MULTIFUNCTIONAL WHEELCHAIR FOR PHYSICALLY DISABLED PEOPLE

ABSTRACT

The creation of multipurpose wheelchairs is now a top priority in order to improve accessibility and the quality of life for people with physical disabilities. In order to provide a variety of features and enhanced adaptability, this study investigates the design, development, and implementation of a multipurpose wheelchair that is integrated with cutting-edge technology. The overarching goal of this project is to create a wheelchair with novel features to make daily living easier while addressing the issues experienced by those with mobility disabilities. This multipurpose wheelchair is made to accommodate people with many different kinds of physical restrictions, such as paraplegia and quadriplegia. The suggested wheelchair has a number of important features, including pressure-relieving mechanisms, automated reclining, and adjustable settings. Additionally, it includes voice command integration for more comfort and autonomy, as well as smart navigation and object detection features to improve safety. A user-centric approach is used to accomplish these goals, concentrating on the particular requirements and preferences of people with physical disabilities throughout the development process. To do this, detailed user research must be conducted in order to comprehend the unique requirements, and then the multifunctional wheelchair must be designed and prototyped. Physically challenged test subjects will be used in real-world scenarios to gauge the device's efficacy and functioning. This project is anticipated to make major contributions to the field of assistive technology by offering insightful information on the development and testing of a multipurpose wheelchair for people with physical disabilities. The results of this study may also open the door to new developments in the field of mobility aids, enabling people with physical limitations to live more independent and active lives in the long run.

INTRODUCTION

A basic human need is the capacity to move around and navigate one's surroundings on one's own. However, it might be very difficult for people with physical limitations. Although it allows for movement, the conventional wheelchair has its drawbacks and frequently falls short of satisfying each user's particular and complex needs. As a result, the development of multifunctional wheelchair technology has revolutionized how people with physical disabilities engage with the outside world. The multifunctional wheelchair is an engineered solution that goes beyond simple mobility by providing a tailored, adaptive, and personalized user experience. It is a modular system of intelligent technology, programmable settings, and IoT sensors that makes it simple for the user to carry out daily tasks, encouraging independence and autonomy. The multipurpose wheelchair system has the potential to completely alter the mobility environment for people with physical disabilities, enabling them to lead more rewarding lives and become more independent. It incorporates cutting-edge technology to improve stability and safety while accommodating a variety of requirements and preferences. In order to give people with physical disabilities a new degree of flexibility and independence, this project will further improve multifunctional wheelchair technology by utilizing revolutionary engineering concepts, cutting-edge technology, and creative design. The ultimate goal is to equip people with physical disabilities with the tools they need to more easily navigate their surroundings and enhance their quality of life. The multipurpose wheelchair system is a crucial step in the direction of a more inclusive society where people with physical disabilities can live more independently and with greater dignity. The multipurpose wheelchair system gives people with physical disabilities a bright future by placing a priority on user experience, safety, and accessibility.

A Novel Multipurpose Smart Wheelchair

WHO estimates that little over 65 million people, or 1% of the global population, require a wheelchair. In India, there are more than 6.1 million people with movement-related disabilities. Independent mobility is essential for older persons and physically challenged people. They frequently need help carrying out their regular tasks. Making them mobile independently could aid in enabling them to become independent. One such tool is a wheelchair, which acts as an aid for such individuals and enables them to conduct their everyday tasks independently. This versatile wheelchair is made so that it can assist people who are physically challenged, old, and blind.

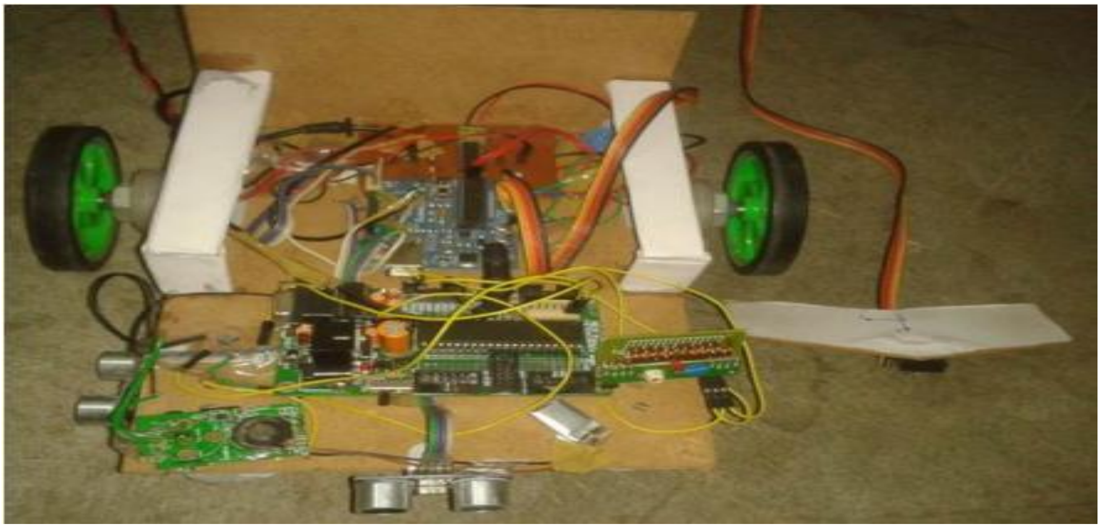


Figure: Model of a wheelchair

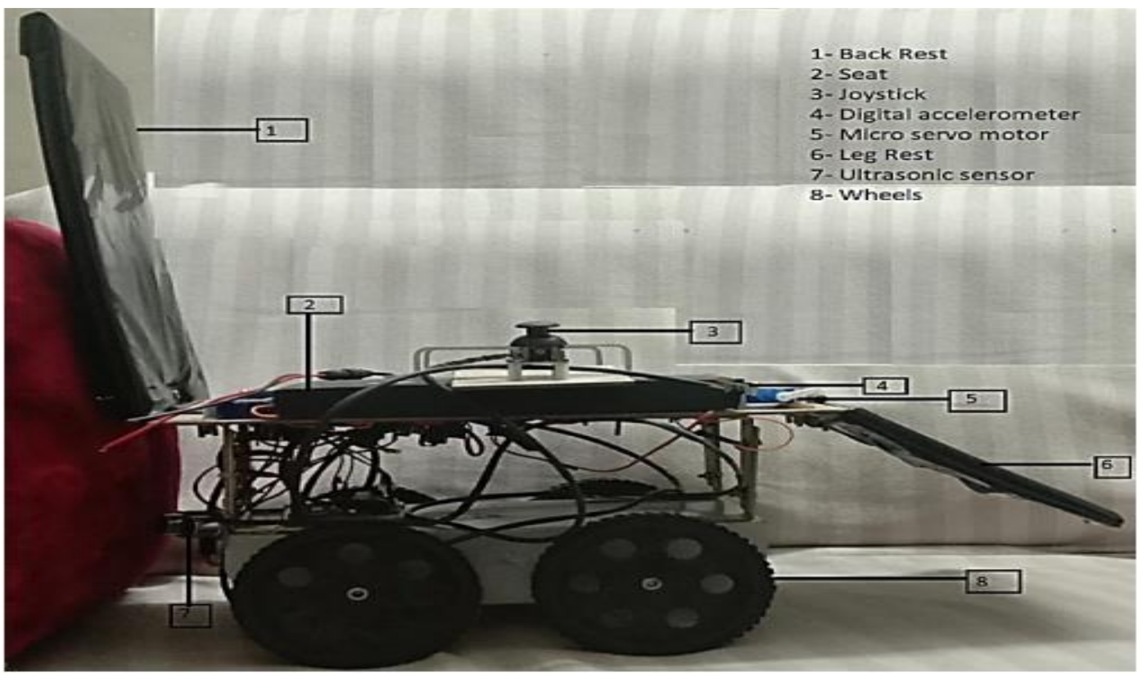
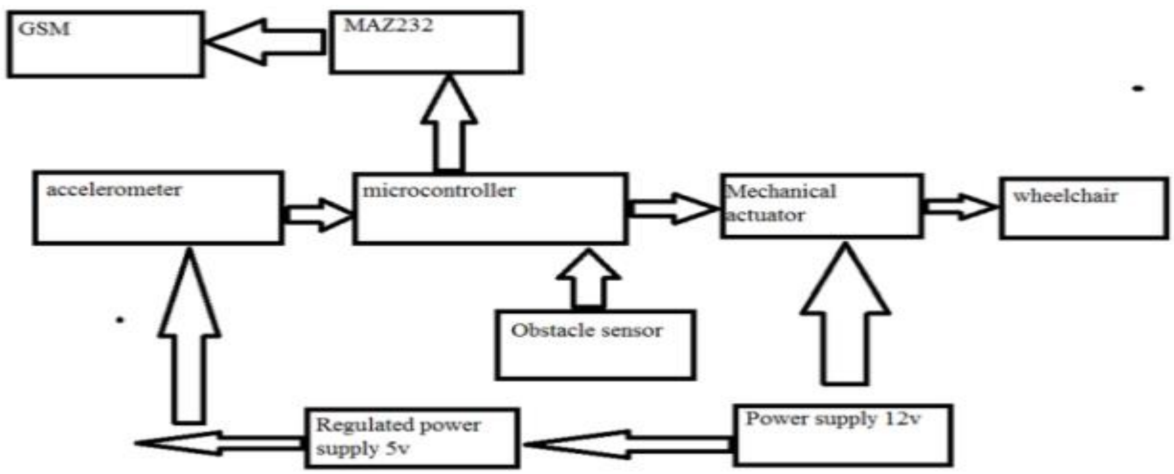


Figure: Completed wheelchair prototype

Block Diagram



Simulated Results

Understanding and incorporating sociological and cultural factors has been specifically stressed in the multifunctional wheelchair project. The design phase carefully considered the intricacies of different cultures, taking into consideration the differing viewpoints on disability, mobility, and assistive technology.

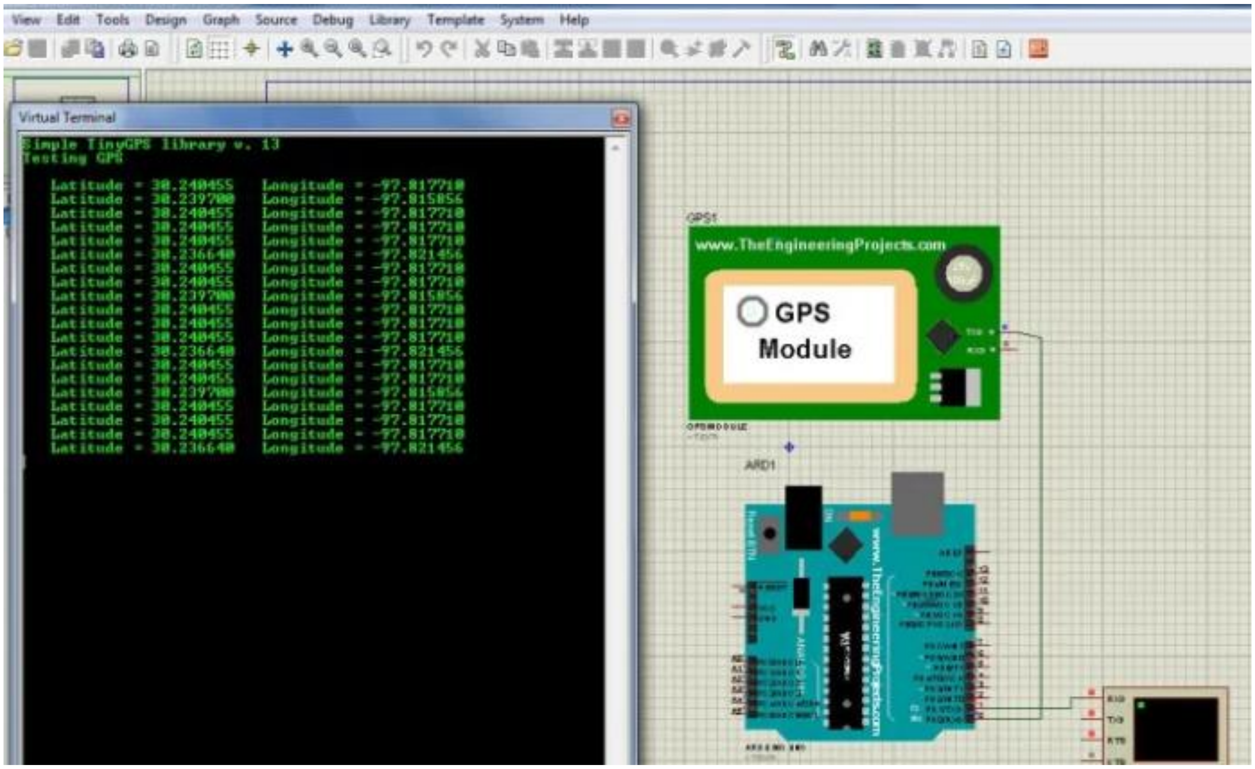


Figure: GPS Location Tracking (latitude and longitude) simulation in Proteus

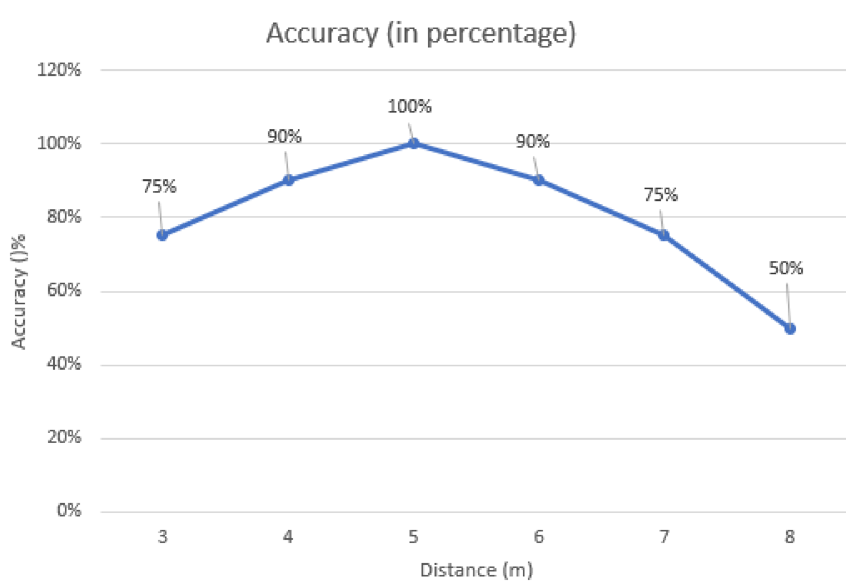


Figure : Location Accuracy Graph

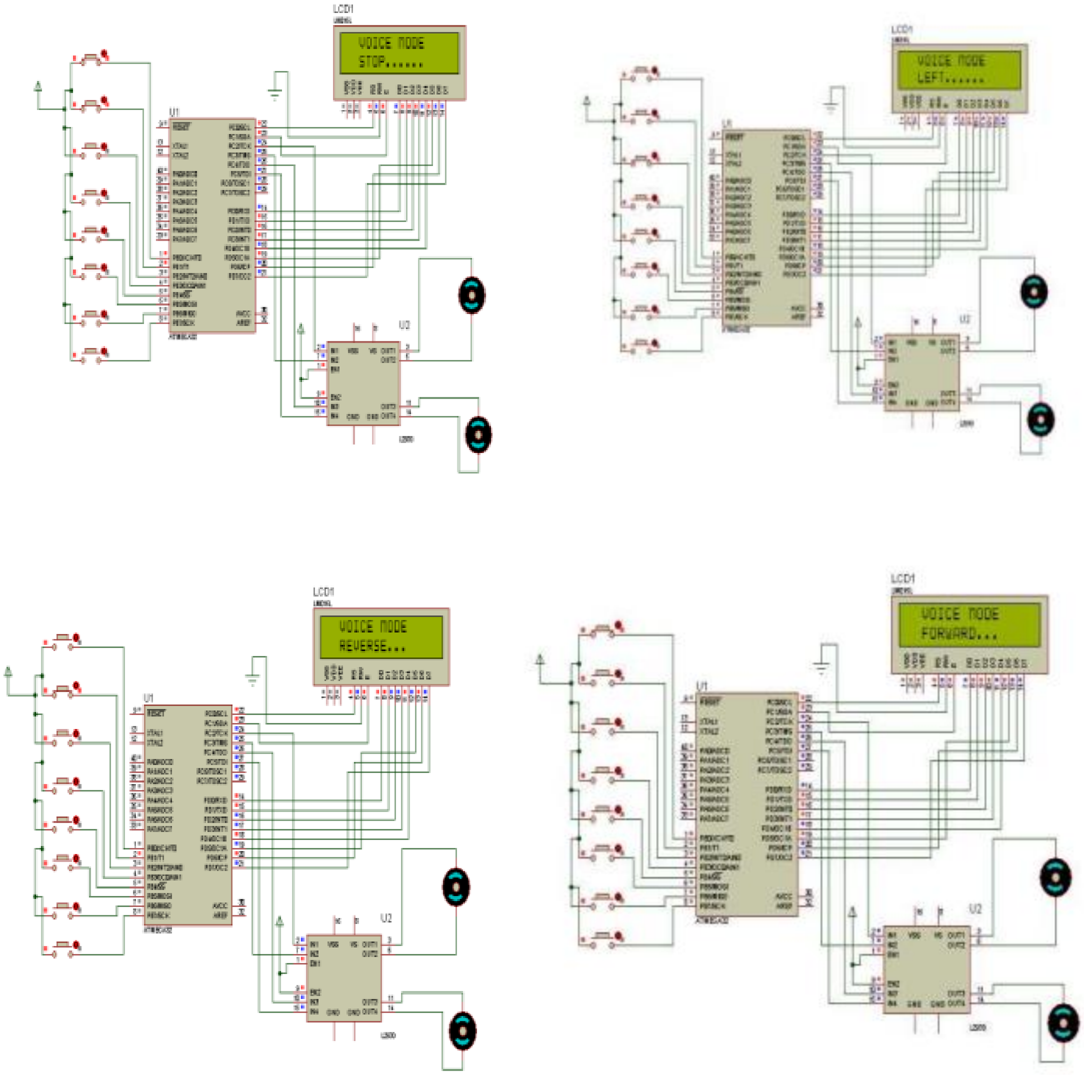


Figure: **Joystick Simulation in Proteus**

Code:

```
#include <esp_now.h>
#include <WiFi.h>

// Structure example to receive data
// Must match the sender structure
typedef struct struct_message {
   char a[32];
   int b;
   float c;
   bool d;
} struct_message;

// Create a struct_message called myData
struct_message myData;

// callback function that will be executed when data is received
void OnDataRecv(const uint8_t * mac, const uint8_t *incomingData, int len) {
  memcpy(&myData, incomingData, sizeof(myData));
  Serial.print("Bytes received: ");
  Serial.println(len);
  Serial.print("Char: ");
  Serial.println(myData.a);
  Serial.print("Int: ");
  Serial.println(myData.b);
  Serial.print("Float: ");
  Serial.println(myData.c);
  Serial.print("Bool: ");
  Serial.println(myData.d);
  Serial.println();
}
```

```
void setup() {
  // Initialize Serial Monitor
  Serial.begin(115200);

  // Set device as a Wi-Fi Station
  WiFi.mode(WIFI_STA);

  // Init ESP-NOW
  if (esp_now_init() != ESP_OK) {
    Serial.println("Error initializing ESP-NOW");
    return;
  }

  // Once ESPNow is successfully Init, we will register for recv CB to
  // get recv packer info
  esp_now_register_recv_cb(OnDataRecv);
}

void loop() {

}
```

```
#include <esp_now.h>
#include <WiFi.h>
// REPLACE WITH YOUR RECEIVER MAC Address
uint8_t broadcastAddress[] = {0xB8, 0xD6, 0x1A, 0xAA, 0x30, 0x10}; // B8:D6:1A:AA:30:10
// Structure example to send data
// Must match the receiver structure
typedef struct struct_message {
  char a[32];
  int b;
  float c;
  bool d;
} struct_message;

// Create a struct_message called myData
struct_message myData;

esp_now_peer_info_t peerInfo;

// callback when data is sent
void OnDataSent(const uint8_t *mac_addr, esp_now_send_status_t status) {
  Serial.print("\r\nLast Packet Send Status:\t");
  Serial.println(status == ESP_NOW_SEND_SUCCESS ? "Delivery Success" : "Delivery Fail");
}

typedef struct struct_message2 {
  char a[32];
  int b;
  float c;
  bool d;
} struct_message2;
```

```
// Create a struct_message called myData
struct_message2 myData2;

void OnDataRecv(const uint8_t * mac, const uint8_t *incomingData, int len) {
  memcpy(&myData2, incomingData, sizeof(myData2));
  Serial.print("Bytes received: ");
  Serial.println(len);
  Serial.print("Char: ");
  Serial.println(myData2.a);
  Serial.print("Int: ");
  Serial.println(myData2.b);
  Serial.print("Float: ");
  Serial.println(myData2.c);
  Serial.print("Bool: ");
  Serial.println(myData2.d);
  Serial.println();
}

void setup() {
  // Init Serial Monitor
  Serial.begin(115200);

  // Set device as a Wi-Fi Station
  WiFi.mode(WIFI_STA);

  // Init ESP-NOW
  if (esp_now_init() != ESP_OK) {
    Serial.println("Error initializing ESP-NOW");
    return;
  }

  // Once ESPNow is successfully Init, we will register for Send CB to
  // get the status of Trasnmitted packet
```

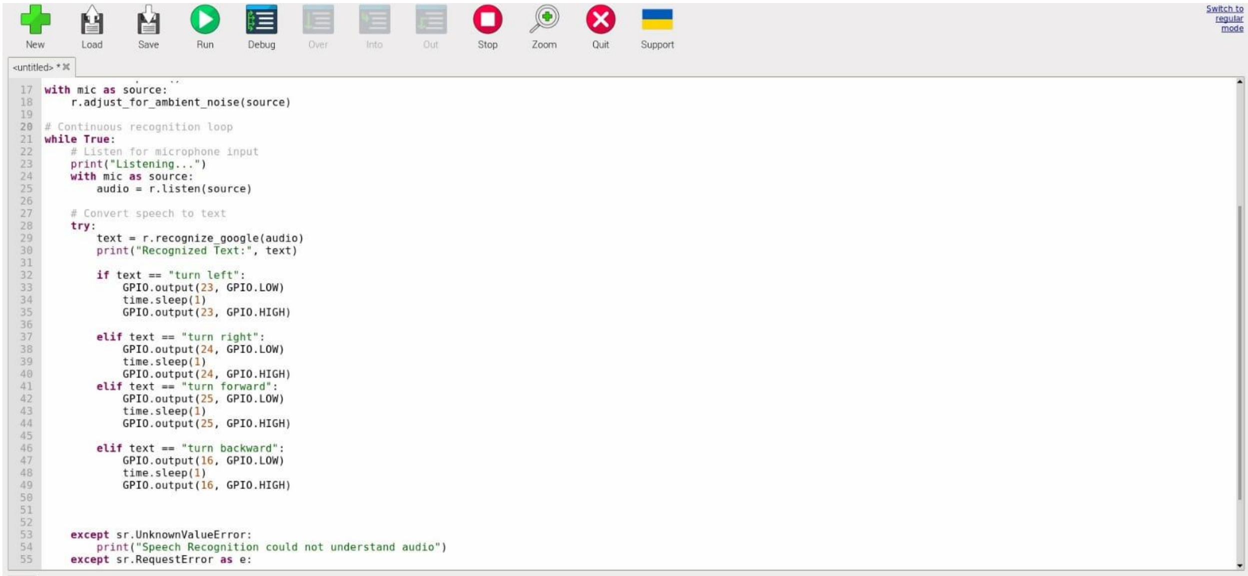
```
  esp_now_register_send_cb(OnDataSent);
  esp_now_register_recv_cb(OnDataRecv);
  // Register peer
  memcpy(peerInfo.peer_addr, broadcastAddress, 6);
  peerInfo.channel = 0;
  peerInfo.encrypt = false;

  // Add peer
  if (esp_now_add_peer(&peerInfo) != ESP_OK) {
    Serial.println("Failed to add peer");
    return;
  }
}

void loop() {
  // Set values to send
  strcpy(myData.a, "THIS IS A CHAR");
  myData.b = random(1, 20);
  myData.c = 1.2;
  myData.d = false;

  // Send message via ESP-NOW
  esp_err_t result = esp_now_send(broadcastAddress, (uint8_t *) &myData, sizeof(myData));

  if (result == ESP_OK) {
    Serial.println("Sent with success");
  }
  else {
    Serial.println("Error sending the data");
  }
  delay(200);
}
```

```
#include <WiFi.h>

// REPLACE WITH YOUR RECEIVER MAC Address
uint8_t broadcastAddress[] = {0xC4, 0xDE, 0xE2, 0x13, 0x89, 0x5C};

// Structure example to send data
// Must match the receiver structure
typedef struct struct_message {
  char a[32];
  int b;
  float c;
  bool d;
} struct_message;

// Create a struct_message called myData
struct_message myData;

esp_now_peer_info_t peerInfo;

// callback when data is sent
void OnDataSent(const uint8_t *mac_addr, esp_now_send_status_t status) {
  Serial.print("\r\nLast Packet Send Status:\t");
  Serial.println(status == ESP_NOW_SEND_SUCCESS ? "Delivery Success" : "Delivery Fail");
}

void setup() {
  // Init Serial Monitor
  Serial.begin(115200);

  // Set device as a Wi-Fi Station
  WiFi.mode(WIFI_STA);

  // Init ESP-NOW
```

```
  if (esp_now_init() != ESP_OK) {
    Serial.println("Error initializing ESP-NOW");
    return;
  }

  // Once ESPNow is successfully Init, we will register for Send CB to
  // get the status of Trasnmitted packet
  esp_now_register_send_cb(OnDataSent);

  // Register peer
  memcpy(peerInfo.peer_addr, broadcastAddress, 6);
  peerInfo.channel = 0;
  peerInfo.encrypt = false;

  // Add peer
  if (esp_now_add_peer(&peerInfo) != ESP_OK){
    Serial.println("Failed to add peer");
    return;
  }
}

void loop() {
  // Set values to send
  strcpy(myData.a, "THIS IS A CHAR");
  myData.b = random(1,20);
  myData.c = 1.2;
  myData.d = false;

  // Send message via ESP-NOW
  esp_err_t result = esp_now_send(broadcastAddress, (uint8_t *) &myData, sizeof(myData));

  if (result == ESP_OK) {
    Serial.println("Sent with success");
```

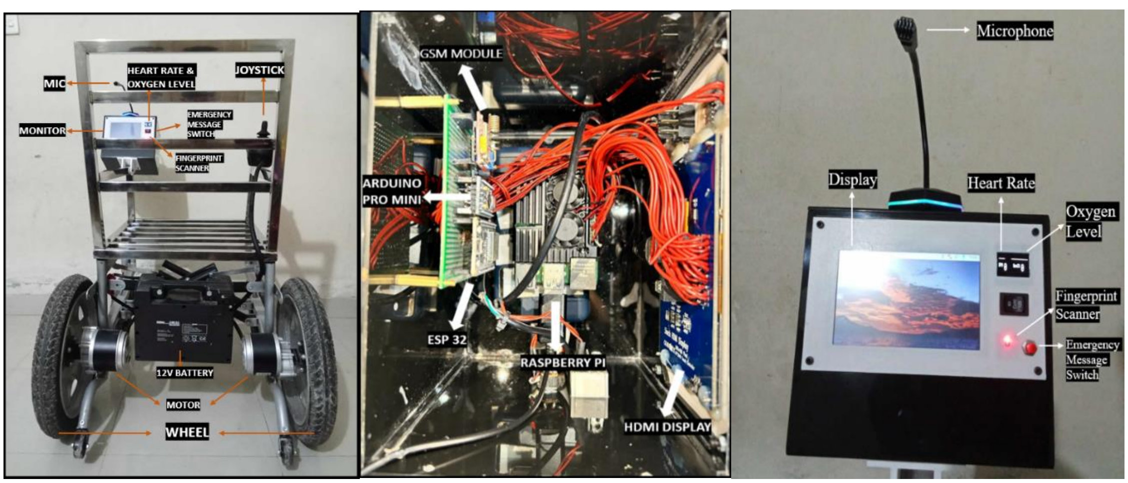
```
  }
  else {
    Serial.println("Error sending the data");
  }
  delay(200);
}
[9:36 AM, 9/17/2023] Suptodhar AKA Hardware: const int potPin1 = 32;
const int potPin2 = 35;
const int potPin3 = 34;

const int motora1 = 25;
const int motora2 = 26;

const int motorb1 = 27;
const int motorb2 = 14;

int potValue1, potValue2, potValue3;

void setup() {
  Serial.begin(115200);
  delay(200);
  pinMode(motora1, OUTPUT);
  pinMode(motora2, OUTPUT);
  pinMode(motorb1, OUTPUT);
  pinMode(motorb2, OUTPUT);
  digitalWrite(motora1, LOW);
  digitalWrite(motora2, LOW);
  digitalWrite(motorb1, LOW);
  digitalWrite(motorb2, LOW);
}

void loop() {
  potValue1 = analogRead(potPin1);
```

```
potValue2 = analogRead(potPin2);
potValue3 = analogRead(potPin3);
Serial.print("potValue1 - ");
Serial.print(potValue1);
Serial.print("   potValue2 - ");
Serial.print(potValue2);
Serial.print("   potValue3 - ");
Serial.println(potValue3);

if (potValue2 > 3300) {
  Serial.println("----up-----");
  digitalWrite(motora1, HIGH);
  digitalWrite(motora2, HIGH);
}
else if (potValue2 < 700) {
  Serial.println("----down-----");
  digitalWrite(motora1, LOW);
  digitalWrite(motora2, LOW);
}

//    else if (potValue3 > 3300) {
//      Serial.println("----right-----");
//      digitalWrite(motora1, LOW);
//      digitalWrite(motora2, LOW);
//      digitalWrite(motorb1, HIGH);
//      digitalWrite(motorb2, LOW);
//    }
//
//    else if (potValue3 < 900) {
//      Serial.println("----left------");
//      digitalWrite(motora1, LOW);
//      digitalWrite(motora2, LOW);
//      digitalWrite(motorb1, LOW);
```




```python
with mic as source:
    r.adjust_for_ambient_noise(source)

# Continuous recognition loop
while True:
    # Listen for microphone input
    print("Listening...")
    with mic as source:
        audio = r.listen(source)

    # Convert speech to text
    try:
        text = r.recognize_google(audio)
        print("Recognized Text:", text)

        if text == "turn left":
            GPIO.output(23, GPIO.LOW)
            time.sleep(1)
            GPIO.output(23, GPIO.HIGH)

        elif text == "turn right":
            GPIO.output(24, GPIO.LOW)
            time.sleep(1)
            GPIO.output(24, GPIO.HIGH)
        elif text == "turn forward":
            GPIO.output(25, GPIO.LOW)
            time.sleep(1)
            GPIO.output(25, GPIO.HIGH)

        elif text == "turn backward":
            GPIO.output(16, GPIO.LOW)
            time.sleep(1)
            GPIO.output(16, GPIO.HIGH)


    except sr.UnknownValueError:
        print("Speech Recognition could not understand audio")
    except sr.RequestError as e:
```

Hardware Result:



Conclusion

In conclusion, multipurpose wheelchairs have become a revolutionary development for those with physical disabilities. Modern flexible designs, cutting-edge features, and user-friendly technology have significantly changed traditional mobility aids, boosting freedom and improving the quality of life for wheelchair users. Multifunctional wheelchairs are effective solutions because they satisfy the many requirements and capabilities of the physically challenged population, dismantling obstacles and promoting inclusivity in society. These wheelchairs have features that make it easier for impaired individuals to engage in and take part in daily activities, including better maneuverability, adjustable sitting positions, simple transfers, and numerous adaptations. Additionally, the introduction of AI systems and smart technology into wheelchair design has opened up new avenues for advancements like collision avoidance, voice control, and smart navigation, giving users safer and more effective mobility options. The healthcare industry, technologists, designers, and disabled communities must work together to advance multifunctional wheelchair design. This partnership will make sure that user input is properly taken into consideration, new technologies are quickly adopted, and specialized solutions are developed for people with various needs. In the end, multifunctional wheelchairs are a crucial instrument in bridging the gap between a society that is inclusive and free from barriers and the physical challenged. They also serve as a tribute to the power of invention.

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