DESIGN A WIRELESS CONTROLLED WHEEL CHAIR FOR PARALYZED PEOPLE WITH JOYSTICK

A Project and Thesis submitted in partial fulfillment of the requirements for the Award of Degree of
Bachelor of Science in Electrical and Electronic Engineering

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CERTIFICATION

This is to certify that this project and thesis entitled **"Design a Wireless Controlled Wheel Chair for Paralyzed People with Joystick."** is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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Dedicated to

Our Parents

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LIST OF ABBREVIATIONS

WCWCPP	Wireless Controlled Wheel Chair for Paralyzed People with Joystick
NSF	National Science Foundation
CPU	Central Processing Unit
EMI	Immune to Electromagnetic Interference
PWM	Pulse width modulation
FWHM	Full Width at Half Maximum
LED	Light Emitting Diodes
AREF	Analog Reference
USB	Universal Serial Port
TX/RX	Transmit and Receive
IC	Integrated Circuit
RMS	Root Mean Square
US	Ultrasonic Sensor
MC	Multipoint Control Unit
UV	Ultraviolet
WD	Waveguide Dispersion

ACKNOWLEDGEMENT

First of all, we give thanks to Allah or God. Then we would like to take this opportunity to express our appreciation and gratitude to our project supervisor **Ms. Nusrat Chowdhury**, **Assistant Professor of Department of EEE** for being dedicated in supporting, motivating and guiding us through this project. This project can't be done without his useful advice and helps. Also thank you very much for giving us opportunity to choose this project.

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To our beloved family, we want to give them our deepest love and gratitude for being very supportive and also for their inspiration and encouragement during our studies in this University.

ABSTRACT

Wireless Control Wheelchair (WCWCPP) for paraplegic people with joystick, electric wheelchair (PW) with computers, sensors and assistive technology. over the past decade Little has been attempted to systematically review the WCWCPP research. The aim of this paper is to provide a complete, complex overview of WCWCPP research trends. We hope that the information gathered in this study will raise awareness of the current PW state and WCWCPP technology and streamline it. In this paper, there are two ways to control the wheel chair. Firstly from Joystick and secondly from Android mobile. If the wheelchair user is able to use the Joy Stick, then he can use it. If the wheelchair user is unable to use the Joy Stick, then someone else can control the wheelchair with the wheelchair access. In this case, the wheelchair has to be connected to the Android device via Bluetooth. We systematically present the WCWCPP's international research efforts. It started with introducing electric wheelchairs and the communities they serve. We will then discuss in detail WCWCPP and related technological innovations highlighting the most research areas. Create the most interesting for future research and development. We are closing in on our vision for the future of WCWCPP research and how to best serve people with disabilities of all types.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Automation innovations have increased exponentially in the past few years. Such advancement was only a fantasy for a few people two or three years ago. However, in today's fast-moving world, Robots have a purpose, for example, an article that tracks robots that can connect and coexist with them. It provides enough current to drive two control engines for each wheel [1].

In this article, there are two ways to control a wheelchair. Firstly from joystick and secondly from android mobile if wheelchair user can use joystick. he is available If wheelchair users cannot use the joystick Indicates that someone else is controlling the wheelchair with wheelchair access. In this case, the wheelchair must be connected to the Android device via Bluetooth.

This stroller is very easy to control. The joystick controller can be mounted to the left or right of the cart. And the wheelchair can be installed according to the convenience of the users another feature of this wheelchair is wireless control. Wheelchairs are often connected to Android devices via Bluetooth. This wheelchair is very easy to use for the disabled. We hope this technology will help people overcome their problems.

1.2 Purpose of this project

The capability of a robot to track and follow a moving object can be used for several purposes. To design a low cost device in order to use general purpose.

i. To save time.

ii. To help humans.

iii. To create easier for people.

iv. Can be used for defense purpose.

1.3 Problem Statement

The traditional article following wheelchair is an ease back answer to the blunder happens will just leave its track that drawn on the floor. This Obstacle will make the notice of the wheel chair be unsmooth. Despite the fact that this wheel chair can pursue the human and item, its development still should be created.

1.4 Applications of this project

- Industrial Automation
- Guide in the museum.
- Send a letter in the office building.
- Can be used as a replacement for cranes in various lifting and transport tasks.
- It can help transport a large number of people working in hospitals, libraries, airports, etc.
- Able to provide services to people at shopping centers or common areas.
- Able to help the elderly, special children and infants.
- Can track specific vehicles.

1.5 Methodology

The Wireless control wheelchair is made by a number of components, such as the Arduino Uno, Bluetooth module, motor driver and LED indicator. One of the devices here is the Arduino Uno. All the components are connected to the arduino uno and all the components are controlled via Ardino. Joystick has a total of four terminals positive and negative and the other two are x-axis and y-axis. Bluetooth device's four terminals are positive and negative and the other two are Tx and Rx. The motor driver l298n is used to control the DC motor in this wheelchair. The signal is sent from the Arduino Uno to the motor driver through four data pins and accordingly the motor is controlled by the motor driver. Another important point is that the main power source of the battery is first given to the motor driver and 5 volt constant output voltage from the motor driver is given as power in Arduino. After giving the power source when all the components will be activated. So if we want to control the wheelchair via Android mobile then Bluetooth device has to be connected to Android mobile. After connecting the wheelchair to the Android device, any data from the Android device, any command can be easily sent to the wheelchair. This wheelchair has an indicator that when a command is sent from an Android device to a wheelchair, the indicator will blink to make it easier to understand that the Android device and the wheelchair are working properly. In this method this wheelchair can be controlled within a range of tk.10m. If the wheelchair user is unable to control the wheelchair themselves, others will be able to control it with wheelchair access. If the wheelchair user can take control of the wheelchair himself, he can easily control the wheelchair through the joystick controller of the wheelchair.

1.5 Project Outline

This project is organized as follows:

Chapter 1 Introduction of the project

Chapter 2 Reviews the literature knowledge of live object follower robots

Chapter 3 Analysis of the system components of the project

Chapter 4 Describe all the Hardware Development parts

Chapter 5 Results and Discussion

Chapter 6 Concludes with some recommendations

CHAPTER 2

LITERATURE REVIEWS

2.1 Introduction

People with intellectual / motor / sensory disabilities must use an electric wheelchair (PW) to meet their mobility needs due to disability or disease. Since some people with disabilities cannot use traditional joysticks to navigate the PW, they use an alternative control system such as a head joystick. Chin-style joysticks, sip-n-puff and thought control [1] [5]. In many cases, PW users have trouble with daily movement. And benefit from automated navigation. Along with movement people with disabilities rely heavily on their caregivers to eat and drink. Manage things and communicate with others especially in large groups.

2.2 How Wheelchair Systems works

Operation modes range from automatic to semi-automatic. Depending on the user's ability and the task at hand, Table 5 lists the subtopics and sample references in the field of SW operating mode research. Get the most from automation But what if they spent most of their time in the same controlled environment? If the user can plan and execute the route to the destination efficiently Having a system that limits collision avoidance may be more beneficial [6], [7] Ideally, the design should depend on the capabilities and needs of the individual user. Increase the amount of control received to the maximum. while providing user assistance as needed [8]

Fig.2.1 Modern wheelchair

2.3 Joystick

This is a joystick that is similar to the 'analog' joystick on the PS2 (PlayStation 2) controller. It is a self-centering spring-loaded joystick. This means that when you release the joystick the joystick will center itself. It also has a comfortable cup button/lid that feels like thumbs up.

Fig. 2.2 Joystick

The goal of the joystick is to communicate 2D (2-axis) motion to the Arduino. This is done by inserting two independent 10K potentiometers (one per axis). It is a dual adjustable voltage divider. It provides a 2-axis analog input in joystick form.

Potentiometers are two blue boxes on either side of the joystick. If you move the joystick then looks at the center axis of each potentiometer. You can see that each potentiometer only detects movement in one direction. We will discuss later how this actually works [8].

2.3.1 How Joystick system works

The basic idea of a joystick is to translate the position of the sticks on the two X (left to right) axes (left to right) and the Y (up and down) axes into electronic data that the Arduino can process. Which can be a little tricky But with a joystick design that consists of two potentiometers and a gimbal mechanism.

When you turn the joystick the thumb grip will move a narrow rod. Housed in two rotatable slotted shafts (Gimbal), one shaft allows movement in the X (left and right) axis, while the other allows movement in the Y (up and down) axis. The Forward and backward will rotate the Y axis from side to side. Tilting from left to right causes the X-axis to rotate as you move the shaft diagonally. It will rotate both axes [10].

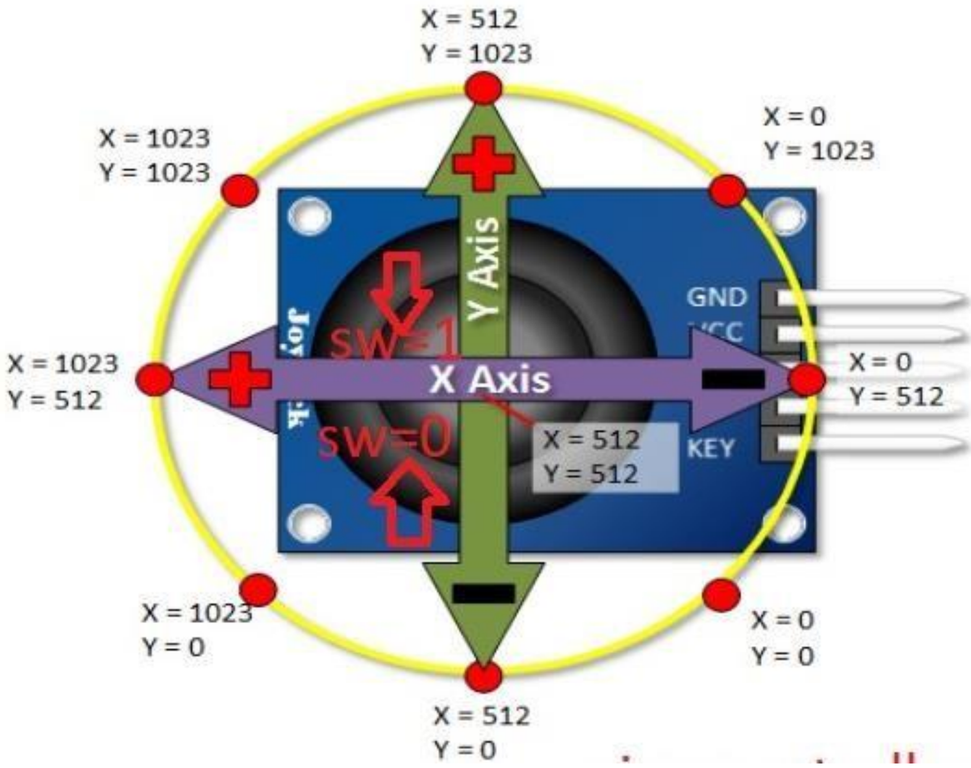

Fig. 2.3 Joystick reading

To read the physical state of the joystick we need to measure the change in resistance of the potentiometer. This change can be read by Arduino analog pins using ADC. Since the Arduino board has a 10-bit ADC resolution, the value of each analog channel (axis) can be changed from 0 to 1023, so moving the stick over it is X-axis. From one end to the other, the value of X changes from 0 to 1023 and the same happens when the joystick is centered and moves along the Y axis. The value is approximately 512. The figure below shows the X and Y directions and also indicates how the output responds when the joystick is pressed in different directions [11].

2.3 Summary

We discussed whole over the Wireless Controlled Wheel Chair for Paralyzed People with Joystick from beginner to twenty first century in this chapter-2. We mentioned history of Wireless Controlled Wheel Chair for Paralyzed People with Joystick. We think this Wheel chair is very important for our country for save human life and cost effective.

CHAPTER 3

ANALYSIS OF THE SYSTEM COMPONENT

3.1 Introduction of Hardware Connection

In this section, we have talked about different parts that will be expected to make this "Wireless Controlled Wheel Chair for Paralyzed People with Joystick".

3.2 Components

The Wheel Chair has the following main components are

i. Arduno uno
ii. Bluetooth module
iii. Car chassis
iv. 12v DC motor
v. Lithium ion Battery 3.7v
vi. L298N Motor driver
vii. Bread board
viii. Joystick
ix. Jumper wire
x. PVC board
xi. Battery holder
xii. Switch
xiii. Tools Needed

3.2.1 Arduino Uno

The board of the microcontroller is Arduino Uno in ATmega328P. It has 14 digital inputs / outputs (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator and connections. USB, socket, ICSP connector and reset button with USB Mini-B interface instead of the standard interface.

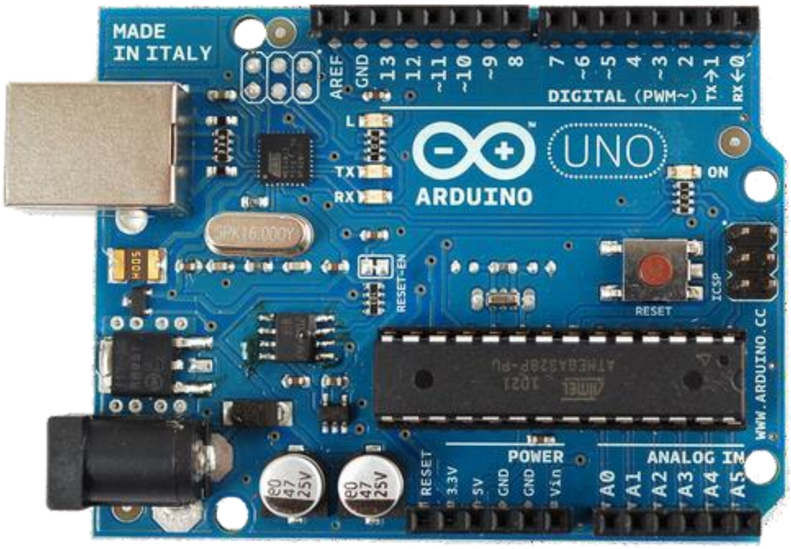

Figure 3.1: Arduino Uno

3.2.1.a Arduino Board Pinout

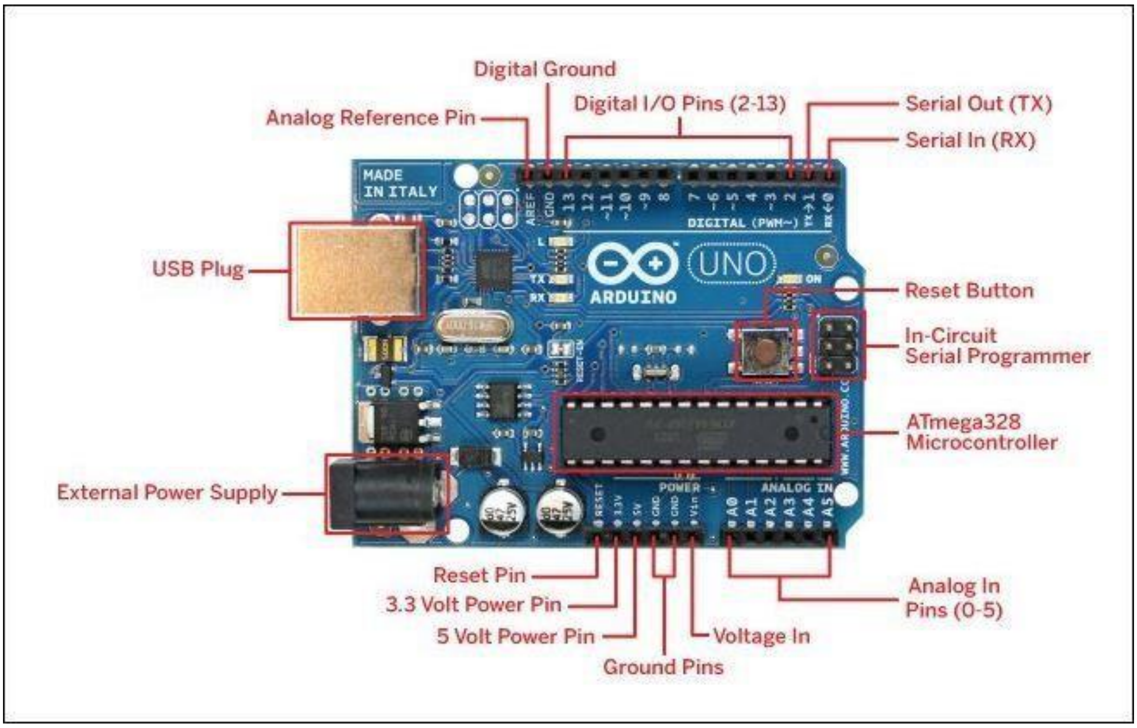

Figure 3.2: Arduino Board Pin out

3.2.2 Bluetooth module

The Bluetooth HC-05 module is an easy-to-use Bluetooth SPP (Serial Port Protocol) module. Designed to establish seamless serial air connection. Provides an easy way to connect to a serial or PC communication controller. The HC-05 Bluetooth device has a mode for switching between master mode and slave mode. This means that it cannot be used to receive or transfer data.

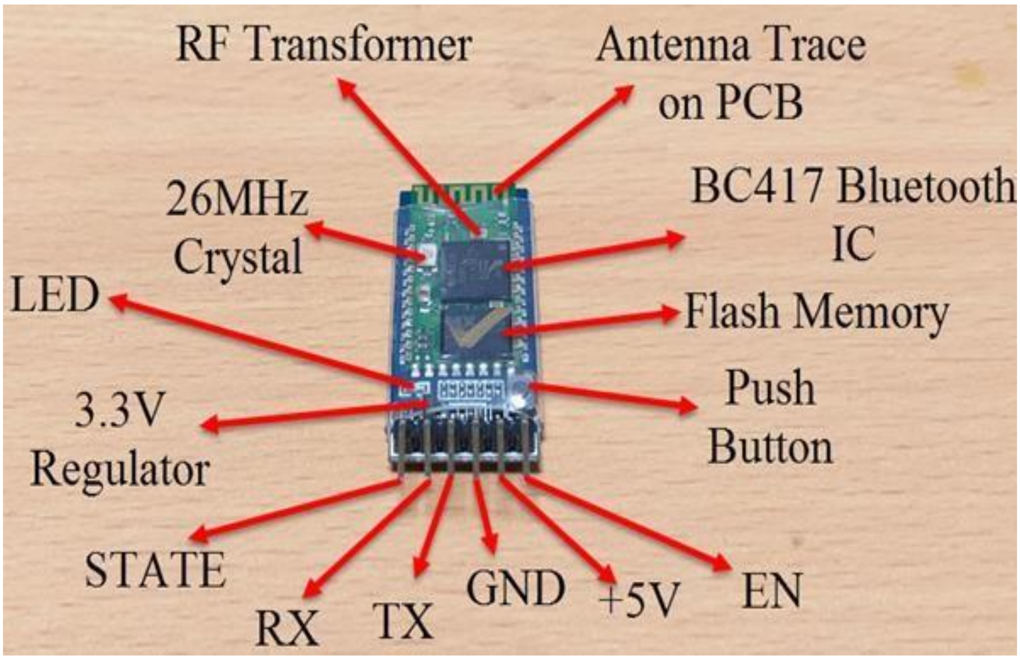

Figure 3.3: Bluetooth Module

3.2.3 Car chassis

Car chassis is the main structure of the robot; Basically, all the parts are put into it. Chassis is a car support system, called a frame. It can withstand all loads on the car under upright and strong conditions.

Figure 3.4: 4-Wheel Robot Car Chassis.

3.2.4 12v DC motor

Due to the small size and high energy consumption, DC engines are normally utilized in the mechanical technology field. The main characteristics of DC motor are high velocity, low torque and reversibility. Four 3V~6V DC motors are used by the spy robot, as seen in Fig. 2. This DC motor is a dual-axis gear motor with a reduction ratio of 1:48. This motor's operating voltage is 3V to 6V. At 6V and 150mA at 3V, respectively, the discharge current is 200mA.

Figure 3.5: DC Gear Motor.

3.2.5 Lithium ion Battery 3.7v

A power supply is required to operate every electronic device, we have chosen a 3.7 volt lithium ion battery to activate this project. Lithium batteries speak to a progressive innovation in sustainable power stockpiling, for PE gadgets as well as for transportation. In the car field, in any case, some significant inquiries are as yet open. Disregarding the gigantic advances got in the new past as far as cell execution, today the lithium-particle batteries have lacking energy or life for use in vehicles to coordinate the presentation of inside ignition motors.

Figure 3.6: Battery (3.7V Lithium Ion).

3.2.6 L298N Motor driver

The L298N Engine Driver module comprises of an incorporated circuit L298 Engine Driver IC, 78M05 Voltage Controller, resistors, capacitor, Force Drove and 5V jumper. Just the jumper is situated will the 78M05 voltage controller be initiated. At the point when the force supply is not exactly or equivalent to 12V, the voltage controller can control the inward hardware and the 5V pin can be utilized to control the microcontroller as a yield pin.

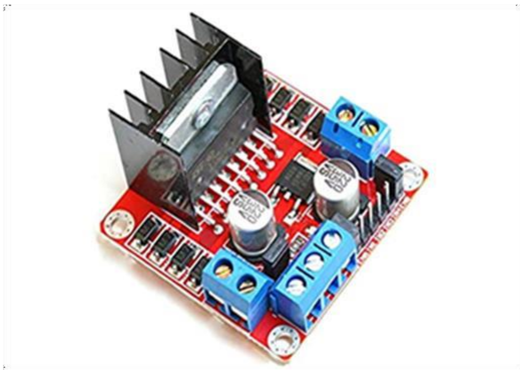

Figure 3.7: L298N Motor Driver.

If the power supply exceeds 12V, a jumper must be installed at different 5V outlets that should be dissipated by 5V terminal to power the internal circuit. The ENA & ENB pin is a motor A and motor B speed control, while IN1 & IN2 and IN3 & IN4 are a motor A and motor B powder.

Below is an internal circuit diagram of the L298N driver module:

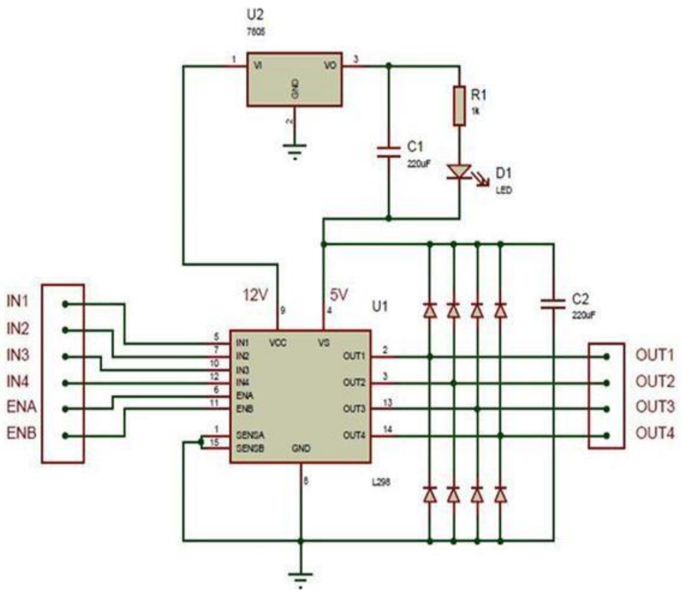

Figure 3.8: L298N Motor Driver Module's Internal Circuit Diagram.

3.2.7 Bread Board

A breadboard is a solder less gadget for an impermanent model with hardware and test circuit plans. Most electronic segments can be interconnected in electronic circuits by embedding's their leads or terminals into the openings and making associations through wires where conceivable. Under the board, the breadboard has metal strips and the openings on the most elevated purpose of the board are associated.

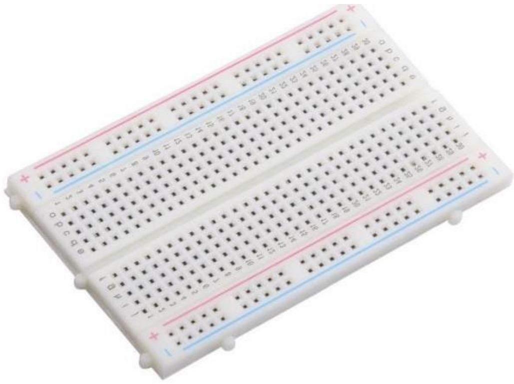

Fig.3.9: Bread Board

3.2.8 Joystick

Most robot services require a joystick. This module provides a cheap solution for it. The joystick module is similar to the analog joystick located on the game pad. This is done by inserting two potentiometer holes at a 90 degree angle. Potentiometers are connected to a small rod of the middle source.

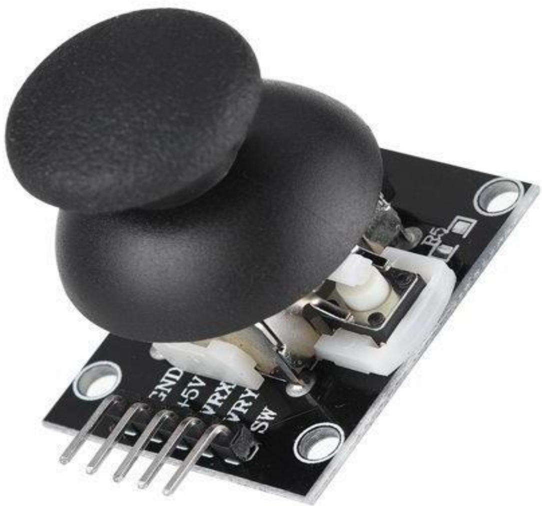

Fig.3.10: Joystick module

This module produces approximately 2.5V output from X and Y after a break. Moving the joystick will convert the output from 0v to 5V depending on its direction. If you connect this module to a microcontroller. You can read about 512 in rest mode (slight change is expected as the source and system differ slightly), you should see a shift from 0 when moving the 1023 joystick depending on the position.

3.2.9 Jumper wire

The jumper wires, which are wires that have a connecting point at each end, are used to connect two densities to each other randomly. Commonly used wires are used on different boards to support the business for circuit switching.

Fig. 3.11. Jumper wire

3.2.10 PVC Board

PVC foam board is a feather light, extended unbending PVC froth sheet that is utilized for an assortment of uses including signs and shows, display corners, photograph mounting, inside plan, thermoforming, models, model making and substantially more. It very well may be effectively sawed, stepped, punched, cut, sanded, bored, screwed, nailed, or bolted. It tends to be fortified utilizing PVC cement. It properties incorporate brilliant effect opposition, exceptionally low water ingestion and high erosion obstruction.

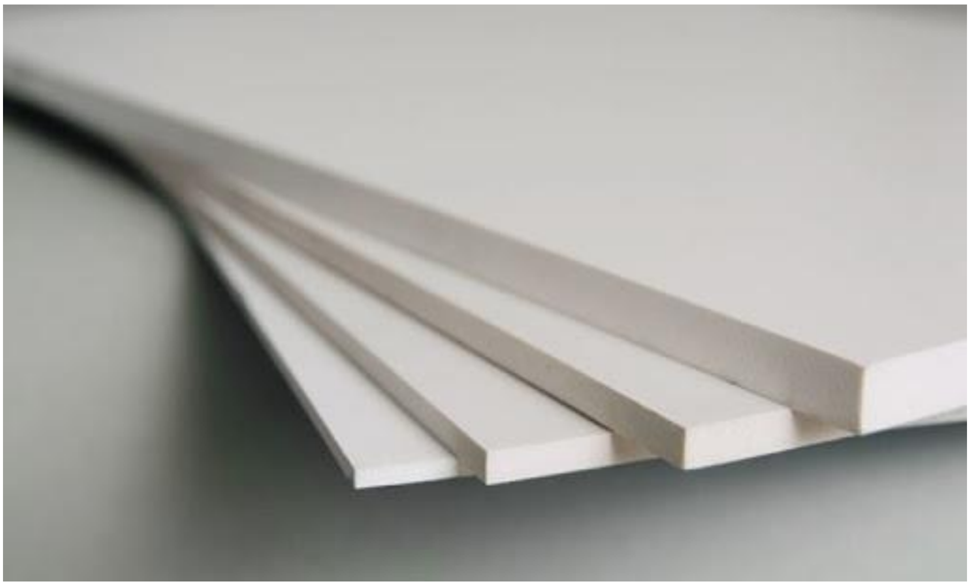

Fig. 3.12 PVC Foam Board

3.2.11 Battery holder

The battery holder is chosen to hold the battery the battery holder is chosen to hold the battery. A battery holder or a battery mount is a coordinated or separate hole to hold cells. In the event that it is a different compartment, it tends to be appended to a cell-fueled gadget. It is utilized to hold the cells safely and power the gadget it is joined to. The essential capacity of a battery holder is to encourage the force supply to the gadget it is appended to. A battery holder or a battery mount is a coordinated or separate hole to hold cells. In the event that it is a different compartment, it tends to be appended to a cell-fueled gadget. It is utilized to hold the cells safely and power the gadget it is joined.

Figure 3.13: Battery Holder.

3.2.12 On/Off Switch

This is done to activate and turn on the project's power supply. It provides additional protection to our project. Actually this gives our devices extra protection.

Fig.3.14: On/Off Switch

The switch where we can press is called a "positive on off switch". The most regular utilization of this kind of switch is to turn lights or other electrical hardware on or off.

3.2.13 Tools Needed

Fig. 3.15 some tools

Some tools name are given below

i. Soldering Iron
ii. Glue gun
iii. Cutter
iv. Knife
v. Digital Multimeter
vi. Screwdriver
vii. Tweezer
viii. Panavisejr
ix. Wire Strippers
x. Needle nose Pliers

3.3 Summary

This chapter deals with the basics of this Wireless Controlled Wheel Chair for Paralyzed People with Joystick. All parts used for this work are good and work well. In this chapter, we attempt to describe in detail the functional characteristics of each used hardware and contribution.

CHAPTER 4

HARDWARE DEVELOPMENT & SYSTEM DESIGN

4.1 Introduction

This chapter describes the implementation and deployment and hardware implementation process of “Design a Wireless Controlled Wheel Chair for Paralyzed People with Joystick” with Solving Algorithms. The main topic discussed in this article is how this project is to simulate. Details and hardware links are provided below:

4.2 Block diagram

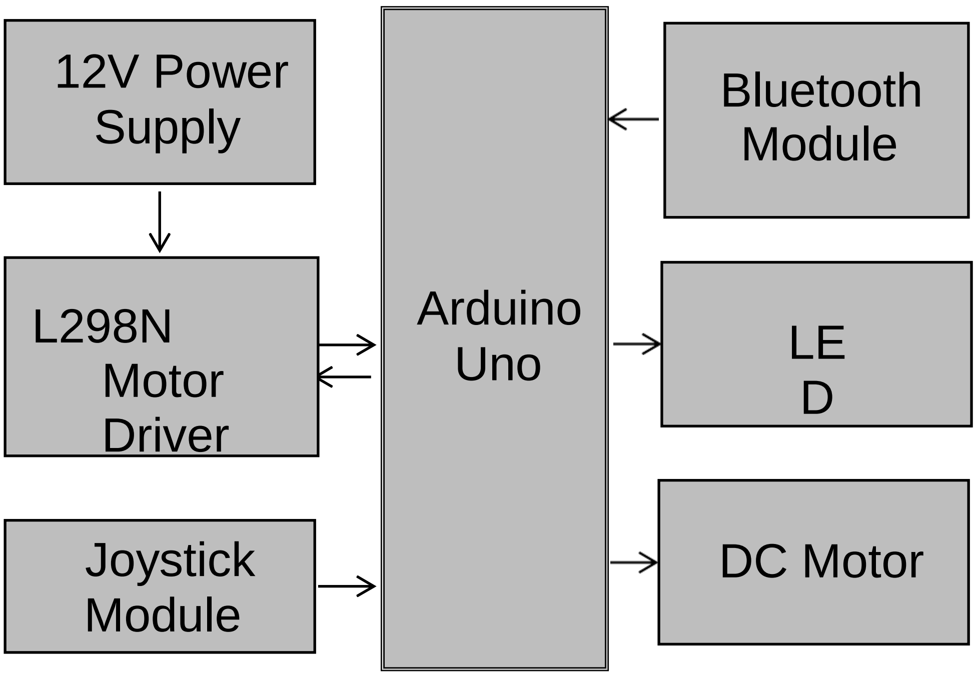

Fig.4.1: Block diagram of Wheel chair for paralyzed people

4.3 Flow Chart

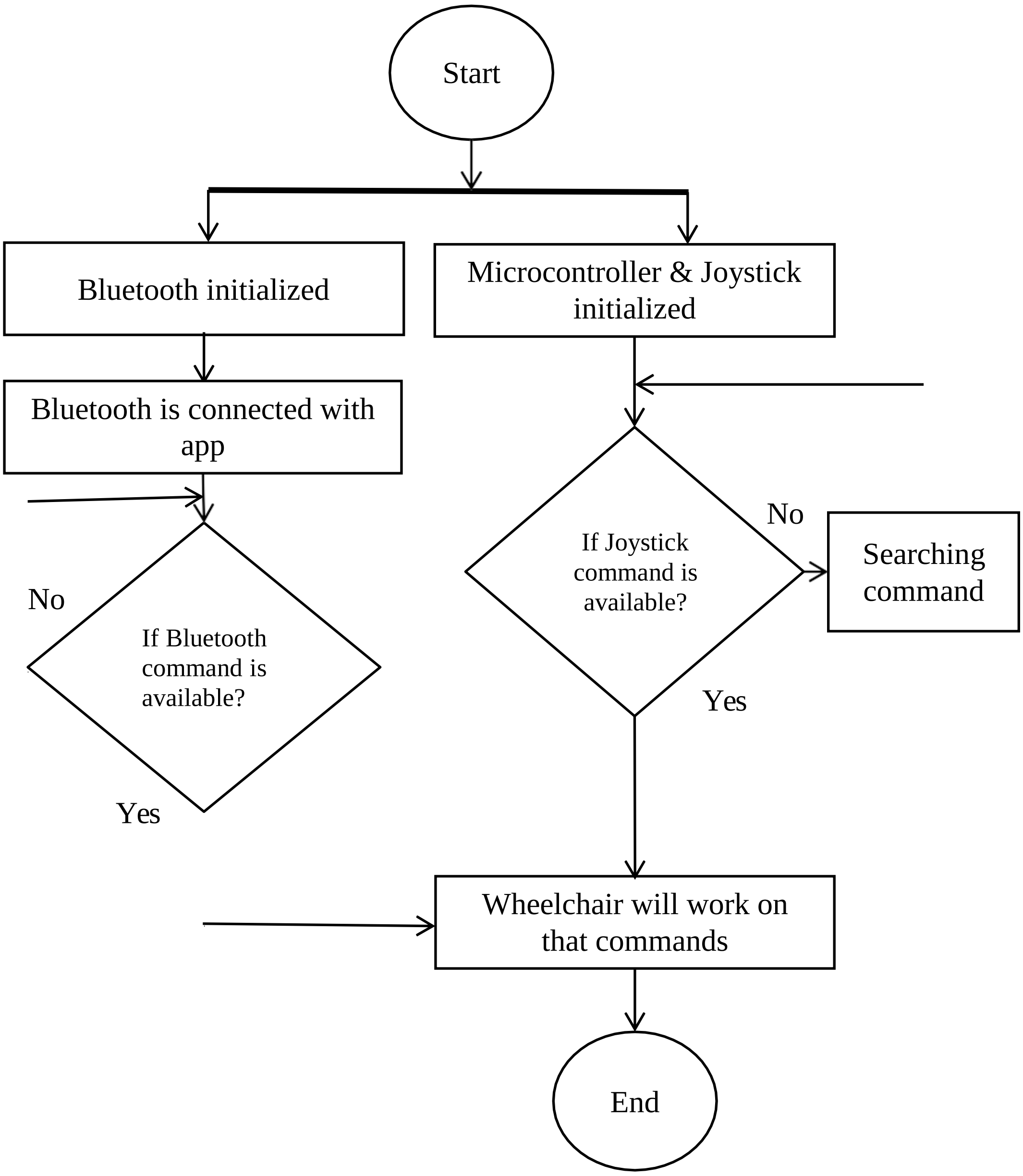

Fig.4.2: Flow chart of Wheel chair for paralyzed people

Once the flowchart starts, there is a decision-making option first. If Joystick command is available then the system goes down then wheelchair will work on that commands. If Joystick command is not available then the system goes main loop, On the other hand, If Bluetooth command is available then the system goes down, then wheelchair will work on that commands. If Bluetooth command is not available then the system goes above main loop. After that the process will be ended.

4.4 Circuit Diagram

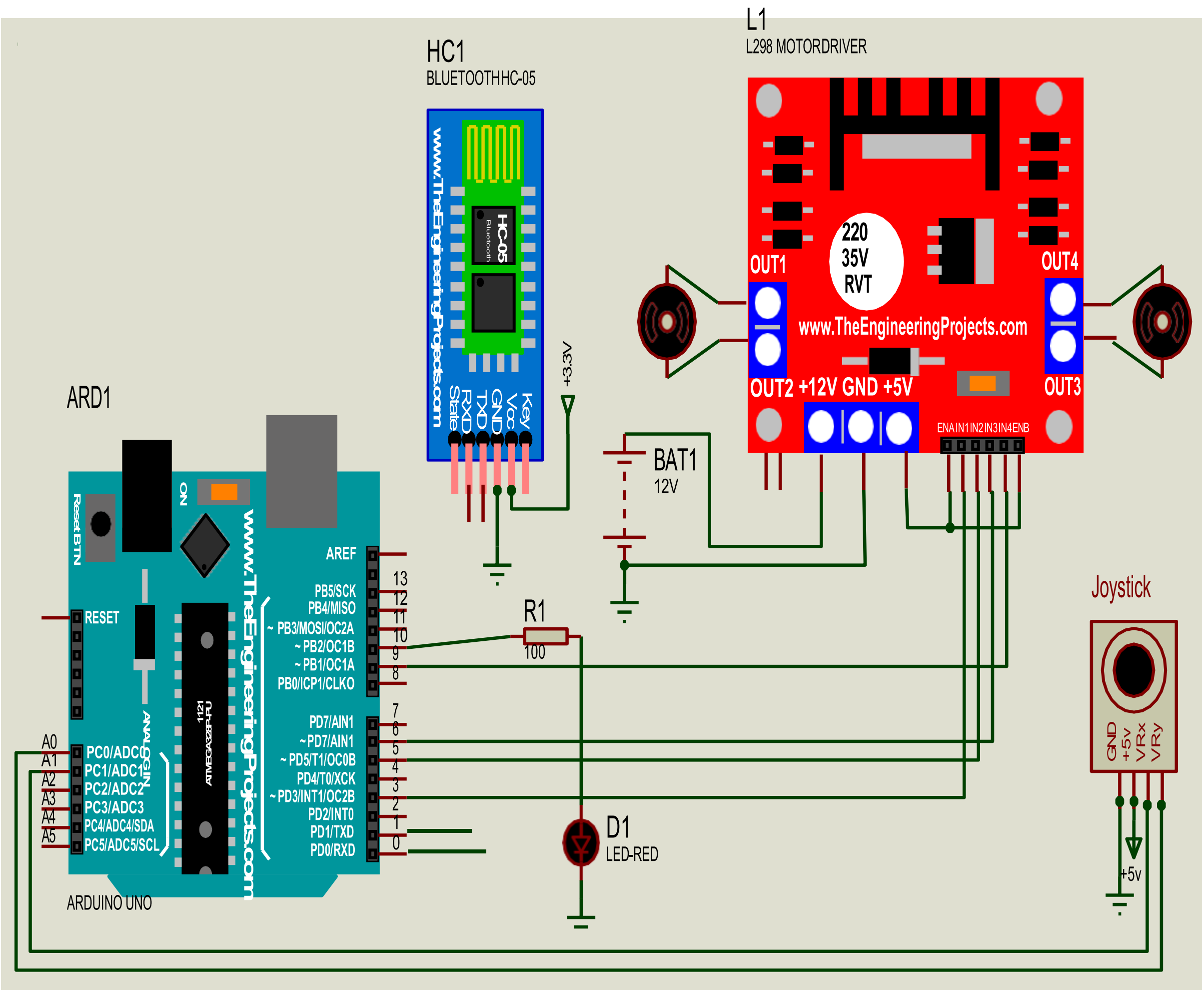

Figure 4.3: Schematic diagram of Wheel Chair for Paralyzed

4.4.1 Descriptions of Hardware Connection

The Wireless control wheelchair is made by a number of components, such as the Arduino Uno, Bluetooth module, motor driver and LED indicator. One of the devices here is the Arduino Uno. All the components are connected to the arduino uno and all the components are controlled via Ardino. Joystick has a total of four terminals positive and negative and the other two are x-axis and y-axis. Bluetooth device's four terminals are positive and negative and the other two are Tx and Rx. The motor driver l298n is used to control the DC motor in this wheelchair. The signal is sent from the Arduino Uno to the motor driver through four data pins and accordingly the motor is controlled by the motor driver. Another important point is that the main power source of the battery is first given to the motor driver and 5 volt constant output voltage from the motor driver is given as power in Arduino.

4.5 Summary

After all that is done as a result of this, the Wireless Controlled Wheel Chair for Paralyzed People with Joystick is ready to run. The main problem in this chapter is to build a hardware connection about the performance of this function. Therefore, the main purpose of this project is to understand the block diagram and the connection diagram.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 Introduction

The results of this chapter will be summarized as well as all conversations and discussions. After finished the project we run experiment on the Wireless Controlled Wheel Chair for Paralyzed People with Joystick. During the successfully experiment period, we become a conclusion on it.

5.2 Final Result

After completing hardware, we successfully run this project. The signal is sent from the Arduino Uno to the motor driver through four data pins and accordingly the motor is controlled by the motor driver. Another important point is that the main power source of the battery is first given to the motor driver and 5 volt constant output voltage from the motor driver is given as power in Arduino. After giving the power source when all the components will be activated. So if we want to control the wheelchair via Android mobile then Bluetooth device has to be connected to Android mobile. After connecting the wheelchair to the Android device, any data from the Android device, any command can be easily sent to the wheelchair. This wheelchair has an indicator that when a command is sent from an Android device to a wheelchair, the indicator will blink to make it easier to understand that the Android device and the wheelchair are working properly. In this method this wheelchair can be controlled within a range of tk.10m. If the wheelchair user is unable to control the wheelchair themselves, others will be able to control it with wheelchair access. If the wheelchair user can take control of the wheelchair himself, he can easily control the wheelchair through the joystick controller of the wheelchair.

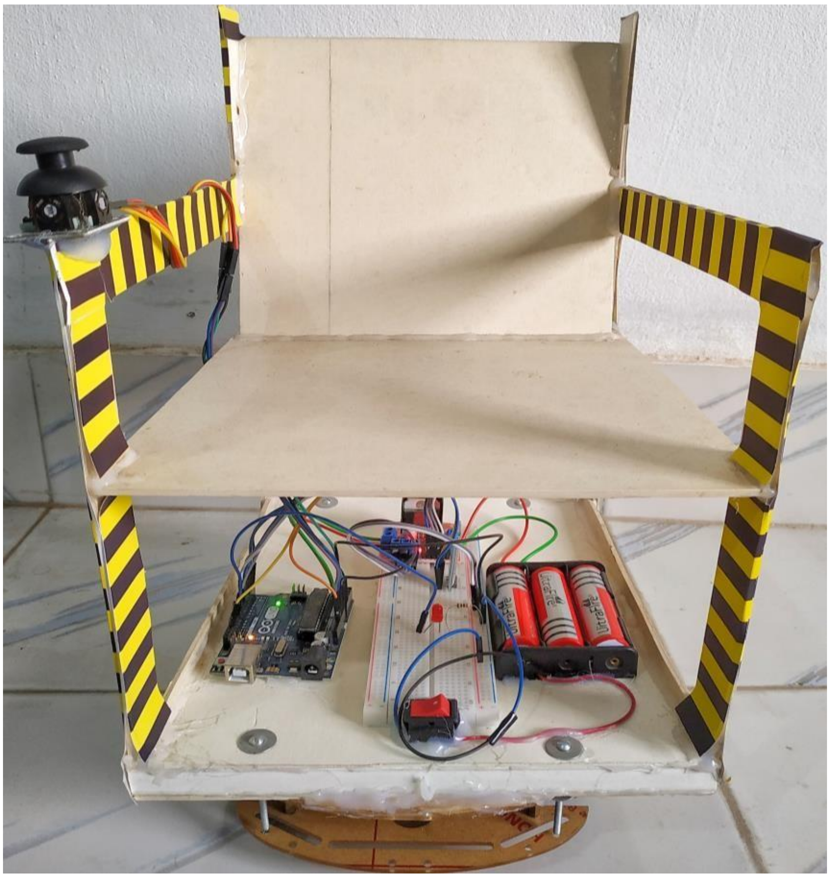

Figure 5.1: Front view of Wheel Chair for Paralyzed

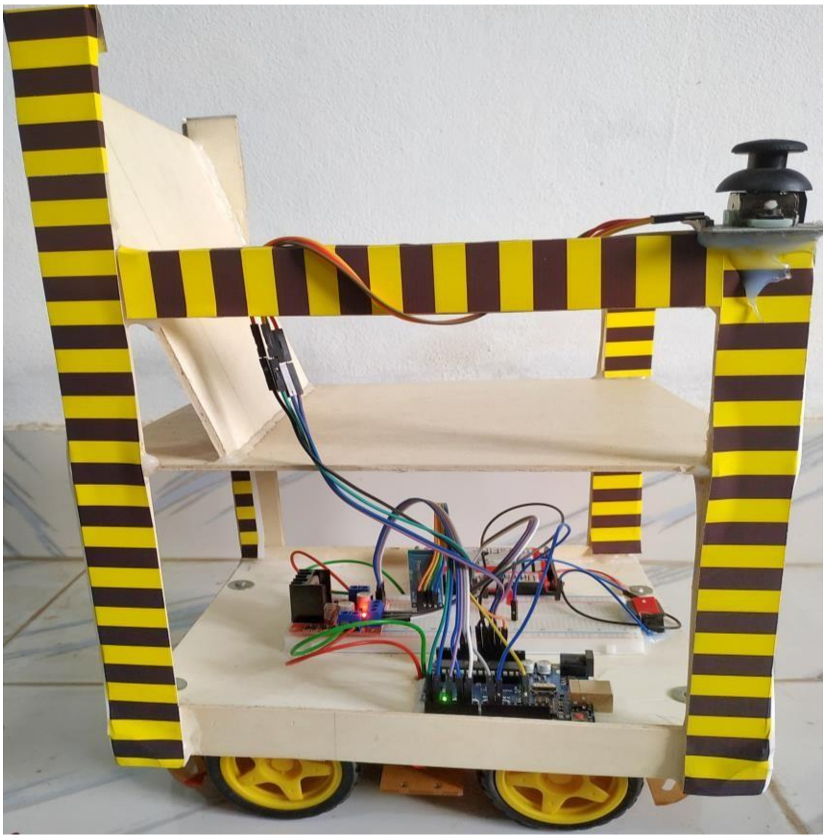

Figure 5.2: Right view of Wheel Chair for Paralyzed

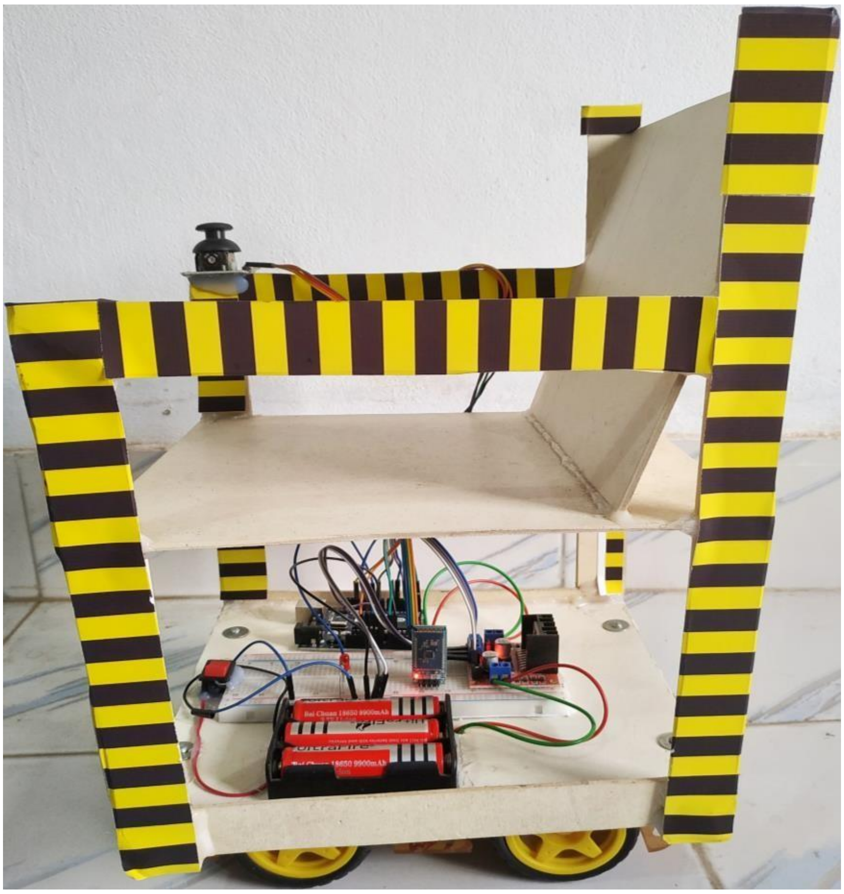

Figure 5.3: Left view of Wheel Chair for Paralyzed

Figure 5.4: Top view of Wheel Chair for Paralyzed

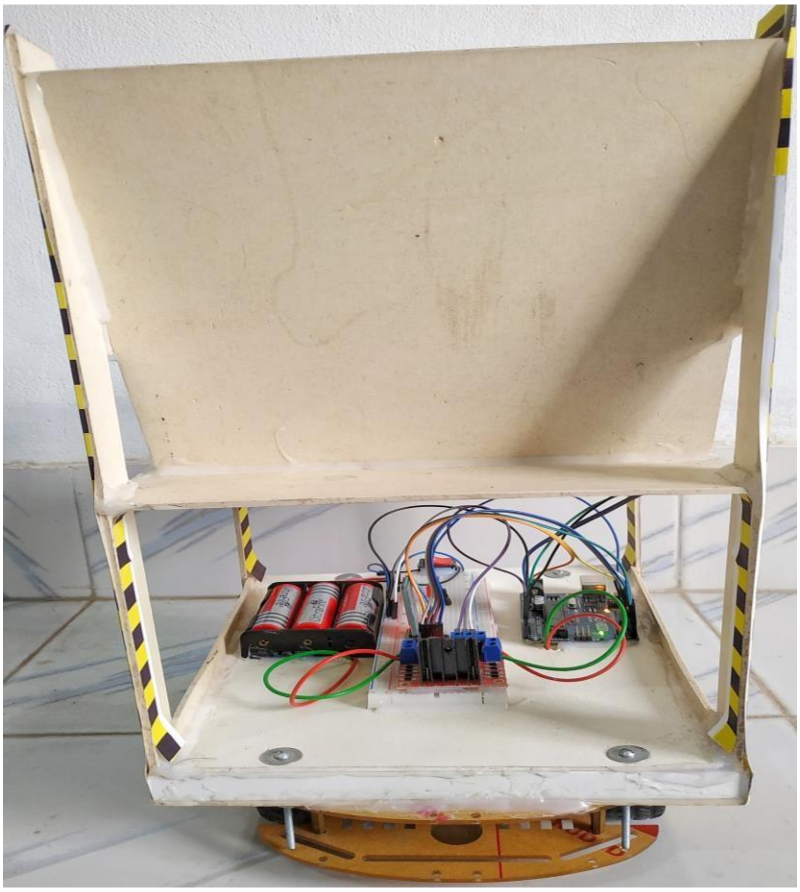

Figure 5.5: Back view of Wheel Chair for Paralyzed

5.3 Cost Analysis

Table 5.1: Cost analysis

Serial No.	Name	Quantity	Price (BDT)
1.	Arduno uno	1	620
2.	Bluetooth module	1	340
3.	Car chassis	1	750
4.	Motor 12v	4	320
5.	Lithium ion Battery 3.7v	3	300
6.	L298N Motor driver	1	150
7.	Bread board	1	120
8.	Joystick	1	210

9.	Jumper wire	2	100
10.	Battery holder	1	60
11.	Switch	1	10
12.	Sticker	As required	60
13.	Battery Charger	1	350
14.	Wire + Soldering lead + Glue stick	As required	220
15.	PVC Board	As required	100
16.	channel	As required	60
	Total		3770

5.4 Summary

In this chapter has discussed the result and discussion. With our project, we became fruitful to demonstrate with regarding the objectives of the project. At last, finishing this chapter the task is prepared to use. We briefly discuss and show the result of our experiment.

CHAPTER 6
CONCLUSIONS

6.1 Conclusion

The main objective of this project is to help everyone who needs a wheelchair to travel. The cart is convenient to use and does not require outside assistance. The objectives of this project are well established. This project can develop an Android system that can control the movement of a mobile chair. Built-in apps are useful for most Android phones. This is a feature of Android apps that can control wheelchair movement to develop a type of movement that allows adults to lie down and people with disabilities to move wheelchairs independently and allow adults and people with disabilities to control Moving the cart using an Android smartphone, the developed system has been tested a bit and has been successfully implemented. Accomplish these objectives to speed up the hardware usage with the expected efficiency. This system allows the elderly and people with disabilities to independently control wheelchairs. So this success is serving a large number of people with disabilities. Fishing rod compulsory carts have a better future. It should continue to be developed in the future as it has significant potential to improve its performance, reliability and safety.

6.2 Future Scopes

For future use a lighter and more powerful motor is recommended to support the user's weight. This project details the design and construction of an intelligent electronic wheelchair with the help of location tracking. The cart works properly to move according to user-defined commands. It also reduces human effort. Any obstacle detection could be a future scope. When turned on the machine will begin to move in all four directions. This allows people with disabilities to work independently. Voice-activated ICs can be used to interface with microcontrollers. GSM can be embedded in current applications to expand features such as emergency messaging.

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APPENDIX

Program Code:

```
int SENSOR_PIN1 = A1;
int SENSOR_PIN2 =  A0;

int RPWM_Output1  = 3;
int RPWM_Output2 = 5;
int LPWM_Output1  = 6;
int LPWM_Output2 = 9;

const int led = 10;
int ledBrightness = 200;
int motorSpeed = 100;
int control;

int volumeButton = 80;

void setup()
{
  Serial.begin(9600);
  pinMode(RPWM_Output1, OUTPUT);
  pinMode(RPWM_Output2, OUTPUT);
  pinMode(LPWM_Output1, OUTPUT);
  pinMode(LPWM_Output2, OUTPUT);
  pinMode(led, OUTPUT);
}

void loop()
{


  ///For Bluetooth
```

```
while (Serial.available()) {
  delay(10);
  control = Serial.read();
}

switch (control) {

  case '2':
    {
      forward();
      break;
    }
  case '4':
    {
      left();
      break;
    }
  case '5':
    {
      stop();
      break;
    }
  case '6':
    {
      right();
      break;
    }
  case '8':
    {
      back();
      break;
    }

  case 'i':
```

```
 {
  volumeInc();
  break;
 }
case 'd':
 {
  volumeDec();
  break;
 }
case 'm':
 {
  volumeMedium();
  break;
 }
case 'l':
 {
  volumeLow();
  break;
 }

default:
 {
  int sensorValue1 = analogRead(SENSOR_PIN1);
  int sensorValue2 = analogRead(SENSOR_PIN2);
  //Serial.println(sensorValue1);



  if (sensorValue1 < 480)
  {
   int reversePWM1 = -(sensorValue1 - 507) / 2;
   analogWrite(led, ledBrightness);
   analogWrite(RPWM_Output1, 0);
   analogWrite(RPWM_Output2, reversePWM1);
   analogWrite(LPWM_Output1, 0);
```

```
  analogWrite(LPWM_Output2, reversePWM1);
  Serial.println(reversePWM1);
}
else if (sensorValue1 > 520)
{
  int forwardPWM1 = (sensorValue1 - 518) / 2;
  analogWrite(led, ledBrightness);
  analogWrite(RPWM_Output1, forwardPWM1);
  analogWrite(RPWM_Output2, 0);
  analogWrite(LPWM_Output1, forwardPWM1);
  analogWrite(LPWM_Output2, 0);
  Serial.println(forwardPWM1);
}
else if (sensorValue2 < 480)
{
  int reversePWM2 = -(sensorValue2 - 507) / 2;
  analogWrite(led, ledBrightness);
  analogWrite(RPWM_Output1, reversePWM2);
  analogWrite(RPWM_Output2, 0);
  analogWrite(LPWM_Output1, 0);
  analogWrite(LPWM_Output2, 0);
  Serial.println(reversePWM2);
}
else if (sensorValue2 > 520)
{
  int reversePWM2 = (sensorValue2 - 518) / 2;
  analogWrite(led, ledBrightness);
  analogWrite(RPWM_Output1, 0);
  analogWrite(RPWM_Output2, 0);
  analogWrite(LPWM_Output1, reversePWM2);
  analogWrite(LPWM_Output2, 0);
  Serial.println(reversePWM2);
}
```

```
        {
          analogWrite(LPWM_Output1, 0);
          analogWrite(RPWM_Output1, 0);
          analogWrite(LPWM_Output2, 0);
          analogWrite(RPWM_Output2, 0);
          //Serial.println("Last");
          //Serial.println(forwardPWM1);
          analogWrite(led, 0);
        }
      }
  }
}

void forward()
{
  analogWrite(led, ledBrightness);
  analogWrite(RPWM_Output1, motorSpeed);
  analogWrite(RPWM_Output2, 0);
  analogWrite(LPWM_Output1, motorSpeed);
  analogWrite(LPWM_Output2, 0);
}
void back()
{
  analogWrite(led, ledBrightness);
  analogWrite(RPWM_Output1, 0);
  analogWrite(RPWM_Output2, motorSpeed);
  analogWrite(LPWM_Output1, 0);
  analogWrite(LPWM_Output2, motorSpeed);
}

void left()
{
  analogWrite(led, ledBrightness);
```

```
  analogWrite(RPWM_Output1, motorSpeed);
  analogWrite(RPWM_Output2, 0);
  analogWrite(LPWM_Output1, 0);
  analogWrite(LPWM_Output2, motorSpeed);
}
void right()
{
  analogWrite(led, ledBrightness);
  analogWrite(RPWM_Output1, 0);
  analogWrite(RPWM_Output2, motorSpeed);
  analogWrite(LPWM_Output1, motorSpeed);
  analogWrite(LPWM_Output2, 0);
}

void stop()
{
  analogWrite(led, ledBrightness);
  analogWrite(RPWM_Output1, 0);
  analogWrite(RPWM_Output2, 0);
  analogWrite(LPWM_Output1, 0);
  analogWrite(LPWM_Output2, 0);
}
void volumeInc()
{
  analogWrite(led, ledBrightness);
  volumeButton = volumeButton + 5;

  if (volumeButton >= 255)
  {
    volumeButton = 255;
  }
  Serial.println(volumeButton);
  motorSpeed = volumeButton;
  delay(200);
```

```
}
void volumeDec()
{
  analogWrite(led, ledBrightness);
  volumeButton = volumeButton - 5;
  if (volumeButton <= 0)
  {
    volumeButton = 0;
  }
  Serial.println(volumeButton);
  motorSpeed = volumeButton;
  delay(200);
}
void volumeMedium()
{
  analogWrite(led, ledBrightness);
  motorSpeed = 155;
}
void volumeLow()
{
  analogWrite(led, ledBrightness);
  motorSpeed = 80;
}
```