Design and implementaion of smart wheel chair for physically disable people



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Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

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Certification

This is to certify that this project entitled "**Design and implementation of smart wheel chair for physically disable people**" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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ABSTRACT

A smart wheelchair can be very helpful for the physically challenged people. As they cannot move anywhere like a normal person. For this reason they always depend on the other people. This wheelchair can remove this problem and help them to move anywhere. The movement of this wheelchair can be control by a wireless joystick. The system has been designed with Arduino,Transcevier,joystick module,Motor drive module,DC gear motor.

The controller Arduino process the command. After processing the controller send the command in the form of digital signal to the motor driving Module and the motor driving IC control the movement of wheelchair. The main interesting things is that the command will go through from the joystick to motor via wirelessly.

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CHAPTER I

INTRODUCTION

1.1 Introduction

The wheelchair is very useful for physically handicapped people. By using robotics and intelligent technologies the smart wheelchair can be designed. The smart wheelchair is very easy to operate. By using the joystick the physically challenged person can control the movement of wheelchair. In this project ,we have employed microcontroller to monitor and control the system. In public gathering , specially in hospital the wheelchair is widely used.

1.3 Objectives

The main objective of this system is to introduce a smart wheel chair.The supplementary objectives of this project are as follows:

i. To reduce user effort in controlling the smart wheelchair.

ii. To ensure safety during movement

CHAPTER II

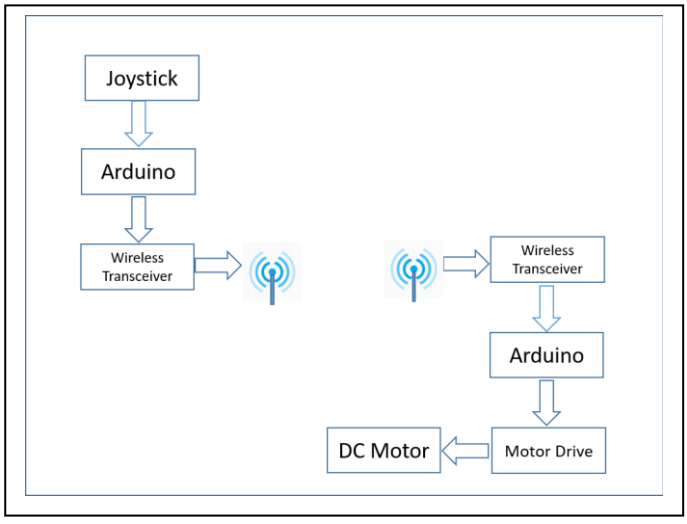
THEORY OF THE PROJECT

2.1 Introduction

In this chapter the technical over view of this project, requuired equipment with their role and specification have been discussed,

2.2 Block Diagram

The command is implemented by using joystick and then the command is sent to the arduino board where the ATMega328p microcontroller execute the command and process it. Than it sends the processed data via nrf24l01 to 2nd Arduino Board.. The 2nd Arduino sends the command in the form of digital signal to the motor driving IC(L293D) and the motor driving IC control the movement of the two dc motors. Thus the dc motor rotates according to the command of the joystick.



2.3 Details of the component:

2.3.1 Arduino Nano

The arduino-nano is a small complete and breadboard friendly board based on the Atmega328p.Here it is used to transmit the rmf signal by transceiver from transmission section to receive section after converting the analog signal to digital signal. As it's small and no require more space so it is used on transmission section.

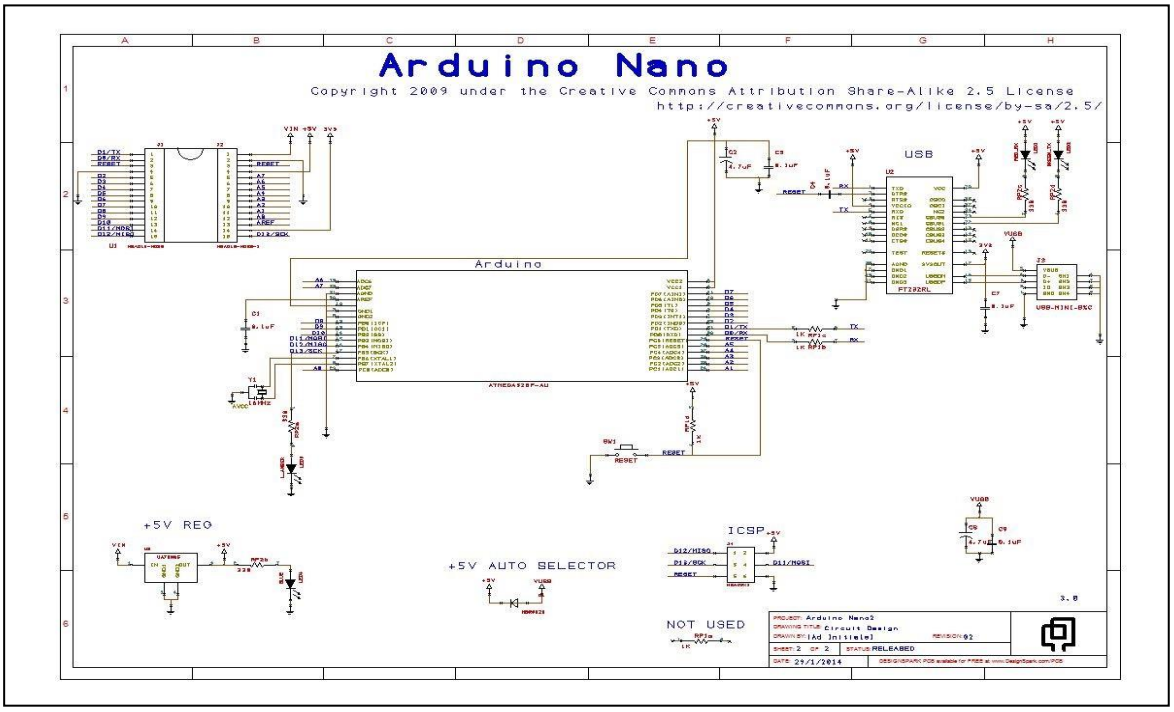


Fig: Arduino Nano Block Diagram

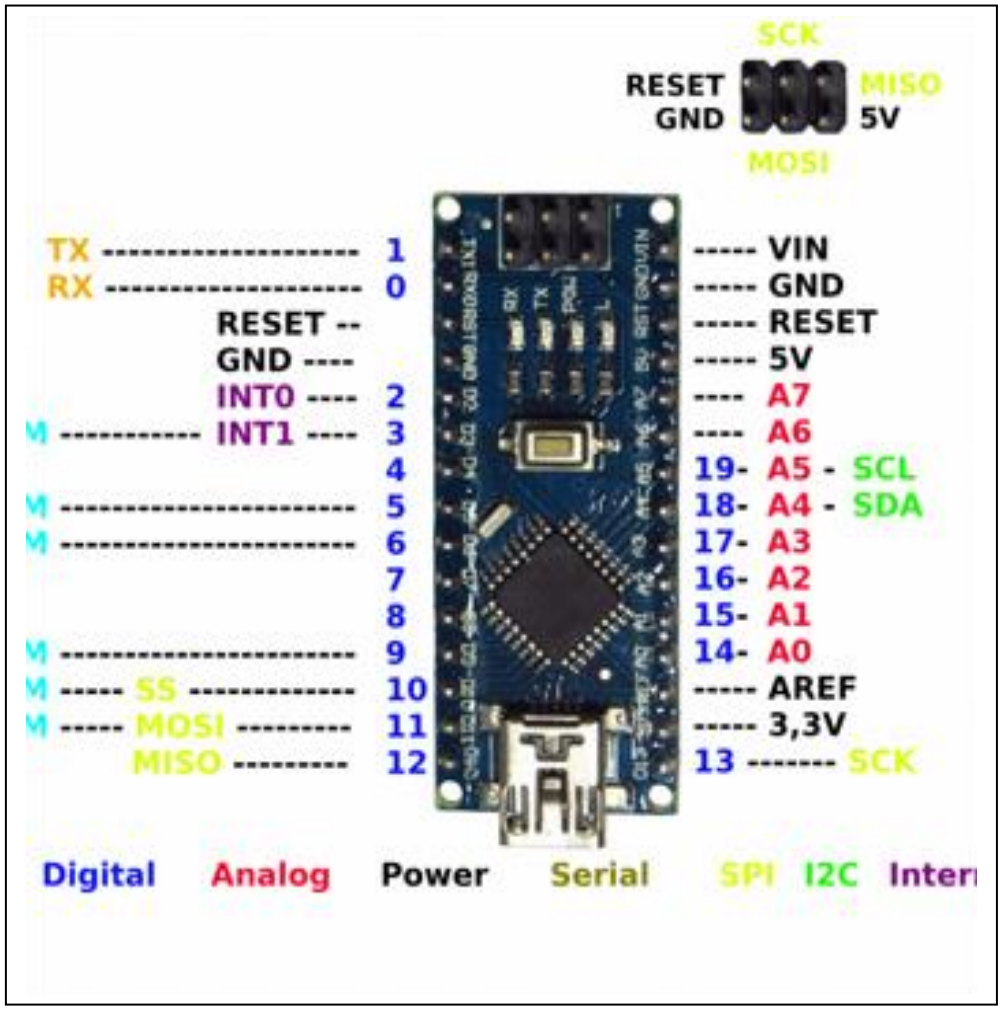


Fig: 2.3.2. Arduino Nano Pin Diagram

Technical specifications:

Table 2.3.2: Technical specifications of Arduino Nano

Microcontroller	ATmega328
Architecture	AVR
Operating Voltage	5 V
Flash Memory	32 KB of which 2 KB used by bootloader
SRAM	2 KB
Clock Speed	16 MHz
Analog IN Pins	8
EEPROM	1 KB
DC Current per I/O Pins	40 mA (I/O Pins)
Input Voltage	7-12 V
Digital I/O Pins	22 (6 of which are PWM)
PWM Output	6
Power Consumption	19 mA
PCB Size	18 x 45 mm
Weight	7 g
Product Code	A000005

2.3.2 Wireless Transceiver (**NRF24L101)**

It uses the 2.4 GHz band and it can operate with baud rates from 250 kbps up to 2 Mbps. If used in open space and with lower baud rate its range can reach up to 100 meters. The **module** can use 125 different channels which gives a possibility to have a network of 125 independently **working** modems in one place.

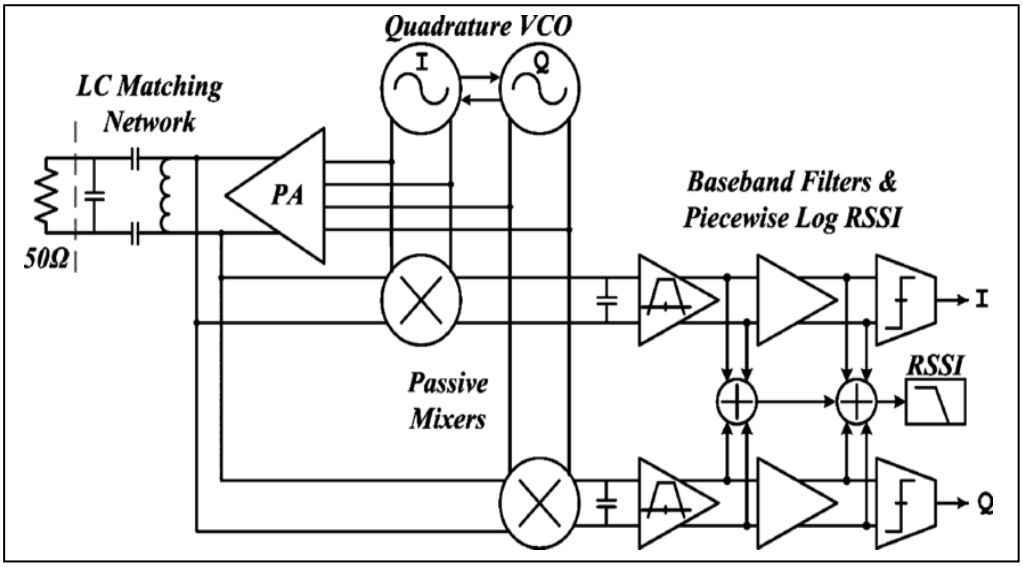


Fig: Wireless Transceiver (NRF24L101) Block Diagram

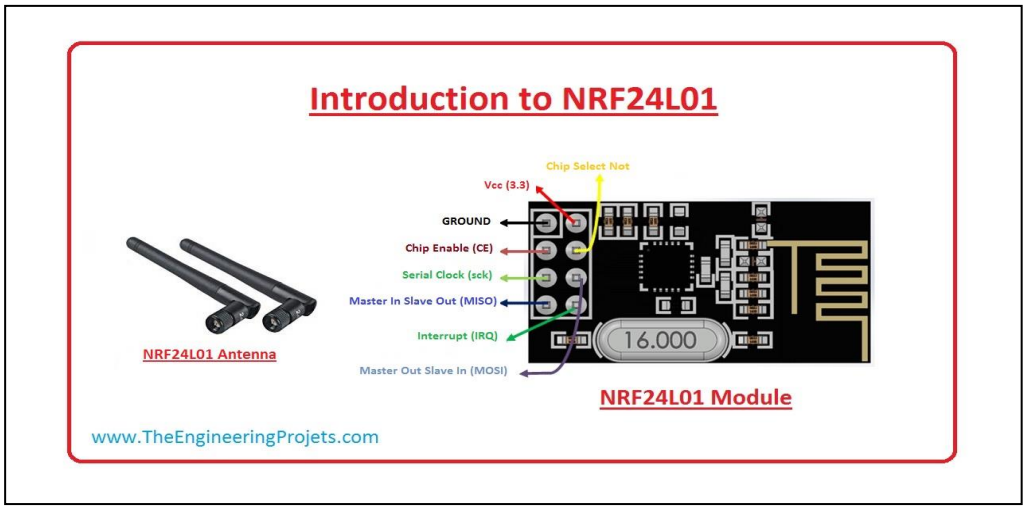


Fig:2.3.3. Wireless Transceiver (NRF24L1001)

2.3.4 Joystick Module

The **Joystick module** is similar to analog **joysticks** found in gamepads. It is made by mounting two potentiometers at a 90 degrees angle. The potentiometers are connected to a short stick centered by springs.This **module** produces an output of around 2.5V from X and Y when it is in resting position.

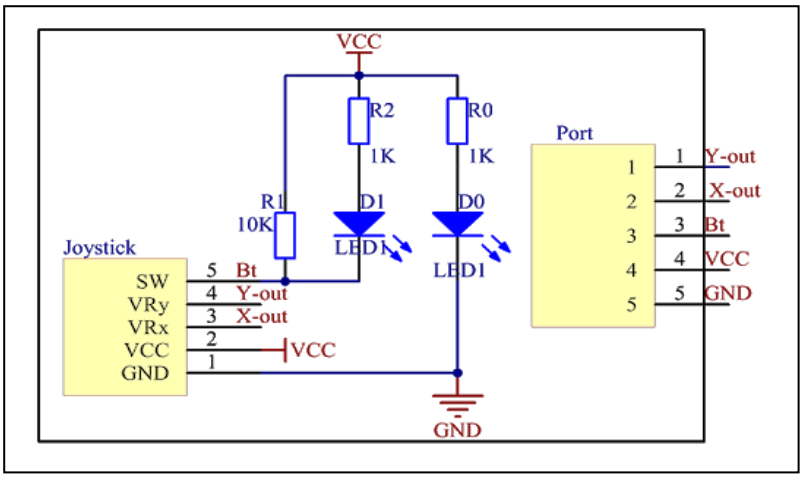


Fig: Joystick module Block Diagram

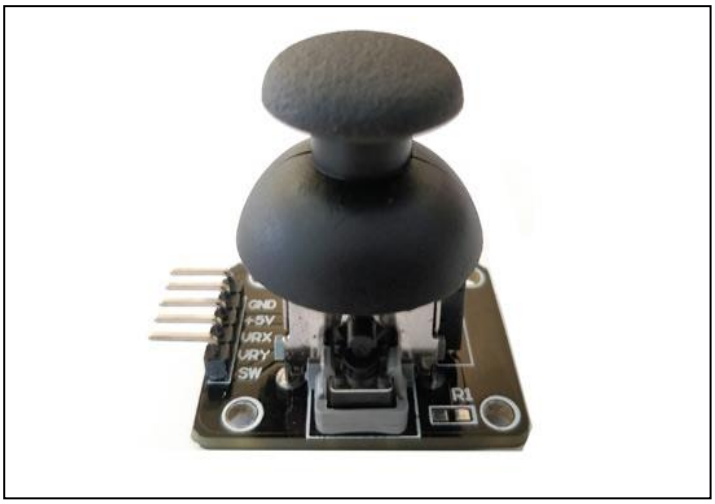


Fig:2.3.4. Joystick Module

Technical specifications:

- Operating Voltage: 5V
- Internal Potentiometer value: 10k
- 2.54mm pin interface leads
- Dimensions: 1.57 in x 1.02 in x 1.26 in (4.0 cm x 2.6 cm x 3.2 cm)
- Operating temperature: 0 to 70 °C

2.3.5 L298N Motor Driver Module

The L298N Motor Driver Module is a high voltage Dual H-Bridge manufactured by ST company. It is designed to accept standard TTL voltage levels. H-bridge drivers are used to drive inductive loads that requires forward and reverse function with speed control such as DC Motors, and Stepper Motors.

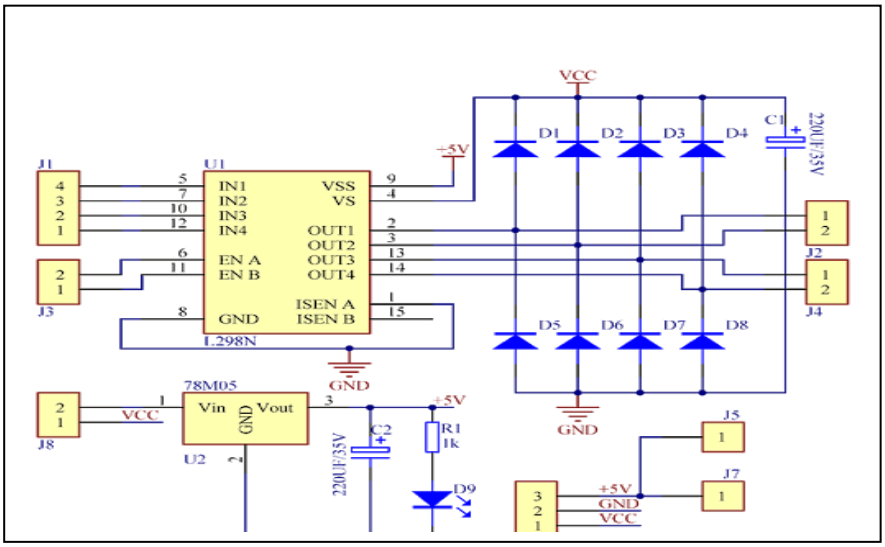


Fig: L298N Motor Driver Module Block Diagram

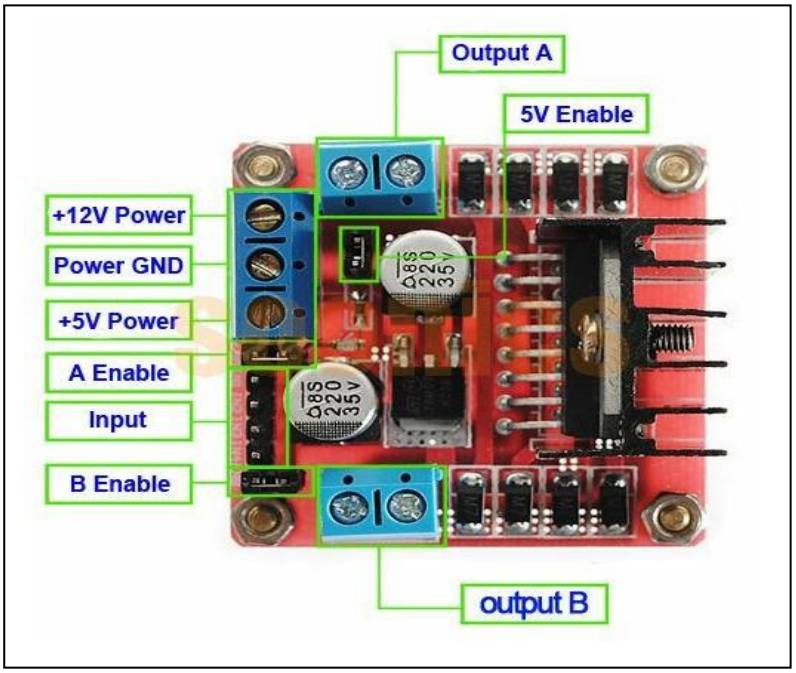


Fig:2.3.5 L298N Motor Driver Module

2.3.6 DC Gear Motor

The electric motor used in most cranes is a type of gear motor that uses the basic principles of speed reduction to increase torque or force.The output speed of the rotor is reduced through a series of large gears until the rotating, RPM speed, of the final gear is very low.

Specification:

N20 Gear Motor:

1. Shaft diameter: 3MM, D-axis
2. Shaft length: 10MM
3. Voltage: 6V (range: 3-12V)
4. No-load speed: 60RPM / 100RPM
5. Torque: 60RPM = 1KG.CM; 100RPM = 0.4KG.CM

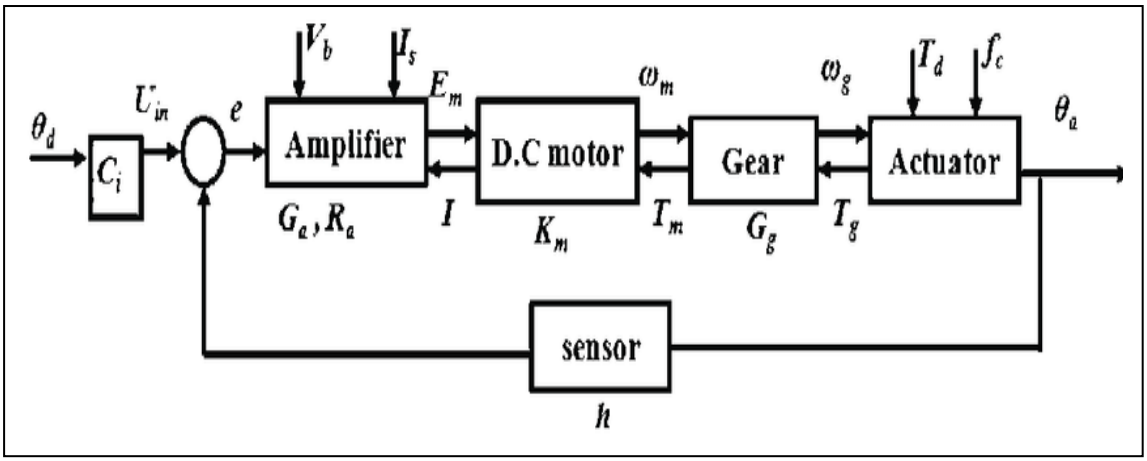


Fig: DC Gear Motor Block Diagram



Fig: 2.3.6. DC Gear Motor

2.3.7 18650 3.7 V Lithium ion Battery

A The electrolyte carries positively charged lithium ions from the anode to the cathode and vice versa through the separator. The movement of the lithium ions creates free electrons in the anode which creates a charge at the positive current collector. ... The separator blocks the flow of electrons inside the battery.



Fig: 2.3.7 18650 3.7 V Lithium ion Battery

2.3.8 B3 Pro Lithium ion Charger

The B3 Compact charger is a very simple to use charger for 2S and 3S battery packs. No need for additional power supplies or 12v batteries as this little unit has its own built in power supply that can be powered with 100-240v.

The B3 is very easy to use, simply plug it into the mains power and the 3 LEDs will light green and then flash to red to indicate the charger is ready. Connect the balance lead of your battery to the balance port of the charger, after 2 secs the charger detects the voltage of the battery .

and starts charging. When the charger starts charging the LEDs will glow constant red, if the battery is a 2 cell then the cell LED indicators 1 and 2 will glow constantly, if it is a 3 cell then the cell 3 LED indicator will also glow. When a cell is completely charged the corresponding LED will turn green, when all cells turn green the battery is fully charged, disconnect the battery before switching off the charger.



Fig: 2.3.8 B3 Pro Lithium ion Charger

2.3.9 TP4056 Lithium Battery Charging Module

The module is used for charging of single lithium battery or multiple lithium batteries in parallel, and the charging port can take power from the USB port.

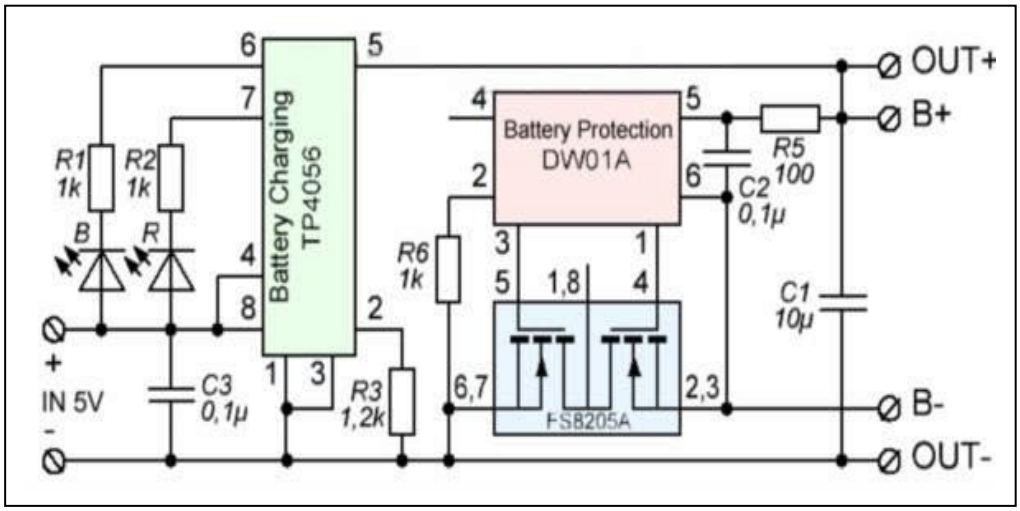


Fig: TP4056 Lithium Battery Charging Module Block Diagram

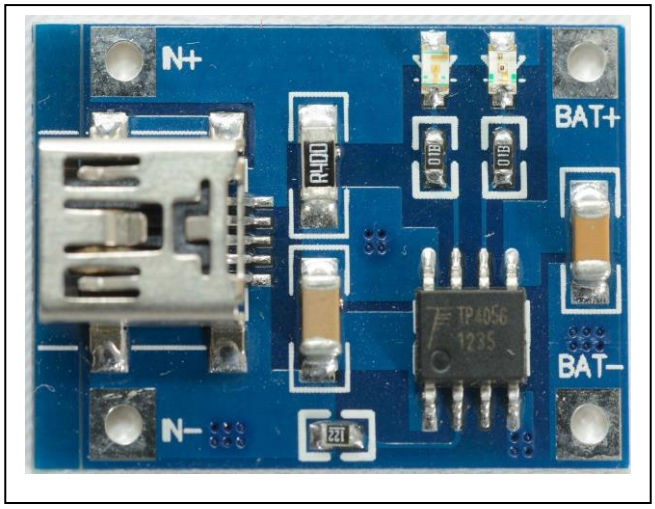


Fig: 2.3.9: TP4056 Lithium Battery Charging Module

2.3.10 0.9 to 5 V DC Step Up Module

1.Small PFM control DC / DC boost controller chip
2.Enter any DC voltage of 0.9V ~ 5V, can be stable output 5V DC voltage, output current of 500 ~ 600MA with two AA batteries input to a single AA battery-powered output current 200ma so, for the mobile phone, camera , single-chip, digital products supply. Stable output 5V DC voltage
3.USB female, can direct power to the USB interface device with USB female versatile
4.PCB size: 34 (mm) x16.2 (mm) ultra-small size, installed in a variety of small equipment



Fig: 2.3.10 0.9 to 5 V DC Step Up Module

2.3.11 Connecting Wire

Connecting wires allows an electrical current to travel from one point on a circuit to another because electricity needs a medium through which it can move. Most of the connecting wires are made up of copper or aluminum

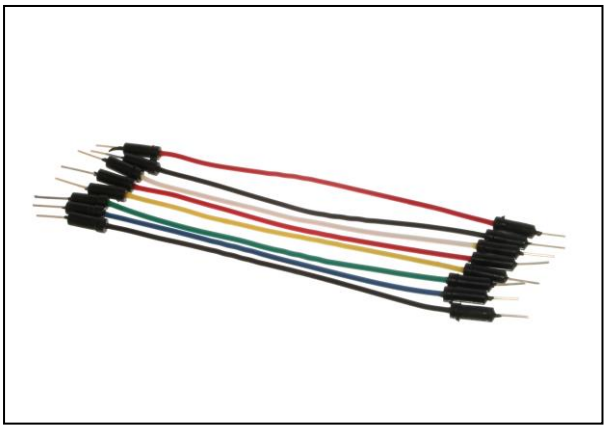


Fig:2.3.11 Connecting Wire

2.3.12 Rubber Wheel

The tread provides traction while the body provides containment for a quantity of compressed air. Before rubber was developed, the first versions of tires were simply bands of metal fitted around wooden wheels to prevent wear and tear. Early rubber tires were solid (not pneumatic).



Fig:2.3.12 Rubber Wheel

CHAPTER III

DESING & FEBRICATION

3.1 Introduction

In this section of this book circuit diagram, working principle has been described along with that a complete image of this project has aloson been shown at the end of this chapter.

3.2 Circuit diagram

The circuit design of wheelchair based on Arduino and wireless transceiver is very simple and is explained below.

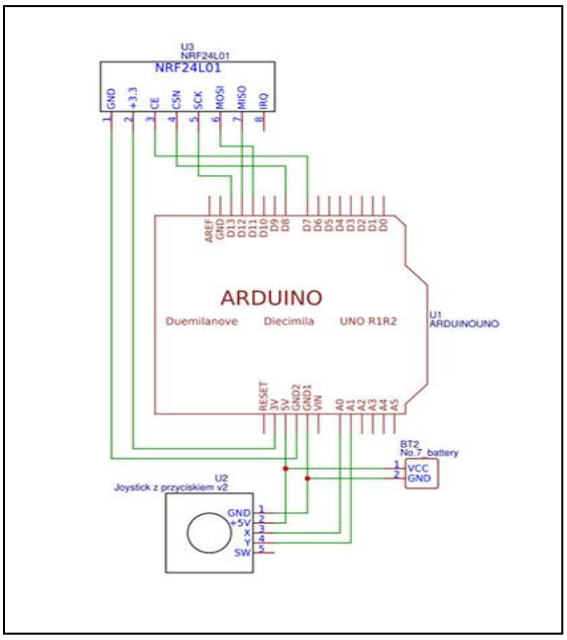


Fig: Circuit of Transmitter

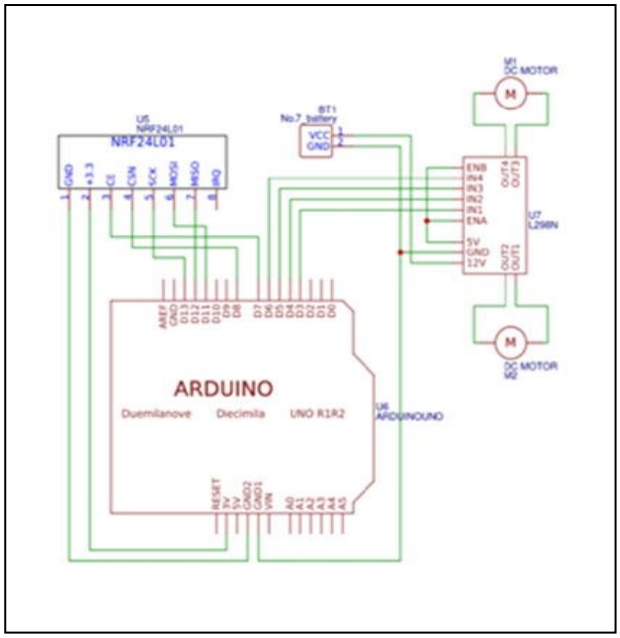


Fig:Circuit of Receiver

3.3 Working Principle

Initially joystick is turned to exact middle position. Till the joystick is kept at middle position the motor will be stop. When the joystick is moved the potentiometer encodes analog voltage values and transfers it to the Arduino board through the analog data pin. The Arduino take these analog values and send it to an ADC (Analog to digital converter).The ADC convert the analog value to digital signal. The digital signal is than processed and send to an another Arduino board which is connected with the motor module of wheel chair via nrfnrf24l01wireless transceiver module. The 2nd Arduino receives the signals from 1st Arduino via nrfnrf24l01wireless transceiver module. And then send command to L298N Motor driver module to rotate the motor based on the command of joystick.

3.4 Image of the Project



Fig: Real image of the project



Fig: Real image of the project

3.6 Used Materials

1. Arduino Uno R3	- 1 pcs
2. Arduino Nano	- 1 pcs
3. Wireless Transceiver (NRF24L1001)	- 2 pcs
4. Joystick Module	- 1 pcs
5. L298N Motor drive Module	-2 pcs
6. DC Gear Motor	- 4 pcs
7. 18650 3.7 V Lithium ion Battery	- 1 pcs
8. B3 Pro Lithium ion Charger	- 1 pcs
9. Charging Module	- 1 pcs
10. 0.9 to 5 V DC Step Up Module	- 1 pcs
11. Connecting Wire	- 4 pcs
12. Rubber Wheel	4 pcs
13. Wires	- As needed

CHAPTER IV

DISCUSSION AND CONCLUSION

4.1 Introduction

We have sucessfully ran the project. The outcome of this wrok, its scops, limitations and future improvements have been enlisted in this chapter. Along with that we have made a cost estamition.

4.2 Result & discussion:

All the programming is done by the Arduino IDE and the program is loaded in to the Arduino board. The joystick gives a facilitated control over the wheelchair. After interfacing of all componentsaccordin to the circuit diagram we get the desired output We have successfully completed our project.

4.3 Cost Estimation

Table:4.1: Cost Estimation

SI	Particulars	Qty.	Unit Price	Total Price
1	Arduino Uno R3	1	470	470
2	Arduino Nano	1	298	298
3	Wireless Transceiver (NRF24L101)	2	400	400
4	Joystick Module	1	250	250
5	L298N Motor drive Module	1	150	150
6	DC Gear Motor	4	700	2800
7	18650 3.7 V Lithium ion Battery	2	95	95
8	B3 Pro Lithium ion Charger	1	450	450

9	TP4056 Lithium Battery Charging Module	1	250	250
10	0.9 to 5 V DC Step Up Module	1	120	120
11	Connecting Wire		-	200
12	Rubber Wheel	4	600	2400
	Others		-	1500
Total				**9633**

4.3 Scope & Applications

1. People who are able to use their hand can use joystick as per requirement.

2. People suffering from certain paralysis can use either voice or head movement as per requirement.

3. People at old age home can use this chair as per their requirement.

4.4 Advantages

° It always the user to adjust the backrest.
• height according to the user convenience
• Quick and easy maneuver
• It also can be used for children

4.5 Disadvantages

• Repair and maintenance cost can be larger than manual wheelchair
• Typically more expensive
• Operating range only 100 meters
• Sometimes the largest Size and heavyweight may be created problem

4.5 Conclusion

We have designed this wheelchair for the physically disabled people those who cannot walk, so that they can easily handle it with their hands by using the Joystick. But for those people who cannot move their legs as well as hands, the voice recognition control wheelchair or the image processing wheelchair can resolve this issue. We can also add an sensor unit to the circuit so that it can detect the obstacle in its path.

Appendix

Transmeter Code & Resiver Code

```
#include <SPI.h>
#include <nRF24L01.h>
#include <RF24.h>
RF24 radio(7, 8); // CE, CSN
const byte address[6] = "00001";
int x,y,sms;
void setup() {
  Serial.begin(9600);
  radio.begin();
  radio.openWritingPipe(address);
  radio.setPALevel(RF24_PA_MIN);
  radio.stopListening();
}
void loop() {
  x = analogRead(A0);
  y = analogRead(A1);
  Serial.print("X = ");
  Serial.print(x);
  Serial.print("  Y = ");
  Serial.println(y);
  if(x>600)
  {
    sms = 11;
  }
  else if(x<400)
  {
   sms = 22;
  }
  else if(y>600)
  {
   sms = 33;  // Right
  }
  else if(y<400)
  {
   sms = 44; // Left
```

```
}

void RobotBackward()
 {
                digitalWrite(MotorA1, LOW);
                digitalWrite(MotorA2, HIGH);
                digitalWrite(MotorB1, LOW);
                digitalWrite(MotorB2, HIGH);

 }

void RobotLeft()
 {
                digitalWrite(MotorA1, LOW);
                digitalWrite(MotorA2, HIGH);
                digitalWrite(MotorB1, HIGH);
                digitalWrite(MotorB2, LOW);

 }

void RobotRight()
 {
                digitalWrite(MotorA1, HIGH);
                digitalWrite(MotorA2, LOW);
                digitalWrite(MotorB1, LOW);
                digitalWrite(MotorB2, HIGH);

 }

void RobotStop()
 {
                digitalWrite(MotorA1, LOW);
                digitalWrite(MotorA2, LOW);
                digitalWrite(MotorB1, LOW);
                digitalWrite(MotorB2, LOW);
}
```

References:

[1] K. Arai, R. Mardiyanto, “Eyes Based Electric Wheel Chair Control System,” International Journal of Advanced Computer Science and Application (IJACSA), Vol. 2, No. 12, 2011.

[2] Poonam S. Gajwani & Sharda A. Chhabria, “Eye Motion Tracking for Wheelchair Control”, International journal of information technology and knowledge management, 2010.

[3] Published in: BMEiCON 2016 9th Date of Conference: 7-9 Dec. 2016 Date Added to IEEE Xplore: 23 February 2017 ISBN Information: INSPEC Accession Number: 16692539 Publisher: IEEE

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