Project Report on

AUTOMATED WHEEL CHAIR

Submission to the ROBOTICS CLUB as a part of INDUCTION'20

TEAM 3

THE ROBOTICS CLUB

Integrating Knowledge....

THE ROBOTICS CLUB-SNIST

SREENIDHI INSTITUTE OF SCIENCE AND TECHNOLOGY

(AUTONOMOUS)

(Affiliated to JNT University, Hyderabad)

Yamnampet, Ghatkesar, Hyderabad – 501 301.

2020

CERTIFICATE

This is the project work titled **'AUTOMATED WHEEL CHAIR'** by

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DECLARATION

The project work reported in the present thesis titled **“AUTOMATED WHEEL CHAIR"** is a record work done by Team “3” in **THE ROBOTICS CLUB** as a part of **INDUCTION-20.**

No part of the thesis is copied from books/ journals/ Internet and wherever the portion is taken, the same has been duly referred in the text. The report is based on the project work done entirely by TEAM “3” and not copied from any other source.

ACKNOWLEDGMENT

This project report is the outcome of the efforts of many people who have driven our passion to explore into implementation of **AUTOMATED WHEEL CHAIR.** We have received great guidance, encouragement and support from them and have learned a lot because of their willingness to share their knowledge and experience.

Primarily, we would like to express our gratitude to our mentors, **Katkam Ashutosh** and **V. Sai Teja.** Their guidance has been of immense help in surmounting various hurdles along the path of our goal.

We thank our Technical Heads **M.M.SAI PRAKASH** and **G.DATTA LOHITH** for being with us till the end of the project completion.

We thank the **Executive Body and** the **Technical Advisory Board** of **The Robotics Club** for helping us with crucial parts of the project. We are deeply indebted to **T.V. Hari Krishna-**the President, **B. Bhanu Teja-**theVice-President and **M.S.S.K Teja –**the General Secretary of **THE ROBOTICS CLUB** respectively and also every other person who spared their valuable time without any hesitation whenever we wanted.

We also thank our Technical advisor **Dr. A. Purushotham**, Professor, Mechanical Department, who encouraged us during this project by rendering his help when needed.

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ABSTRACT

The theme of the project:

Biomedical devices

The Problem:

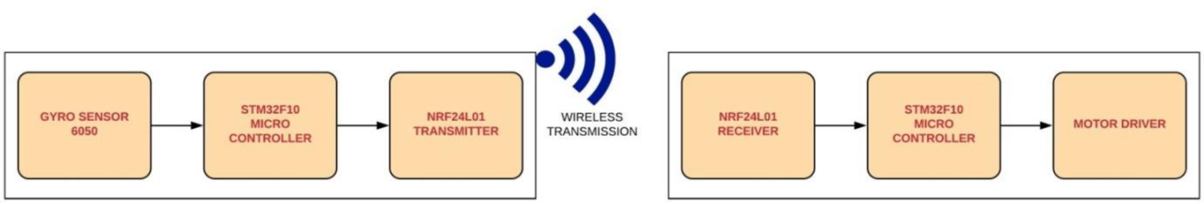
As we know that there are many differently-abled people who feel difficulty in moving in the wheelchair. They always need a guardian in assisting them and for people who move on electronic wheelchairs but are completely paralyzed don't have any scope of directing the wheelchair.

The team's approach to solve the problem:

Our team's main aim to solve the problem of the mobility of the paralyzed people by controlling the speed and direction of the wheelchair by the head movements that help in moving from one place to another place easily with a negligible amount of difficulty.

We could design an electronic wheelchair that would move according to the instructions of the patient by his head movements and that would be completely wireless transmission with good accuracy.

BLOCK DIAGRAM:



CHAPTER-1

1.1: Problem statement

Generally everyone wants to be independent. People, who are paralyzed cannot move on their own, always need to look for others assistance to complete their tasks. So he always feels bad about his dependence to make their dreams true we have come up with a solution which helps them to have wheel chair movements by moving their head.

1.2 Introduction to project

There are many differently abled people who are achieving many things with their confidence. Our project main aim is to help quadriplegic patients to have their wheelchair movements by moving their heads which helps to complete their tasks without assistance, makes them feel comfortable. This can be an effective method to eradicate the social challenges faced by Physiologically challenged persons. This project correlates advancement of technology with human requirements. The wheel chair moves according to the instructions given by the person and it is completely wireless. This gives freedom for them by helping them to move from one place to another place easily.

1.3. LITERATURE SURVEY

According to our survey, more than 1 billion people over the world are disabled. Though they are disabled by birth or accident, they need helping hand throughout their survival. So we chose this project of making wheel chair for the people who want to move independently. Everyone likes to be independent, even the disable too. According to the survey we have done most of the paralyzed are found hard to move and mostly depend on people around them even for their basic needs. So we step forward and took a chance for solving their problem through our project WHEEL CHAIR which moves according to our HEAD GESTURES though this idea doesn't work for at least half of the disabled but definitely could gain confidence in few.

CHAPTER-2

ARCHITECTURE

2.1 COMPONENTS USED

2.1.1 HARDWARE

S.NO.	COMPONENTS USED	NO.OF COMPONENTS USED
1.	STM32 and boot loader	2
2.	NRF modules	2
3.	Motor driver(L298n)	1
4.	Accelerometer and gyro sensor	1
5.	Wheels	4
6.	Battery	3
7.	Motors	2
8.	Connecting wires	Required length
9.	Acrylic sheets	Required length
10.	L-clamps	6

2.1.2 SOFTWARE

1. Arduino IDE

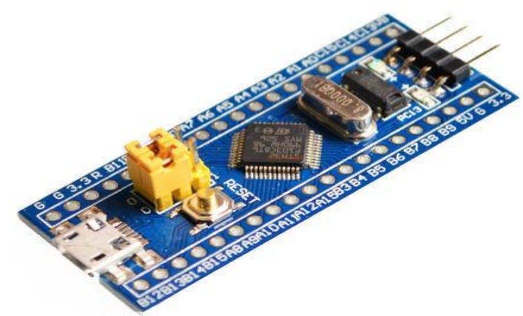
2.2 COMPONENTS DESCRIPTION

HARDWARE:

COMPONENTS:

1. STM32 and Boot loader:

The STM32 F1-series was the first group of STM32 microcontrollers based on the ARM Cortex-M3 core and considered their mainstream ARM microcontrollers. The F1-series has evolved over time by increasing CPU speed, size of internal memory, variety of peripherals. There are five F1 lines: Connectivity (STM32F105/107), Performance (STM32F103), USB Access (STM32F102), Access (STM32F101), and Value (STM32F100). The summary for this series is:
Core:
ARM Cortex-M3 core at a maximum clock rate of 24 / 36 / 48 / 72 MHz
Memory:
Static RAM consists of 4 / 6 / 8 / 10 / 16 / 20 / 24 / 32 / 48 / 64 / 80 / 96 KB.
Flash consists of 16 / 32 / 64 / 128 / 256 / 384 / 512 / 768 / 1024 KB.
Peripherals:
Each F1-series includes various peripherals that vary from line to line.
IC packages: VFQFPN36, VFQFPN48, LQFP48, WLCSP64, TFBGA64, LQFP64, LQFP100, LFBGA100, LQFP144, LFBGA144.



2. NRF24L01 module:

NRF24L01 module is used as a transceiver in our bot as we used wireless communication in this bot .the NRF24L01 operates in 2.4GHz band .it works with the reverse SMA connector .the transmission rate of this module is 250kbps.it can operate up to 800-1k communication distance in open air. it has 8 pins Vcc(+3.3v), ground, CE,SCK,MISO,IRO,MOSI,CSN)

Ground: Connected to the Ground of the system.

Vcc: Powers the module using 3.3V.

CE (Chip Enable): Used to enable SPI communication.

CSN (chip select not): this pin has to be kept high always; else it will disable the spi communication.

SCK (serial clock): provides the clock pulse using the SPI communication works.

MOSI (master out slave in): connected to MOSI pin of MSU, for the module to receive data from the MCU.

MISO (master in slave out): connected to MISO pin of MCU, for the module to send data from MCU.

IRQ (interrupt): it is an active low pin and is used only if interrupt is required.

3. Motor Driver(L298n):

L298n is a dual H-bridge motor driver which allows control of both direction and speed of the motors. The module can drive the motors up to 5-35v motors and up to peak current of 2A.there are five output pins, two input pins and, six digital input pins.

Out1&out2, out3&out4 pins: Terminals of the motors (output of the motor driver).

+12v pin&ground: These pins are used as the terminals of the batteries to power the motor driver.

+5v pin: +5v pin used as output for the arduino board.

In1, in2, in3, in4 pins: These pins are used to take the input from the arduino.

EnA, enB pins: These pins are used for enabling and controlling of the speed of the motor.

4. Accelerometer and Gyroscope (Mpu6050):

Mpu6050 is a micro Electro-Mechanical system (MEMS).Mpu6050 has the 3-axis Accelerometer and the 3-axis gyrosensor which can measure the rate of change of angular velocity per time.It has eight pins the description is given below:
Vcc (+3vor+5v): given to the arduino board to power the board.

Ground: Ground is generally used as the negative terminal or to ground the terminal.

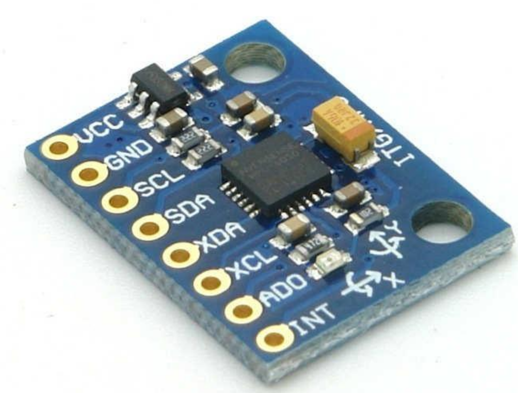
SCL (serial clock): this pin is used for the l2c communication.

SDA (serial data): this pin is used for the transferring of data through l2c communication

Auxiliary Serial Data (XDA): It can be used for other interfaced other I2C module withMPU6050.
Auxiliary Serial Clock (XCL): It can also be used for other interfaced other I2C module with MPU6050.

Ado (l2c protocol port): If more than one MPU6050 is used a single MCU, then this pin can be used to vary the address.

INT (interrupt): This pin is used to indicate that data is available for MCU to read.



5. Wheels:

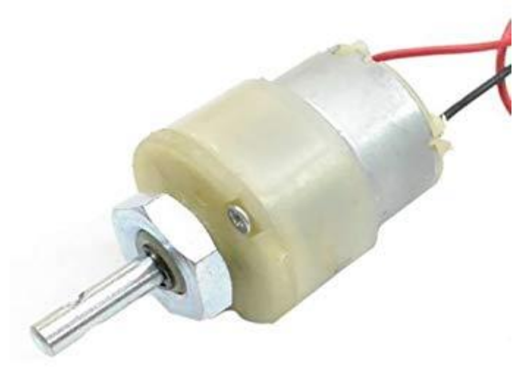
Plastic wheels of 10cm are used to move the bot.

6. Battery:

Li-ion 2600mah, 3.7v batteries are used to power the motor driver.

7. Motors (center shaft motors 200RPM):

Here we used a center shaft motor which has the shaft at the center of the motor and it used for the linear rotatory motion of the bot (wheel chair) and 200Rpm has a high torque to lift heavy loads. Center shaft motors has a motor rating of 4-12v.center shaft motors has two terminals which are connected to motor driver .



8. Connecting wires:

Generally jumper wires are used for the connection between the arduino and the motor driver and other sensors.

9. Acrylic sheets:

Acrylic is a transparent plastic material with outstanding strength, stiffness, and optical clarity. These are used for secondary base of the bot.

10. L-clamps:

L-clamps are the perpendicularly placed metal sheets which are used for to hold the center shaft motor and the back of the wheel chair .these are fixed with the nuts and bolts.

2.2.2 SOFTWARE:

One of the software's we used in programming our boy is Aurdino IDE. We used node mcu to control the motors. To program it the software used is Aurdino IDE. The open source Aurdino software makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X and Linux. It supports the languages C and C++ using special rules of source structuring. Projects made using this software are known as sketches. Programming a microcontroller is somewhat different from programming a computer; there are a number of specific libraries for different boards. We have to write the code in this software based on our necessity. There are different methods and keywords so that our board understands what the action to be performed.

Syntax:

```
Void setup ( ){

// put your setup code here, to run once

}

Void loop ( ){
```

// put your main code here to run repeatedly

}

Here in setup method we initialize the pins we use pin Mode (pin, INPUT/OUTPUT)

CODE:

Transmitter Code:

```
#include <nRF24L01.h>



#include<SPI.h>

#include <RF24.h>

//#include <RF24-STM_config.h>

RF24 radio(PB0,PA4); // CE, CSN

  // const byte address[5] = {1,'e','l','l','o'};

   void setup() {

     Serial.begin(115200);

   radio.begin();

   pinMode(PB5,OUTPUT);

   pinMode(PB6,OUTPUT);

   pinMode(PB7,OUTPUT);

   pinMode(PB8,OUTPUT);
```

```
   radio.openReadingPipe(0,0xB3B4B5B602);

   //Setting the address at which we will receive the data

   radio.setPALevel(RF24_PA_MIN);               //You can set this as minimum or maximum depending on the distance between the transmitter and receiver.

   radio.startListening();

   //This sets the module as receiver



   }

    void loop()

   {



    //Serial.println("Working");

   if (radio.available())              //Looking for the data.

  {char text[]="";

  //Serial.println("reading");

  radio.read(&text, sizeof(text));

    Serial.println(text);

Serial.println(text[0]);

     if(text[0]=='f'){Serial.println("forward");
```

```
digitalWrite(PB6,HIGH);

digitalWrite(PB8,HIGH);

digitalWrite(PB5,LOW);

digitalWrite(PB7,LOW);

delay(250);}

else if(text[0]=='b'){Serial.println("backward");

digitalWrite(PB5,HIGH);

digitalWrite(PB7,HIGH);digitalWrite(PB6,LOW);

digitalWrite(PB8,LOW);delay(250);}

else
if(text[0]=='l'){Serial.println("left");digitalWrite(PB6,HIGH);digitalWrite(PB5,LOW);delay(250
);}

else
if(text[0]=='r'){Serial.println("right");digitalWrite(PB8,HIGH);digitalWrite(PB7,LOW);delay(25
0);}

else{}

}

delay(100);

}
```

Receiever Code:

```
#include <nRF24L01.h>

#include<SPI.h>

#include <RF24.h>

//#include <RF24-STM_config.h>

RF24 radio(PB0,PA4); // CE, CSN

  // const byte address[5] = {1,'e','l','l','o'};

void setup() {

 Serial.begin(115200);

 radio.begin();

 pinMode(PB5,OUTPUT);

 pinMode(PB6,OUTPUT);

 pinMode(PB7,OUTPUT);

  pinMode(PB8,OUTPUT);

  radio.openReadingPipe(0,0xB3B4B5B602);

    //Setting the address at which we will receive the data

    radio.setPALevel(RF24_PA_MIN);              //You can set this as minimum or maximum depending on the distance between the transmitter and receiver.

    radio.startListening();
```

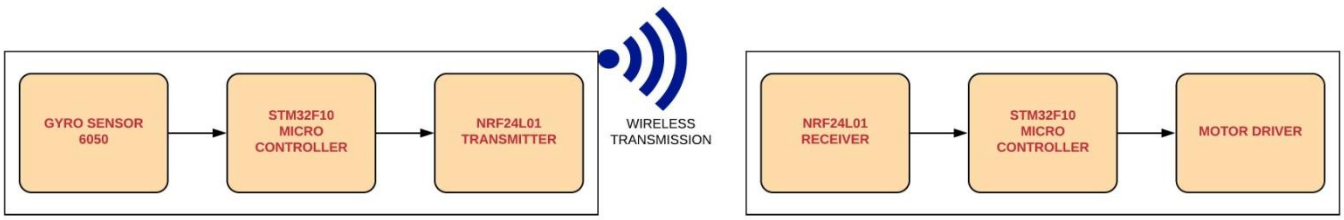
```
   //This sets the module as receiver


   }

    void loop()

   {

    //Serial.println("Working");

   if (radio.available())              //Looking for the data.

  {

char text[]="";

  //Serial.println("reading");

  radio.read(&text, sizeof(text));

 Serial.println(text);

Serial.println(text[0]);

    if(text[0]=='f'){Serial.println("forward");

   digitalWrite(PB6,HIGH);

   digitalWrite(PB8,HIGH);

   digitalWrite(PB5,LOW);

   digitalWrite(PB7,LOW);

   delay(250);digitalWrite(PB6,LOW);digitalWrite(PB8,LOW);}
```

```
else if(text[0]=='b'){Serial.println("backward");

digitalWrite(PB5,HIGH);

digitalWrite(PB7,HIGH);delay(250);digitalWrite(PB5,LOW);digitalWrite(PB7,LOW);}

else
if(text[0]=='l'){Serial.println("left");digitalWrite(PB6,HIGH);delay(250);digitalWrite(PB6,LOW
);}

else
if(text[0]=='r'){Serial.println("right");digitalWrite(PB8,HIGH);delay(250);digitalWrite(PB8,LO
W);}

else{}

}

  delay(100);

}
```

CHAPTER 3

IMPLEMENTATION AND WORKING

3.1. BLOCK DIAGRAM:



BLOCK DIAGRAM OF AUTOMATED WHEEL CHAIR

3.2 WORKING

The Automatic smart wheel chair, it works in such a way that when the bot starts moving according to the information provided by the GYRO SENSOR ,it is a sensor which detects the changes occurred in the degrees of freedom of the head band(i.e. X,Y,Z Axis). For example when the user have to move in the right direction then he/she has to rotate his head in that respective direction then the GYRO copies the values and transfers the signals or data with which the further action will takes place.

The motors were attached on the either sides of the bot and a free (360 degree) wheel is attached to the bot at front for movement. This motors are programmed in such a way that when the user wants to move in right direction then the right wheel will be stationary and when the user wants to move in left direction then left wheel will be stationary and when both are in motion bot will move in forward direction. These all motors will be controlled by motor driver. These all components (I.e. motors, gyro, and motor driver) are connected to the microcontroller, here we are using the STM32 controller, it is the 24 bit controller. Also the motors here used are the center shaft motors. In this way our Automatic smart wheel chair works……

3.3 ALGORITHM

Start

Step 1: Receive the values from the gyro sensors.

Step 2: Decide the direction in which the bot should move.

Step 3: transmit the values for the gyro values.

Step 4: After receiving the values from the transmitter decide the direction in which the bot move.

Step 5: Move the bot in that particular direction and repeat the same again.

End

CHAPTER 4

EXPERIMENTAL RESULTS

4.1 RESULTS

The robot is capable of moving in any direction I.e, when a paralyzed person moves his/her head downwards then, the bot moves forward. When he/she moves his/her head upwards then, the bot moves backwards. When he/she moves his/her head left and right, then the bot moves left and right respectively

4.2 FUTURE ENHANCEMENT

Our bot will make a paralyzed person independent. In future enhancement we want to.

a. Make our bot to move in any direction with the movement of the tongue with the help of Hall Effect sensor.

b. We want to make paralyzed person more independent by adding a robotic arm, which helps him/her in taking food.

4.3 CONCLUSION

The overall activity of the bot is to make a paralyzed person mobile and make him feel independent and comfortable.

EXPENSES:

S.NO.	COMPONENT NAME	QUANTITY	PRICE(Rs)
1.	Center shaft motors(200Rpm)	2	400
2.	NRF24L01 module	2	420
3.	MPU6050	1	150
4.	Stm-32	2	400
5.	Motor Driver(L298N)	1	150
6.	Wheels	2	90
7.	Castor Wheel	1	80
8.	Jumper wires	90	100
9.	L clamps	6	60
10.	Motor clamps	2	40
11.	Nuts and Bolts	20	60
12.	Plywood	1	100
13.	Cap	1	100
14.	Battery Li ion	5	450
15.	Cell Holder	1	60
		Total:	2,720