Bluetooth Controlled Wheelchair for Paraplegic People

Project Report

EC ID: - 220113

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Abstract

This report provides a brief idea of our solution to make the day-to-day movement of paraplegic patients easy and independent on others. Our solution solves the issues with the traditional wheelchair by using electric motor and Bluetooth connectivity interface. The content includes the root idea of the solution, basic components required for building the prototype, testing of each and every component and step by step development of the prototype and the mobile application

INDEX

Serial Number	Content	Page Number
1.	Introduction and Problem aimed to be solved by this prototype	4
2	Why are we using Bluetooth Connectivity?	4
3	Components Required to Build this Prototype	5
4	Estimated Cost	6
5	Plan of Action	6
6	Timeline of Progress	7
7	Application to Control Wheel Chair via Bluetooth	7
8	Building Chassis, Assembly, Arduino Coding and Connections	11
9	Conclusion	15

1. Introduction and Problem Aimed to Solved by this prototype

1.1 What is Paraplegia

Paraplegia is a type of paralysis that affects the lower half of the body. It is mostly caused due to an injury or any form of illness which impacts the nervous system or the part of it which controls the lower half of your body.

One with paraplegia might have trouble moving his/her legs and feet

1.2 How Paraplegia can be treated

Unfortunately, there is no way to cure paraplegia, but in some cases, people can gain some control over the affected area. The treatment options include Physical therapy, Medications, Surgery, Mobility Devices, and some Occupational therapy.

Our team here focuses on improving the Mobility devices in a smart way which will help the patient slightly more to cutoff the problems faced by one using traditional wheelchair.

1.3 Problem aimed to be solved

Traditional wheelchairs are moved by the patient with their own hands, or one must push then from behind. With those wheelchairs, it becomes difficult for them for moving up in an inclined area.

Also, it is difficult for them to commute for their daily basic needs with the traditional wheelchairs here and with rough surfaces, the uncomfortability of the patient adds on.

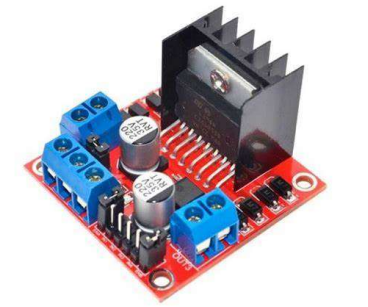
Hence our team designed a solution to interface electric motors with the wheels and have a Bluetooth connectivity interfaced to control the motor. By this, the person can be able to commute with ease without being uncomfortable and dependent on others.

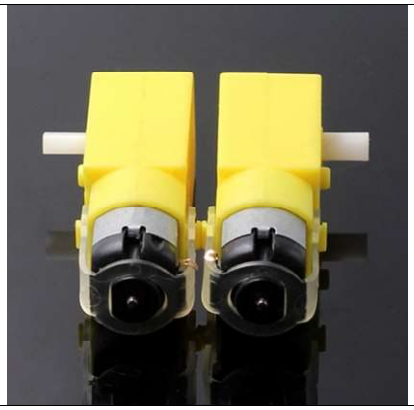
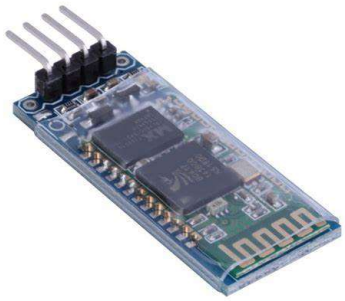
2. Why are we using Bluetooth?

The answer for why we went for the Bluetooth connectivity is that our aim in this Engineering Clinics is to showcase the application of Bluetooth as a mode of communication between the beneficiary and the wheelchair. The application of Bluetooth can be implemented in Brain Computer Interface (BCI).

Our initial plan was also to implement the BCI between the wheelchair and the person, but because of unavailability of BCI module, we went for Mobile phone as a control device

3. Components Required to build this prototype

Name	Image	Quantity
Arduino Uno Development Board		1
L298N Motor Driver Controller Module		1
Demo Wheels		2
Castor (360º)		1
Batteries (12V)		Quantity may differ by the battery capacity

Geared Motors		2
HC-06 Bluetooth Module		1
Connecting Wires		May vary according to needs

4. Estimated Cost

The estimated cost of the project will be around INR 1200, excluding the Arduino UNO board. The cost of making the prototype may vary from the above-mentioned amount as of now we are having difficulty in arranging the batteries required.

5. Plan of Action

The first and foremost thing is to arrange the necessary products and get it on hands of our team. After that, we will code the necessary embedded C program for our Arduino to receive commands via the mobile phone application i.e., Forward, Backward, Left and Right and perform the motor driving operation accordingly.

The mobile phone application would be built on MIT App Inventor, the popular platform for building the Mobile phone applications for the beginners.

The final step would be to build the prototype model, test it and if any faults found, we will try to rectify the faults.

6. Timeline of Progress

i. Before CAT 1, identifying the components

ii. Between CAT 1 to CAT2, having the components with us and immediately start the coding part and building the smartphone application

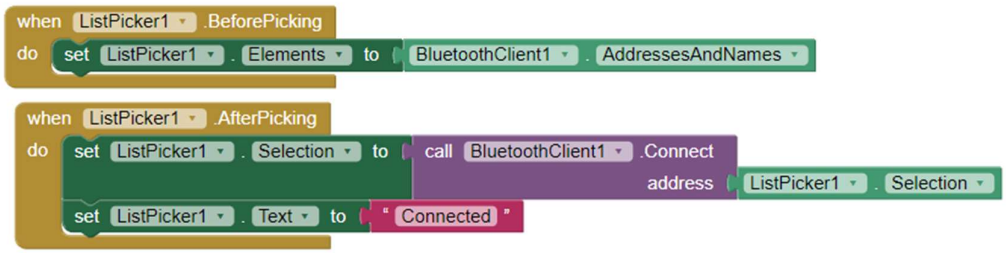
iii. After that, building the base/Chassis on which we will place our hardware components and check if the prototype is working

iv. If the prototype is working, then we will beautify it i.e., making it look like a wheelchair

7. Application to Control the Wheelchair via Bluetooth

For developing the android application, we have used the free open-source tool *MIT App Inventor.*
The following steps gives a detailed description of the code blocks and their explanation.

7.1 Enabling User to select the Bluetooth device



First, we create a *List picker.* The job of the list picker is to display the contents in form of a list. We setup the block *ListPicker.BeforePicking* to and display the available nearby Bluetooth devices.

Then we setup the block *ListPicker.AfterPicking* to call the Bluetooth client's address which the user has chosen. And then we change the text "Show Devices" to "Connected".

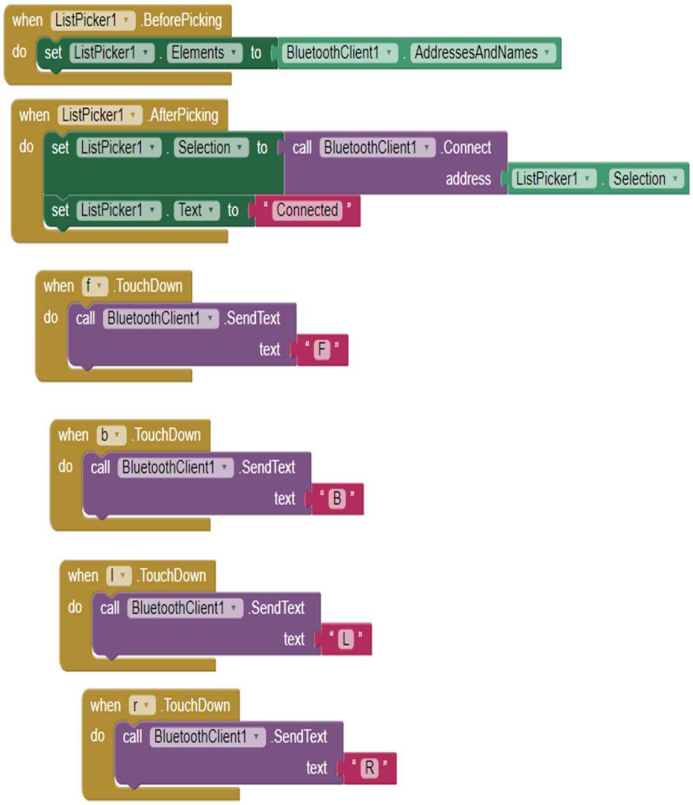
7.2 Sending Text to the Arduino via Bluetooth

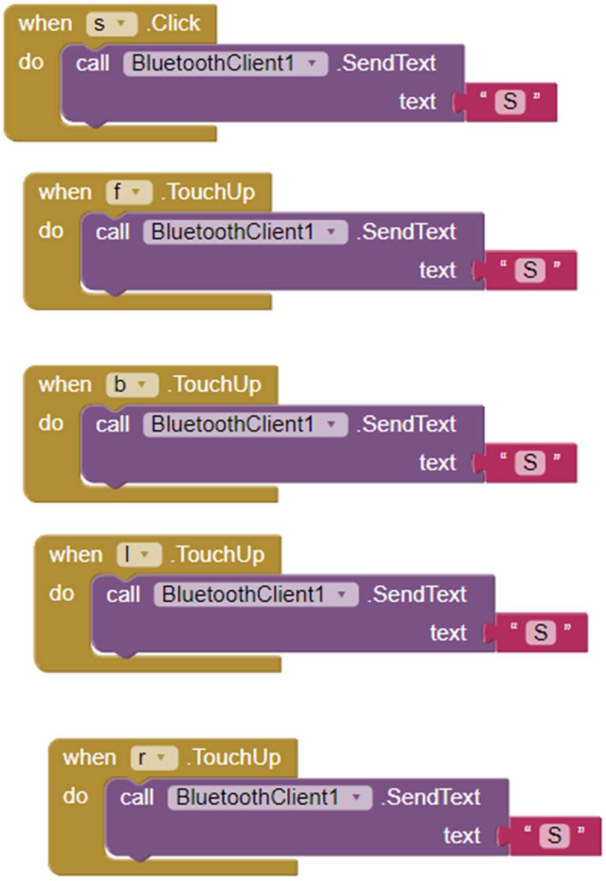
We have programmed the Arduino in such a way that, the particular action is being performed by the Arduino, when it receives a particular text via Bluetooth.

We have defined an integer for each specific action to be performed as follows

1. Forward – "F"
2. Backward – "B"
3. Left – "L"
4. Right – "R"
5. Stop- "S"

7.2.1 Code Blocks for sending character from the mobile device

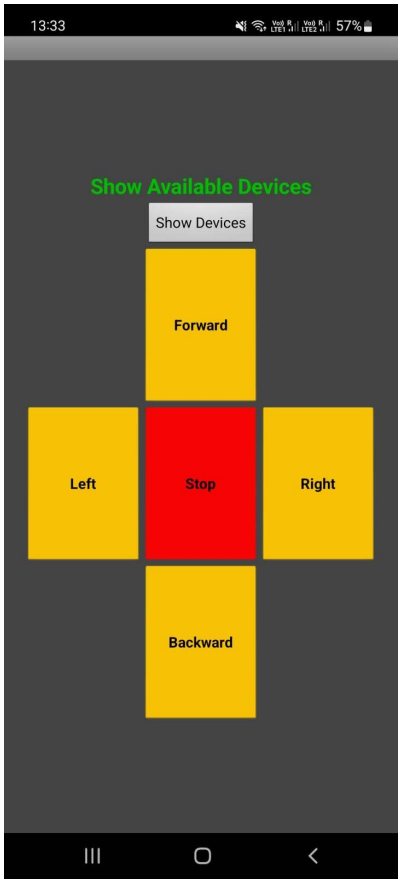


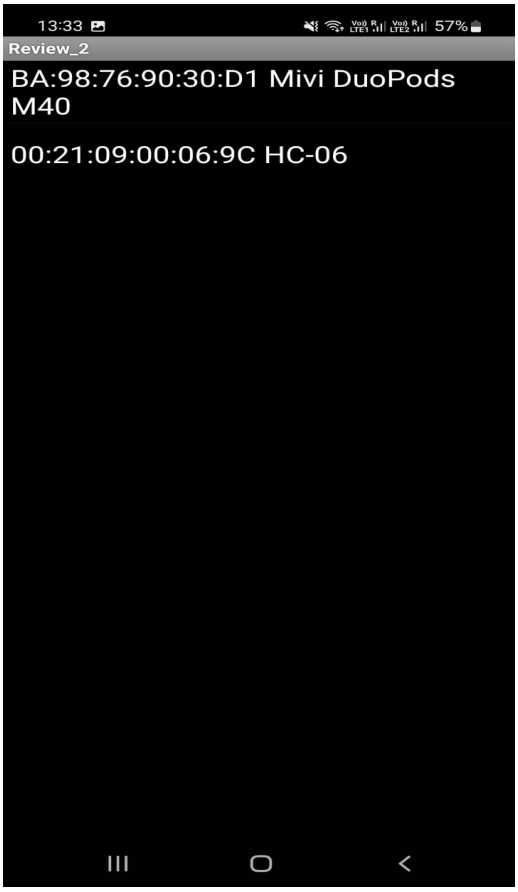


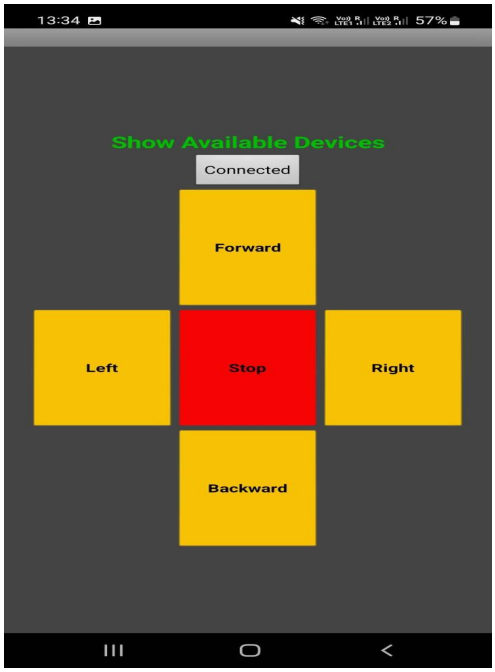
The command *TouchDown* send the particular charecter when an particular button is kept pressed by the user and *TouchUp* sends the character “S” as we have setup the Arduino in such a way that, the Wheel chair should stop moving when the Arduino receives the charecter “S”.

7.3 User Interface

The following image shows the User Interface of the application







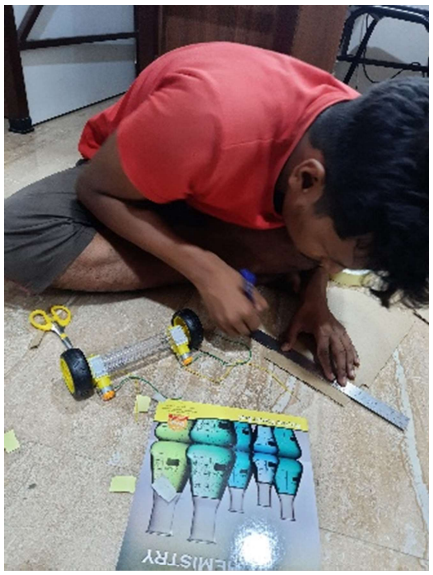
8. Building Chassis, Arduino Coding, Connections and Assembly

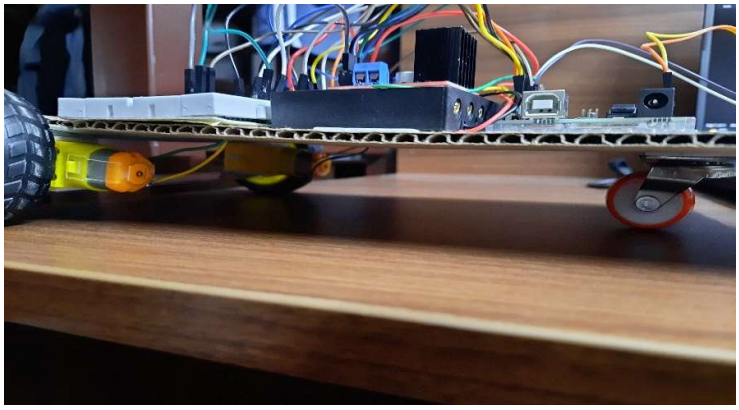
1. Building Chassis

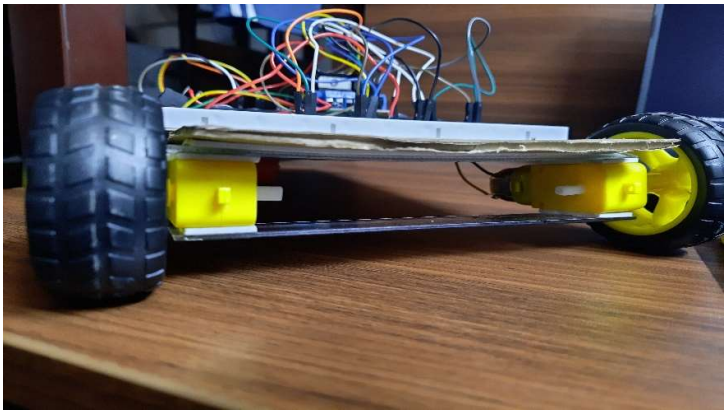
We have cut a rectangular piece of carboard sheet, where at one end the 2 motors will be fit and on the front end, the 360º Castor wheel will be fit.

We have used 2 plastic scale as a firm support to hold the motor in place with the help of double-sided adhesive tape so that the motor does not get displaced from its position due to the load put upon it because of the components

Above the Chassis, we have placed our components and made our connections. The Wires from the motor and the switch are soldered firmly.







1. Arduino Coding

```
char in = 0;

void setup() {

  Serial.begin(9600);
  pinMode(12,OUTPUT);
  pinMode(11,OUTPUT);
  pinMode(9,OUTPUT);
  pinMode(10,OUTPUT);
  // Seting up pins as output mode
}

void loop() {
 if(Serial.available() > 0)
  {
    in = Serial.read();
    if(in=='F')
    {
        digitalWrite(9,HIGH);
        digitalWrite(12,HIGH);
    }
    else if(in=='B')
    {
      digitalWrite(10, HIGH);
      digitalWrite(11,HIGH);
    }
    else if(in=='L')
    {
      digitalWrite(12, HIGH);
    }
    else if(in=='R')
    {
      digitalWrite(9, HIGH);
    }

     else if(in=='S')
     {
       digitalWrite(9,LOW);
       digitalWrite(10,LOW);
       digitalWrite(11,LOW);
       digitalWrite(12,LOW);
     }}
}
```

First, we set all pins as “OUTPUT” mode. Then in loop, we read the character received from the Bluetooth module.

When the Forward key is pressed, the pins 9,12 will be ***‘high’*** hence turning IN4 and IN1 ***‘high’*** , which turns the motor anticlockwise hence, the wheelchair will be moving forward.

When the Backward key is pressed, the pins 10,11 will be ***‘high’*** hence turning IN3 and IN2 ***‘high’***, which turns the motor clockwise hence, the wheelchair will be moving backward.

When the Left key is pressed, the pin 12 will be ***'high'*** hence turning IN1 ***'high'***, which turns the left motor anticlockwise hence, the wheelchair will be moving left.

When the Right key is pressed, the pin 9 will be ***'high'*** hence turning IN4 ***'high'***, which turns the right motor anticlockwise hence, the wheelchair will be moving right.

2. Connections

2.1 Bluetooth Module

5V Pin – 5V Pin of Arduino

GND Pin – GND Pin of Arduino

Rx Pin – Tx Pin of Arduino

Tx Pin – Rx Pin of Arduino

2.2 Motor Driver

12V Input – Positive Terminal of Battery Module

GND Pin – Negative Terminal of Battery Module

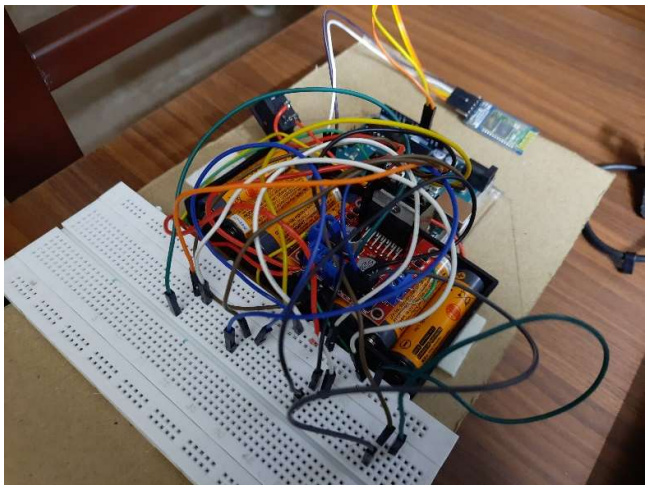
Motor Pins – Connect to Motors

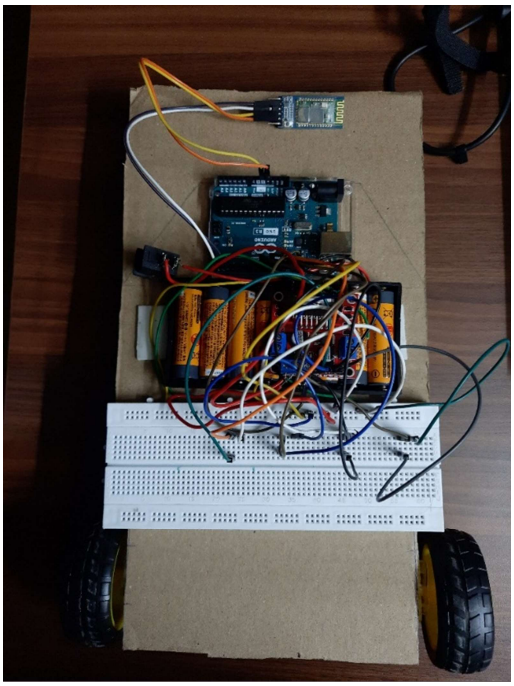
Control Pins IN4,IN3,IN2,IN1 – Connect to 9,10,11,12 Pins of Arduino

2.3 Arduino

5V From L298N Driver Module – Power Arduino

GND of Digital Pins – GND of L298N Drive Module





3. Assembling Chair

At the back side, we have constructed a T joint to support the rest of the chair which is going to be assembled onto the chassis. Then we have built the seating area with a single sheet of cardboard(390 x 170 mm), that acts as a cantilever supported by two side panels(160 x 100 mm). Then we have made the arm rests with carboard strips(150 x 25 mm) to make it look like a real wheel chair.

9. Conclusion

We Have successfully built the prototype and tested it. The result was good as the prototype was working successfully. Further to improvise this prototype to built it as a real-world working product, we can develop the chassis using aluminum metal as its both light and strong. For motors we can use high power ratted motor and can build our own custom motor driver module to as per the required voltage supply. For batteries we can use the modules available in the automobile / home appliance market.