXL335

Accelerometer with DC Motors Using Driver and IR Obstacle Avoidance Sensor and IR Line Following Sensor.

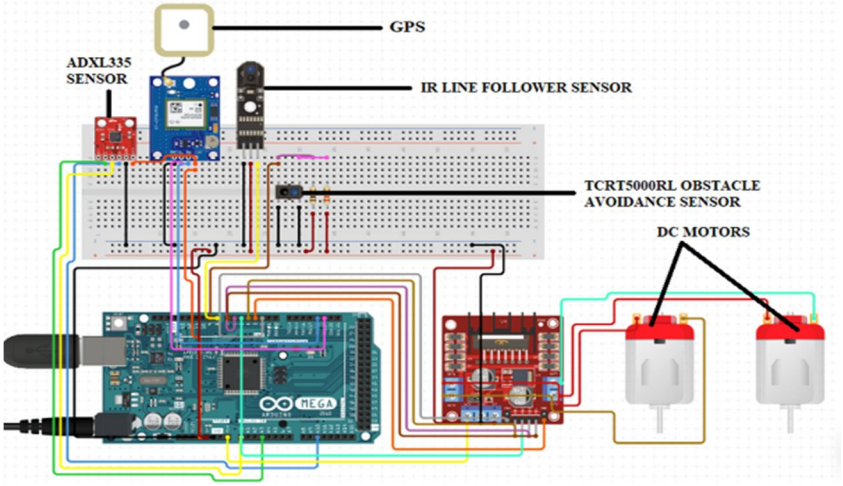


Figure 16. Automated wheelchair through GPS

From the above diagram the ADXL335 accelerometer sensor is connected to dc motors and TCRT5000RL sensor also connected with same dc motors through the L293D driver so that the wheelchair can be balanced and avoid the obstacles. Through GPS when the user registers the location the dc motor follows the line drawn through IR line follower sensor.

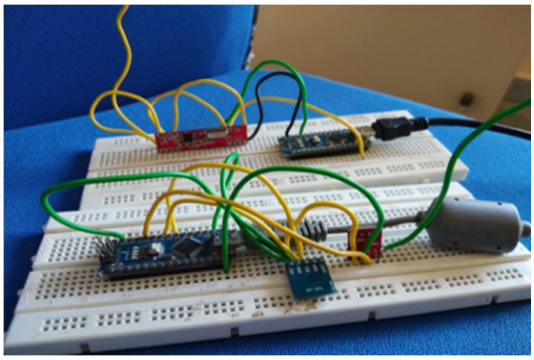


Figure17. Calibrating the ADXL335 sensor

From the above figure we calibrate the accelerometer sensor to maintain the balance of DC motors.

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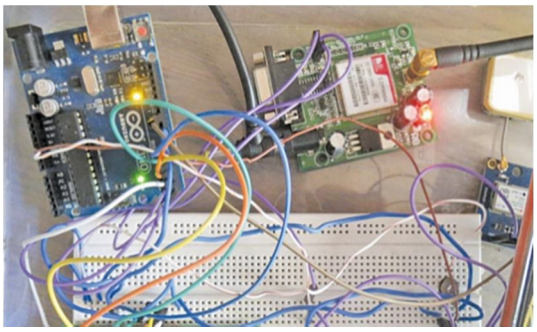


Figure 18. Calibrating the GPS

After calibrating ADXL335 sensor the above figure represents the calibrating the GPS for the line following wheelchair through IR sensor.

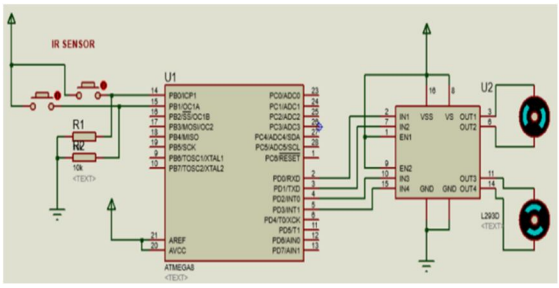


Figure 19. Simulation of IR sensor for Line following.

From the above simulation the IR sensor act as active high and active low so, when it triggers to '1' the wheelchair will automatically move forward, backward, left and right by following the line drawn. When the line drawn in black then it is detected as '1' otherwise it is considered as '0'. So, in above simulation it is shown as switch where, when IR sensor is '11' it moves forward, '01' it moves right, '10' it moves left and finally when it is '00' it stops.

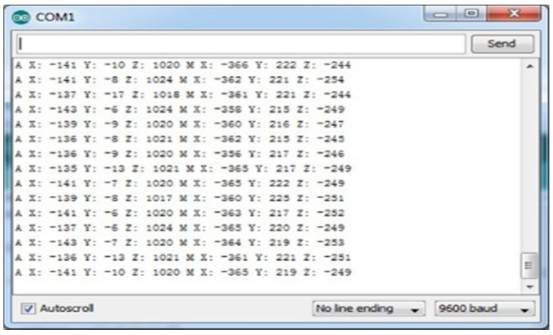


Figure 20: Output of ADXL335 Accelerometer sensor.

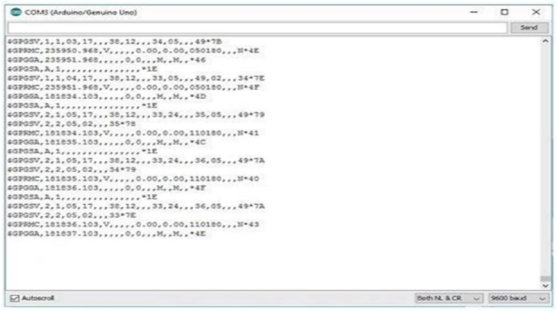


Figure 21: Output of GPS interfaced GSM and IR sensor.

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B. Interfacing Touch-Based Wheelchair Simulation

Interfacing touch-based wheelchair simulation through the Bluetooth RC controller application communicated through Bluetooth hc-05.

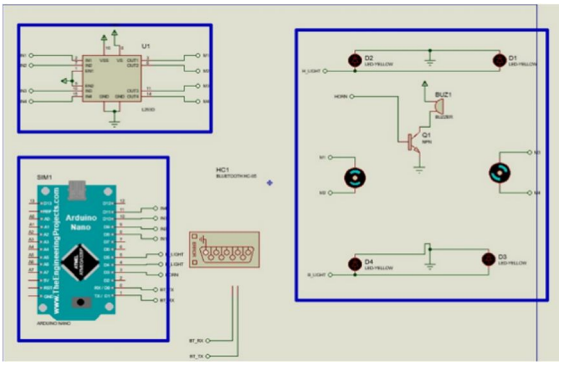


Figure 22. Simulation of touch-based wheelchair controller through Bluetooth RC controller application.

From the above simulation the wheelchair can be operated through application in android phone called Bluetooth RC controller application. By establishing connection between the HC-05 Bluetooth in simulation and comport in mobile device to operate motors, head light, backlight and horn.

C. Interfacing Voice Based Wheelchair Simulation

Interfacing Voice Based Wheelchair Simulation Through the Arduino Voice Controller Application Communicated Through Bluetooth Hc-05.

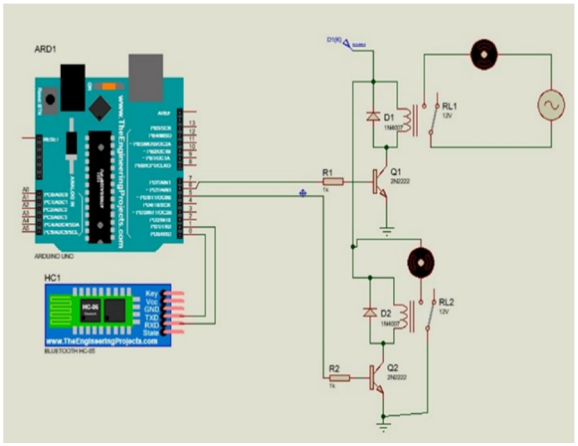


Figure 23. Simulation of voice-based wheelchair controller through Arduino voice controller application.

Form the above simulation the wheelchair can be controlled through the voice command to move forward, backward, left, right and to stop. The connection is established between the Bluetooth of mobile application and definite com port of HC-05 Bluetooth module.

V. CONCLUSION AND FUTURE WORK

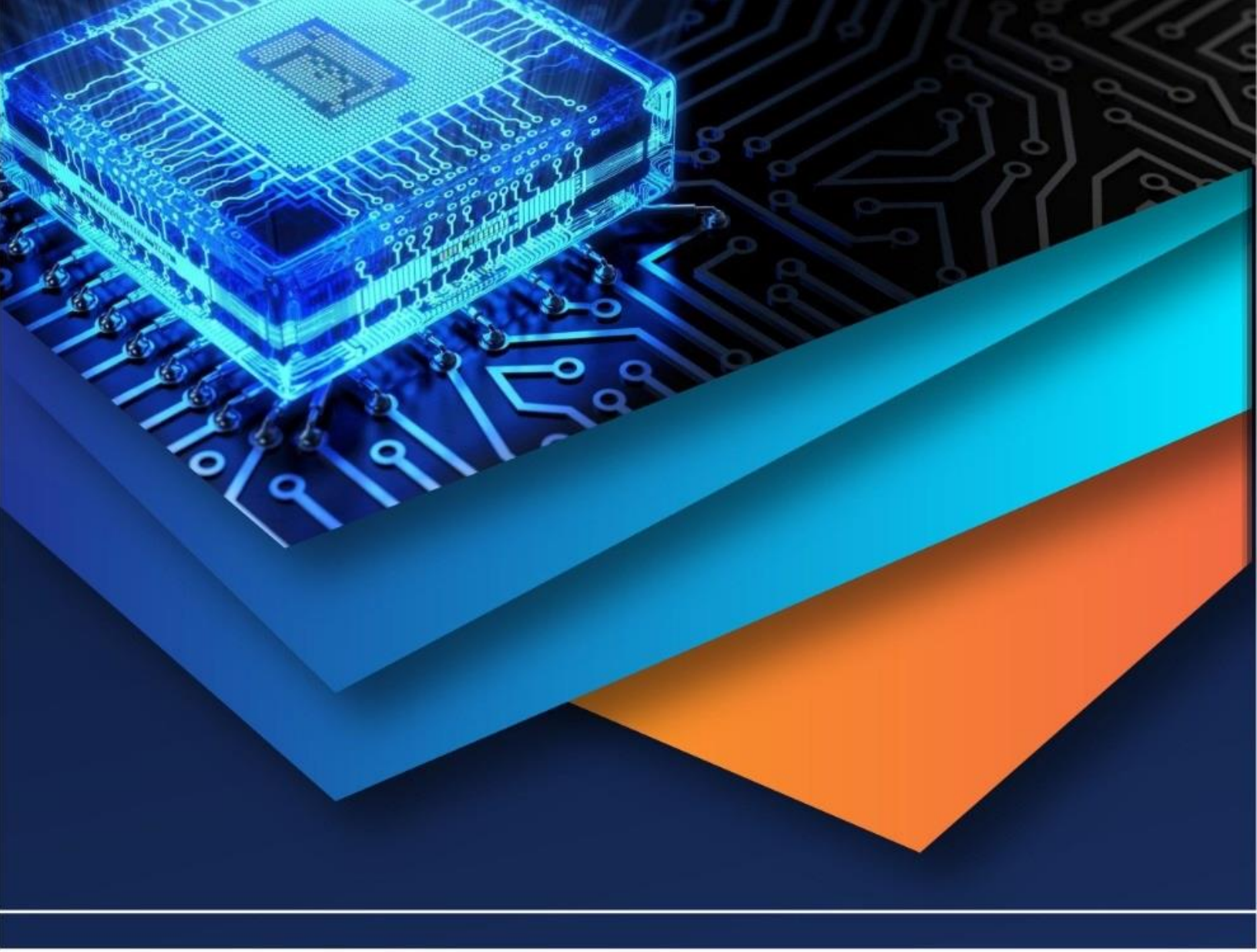
Our primary objectives for this venture are to form a framework that let any paralyzed, disabled and dazzle people groups to afford the system and to form less demanding to function conjointly we accept to devour less control to the components and remain absent from the disadvantages and it can be utilized for numerous applications like for crippled patience in clinic, It can be utilized by the elderly and physically challenged individual to move interior and exterior the house and in transport halt, railroad station, air terminals for elderly peoples. In future, more progressed controllers and sensors can be utilized. Raspberry pi can be utilized for more progressed highlights. Encourage the wheelchair can be created by fake insights so that it can effectively interface to the client thought additionally to plan a wheelchair with all the comforts the crippled people require.

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