

## **VOICE RECOGNITION BASED INTELLIGENCE WHEELCHAIR AND GPS TRACKING SYSTEM**

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### **ABSTRACT**

Mobility assistance is a major challenge for elderly and physically disabled individuals. Traditional wheelchairs require manual operation, which is often difficult for users with limited limb movement. To address this issue, a Voice Recognition-Based Intelligent Wheelchair with GPS Tracking System is proposed. The system uses speech recognition technology integrated with microcontroller-based motor control to move the wheelchair according to voice commands such as “forward,” “backward,” “left,” and “right.” Additionally, a GPS module continuously tracks the location of the wheelchair, allowing caregivers or family members to monitor movement through GSM-based notifications or a mobile application. This system enhances independence, safety, and accessibility for differently-abled individuals using IoT-based monitoring and smart control.

**Keywords:** Voice Recognition, Intelligent Wheelchair, GPS Tracking, GSM, IoT, Speech Control, Mobility Assistance, Microcontroller, Smart Healthcare, Assistive Technology, Real-Time Monitoring, Accessibility.

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### **I. INTRODUCTION**

Advancements in assistive technology have greatly improved the quality of life for people with mobility impairments. However, conventional electric wheelchairs require joystick control, which is not suitable for users with severe hand or arm disabilities. Voice-controlled wheelchairs overcome this limitation by enabling hands-free operation, offering both comfort and autonomy. This project integrates voice recognition, IoT connectivity, and GPS tracking into a single system. The voice module interprets spoken commands and sends corresponding signals to a microcontroller that controls DC motors for movement. A GPS and GSM module are included for tracking and safety purposes, ensuring that caregivers can receive real-time updates about the wheelchair’s location. The combination of these technologies provides an intelligent and reliable mobility aid for differently-abled users.

### **II. LITERATURE SURVEY**

1. Sharma et al. (2019) – Voice Controlled Smart Wheelchair

Sharma et al. developed a voice-controlled wheelchair using an Arduino UNO and Bluetooth module. The system processed simple commands like “forward” and “stop” using a smartphone app. Although the design was cost-effective, it lacked GPS tracking and real-time location awareness for caregiver monitoring.

2. Ahmed and Reddy (2020) – IoT-Enabled Wheelchair with Location Tracking

Ahmed and Reddy proposed an IoT-based wheelchair using NodeMCU and Google Firebase for real-time data storage. GPS data was continuously updated on a cloud dashboard. The system allowed caregivers to monitor location history but did not integrate direct speech recognition for movement.

3. Patel et al. (2021) – Smart Assistive Wheelchair for Disabled Users

Patel et al. designed an assistive wheelchair combining ultrasonic sensors and voice control. The system successfully prevented collisions by stopping automatically when obstacles were detected. However, it lacked an external communication system to share tracking information with caregivers.

#### 4. Kumar and Sinha (2022) – Voice and Gesture Controlled Wheelchair

Kumar and Sinha presented a wheelchair that responded to both hand gestures and voice commands. It used the HM2007 voice recognition module and Arduino Mega. While offering dual control, the design was limited to local operation without remote tracking or alert functionality.

#### 5. Mehta and Das (2023) – GPS-Based Mobility Assistance System for Elderly

Mehta and Das proposed a GPS-integrated mobility device for elderly users that sent SMS alerts with coordinates during emergencies. Though efficient in location tracking, it required manual activation and lacked automated control or voice-driven navigation.

### III. EXISTING SYSTEM

Existing electric wheelchairs rely on manual joysticks or push-button interfaces for control. These designs are unsuitable for users with upper limb disabilities. Some systems offer limited automation using sensors or Bluetooth connectivity but fail to provide real-time monitoring or intelligent navigation. Additionally, most current solutions lack GPS-based tracking, making it difficult for caregivers to locate users in case of emergencies. Therefore, there is a growing need for a smart, voice-controlled wheelchair integrated with tracking and safety features.

### IV. PROPOSED SYSTEM

The proposed system introduces an IoT-enabled, voice-controlled intelligent wheelchair that supports real-time GPS tracking. It utilizes:

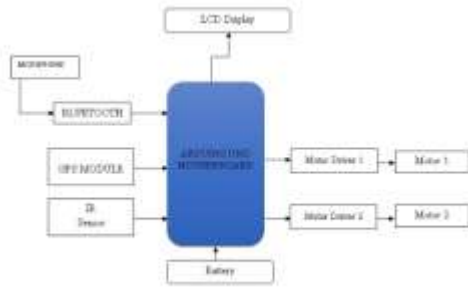
- **Voice Recognition Module (e.g., Elechouse V3 or HM2007):** To interpret spoken commands.
- **Microcontroller (Arduino or NodeMCU):** Acts as the central controller to process commands.
- **Motor Driver (L298N):** Controls the direction and speed of the wheelchair motors.
- **GPS Module (NEO-6M):** Provides real-time location data.
- **GSM Module (SIM800L):** Sends SMS alerts with location coordinates to caregivers.
- **Power Supply and Relay System:** Ensure safe and reliable motor control.

The system operates by detecting user voice commands, converting them into digital signals, and driving the motors accordingly. The GPS module tracks the wheelchair's location and sends updates to the caregiver via GSM or a mobile application. This approach offers both mobility independence and safety monitoring.

### V. SYSTEM ARCHITECTURE

The system architecture consists of five key modules:

1. **Voice Input Module:** Captures and processes user commands.
2. **Control Unit:** Microcontroller interprets commands and drives motors.
3. **Motor Driver Unit:** Executes directional movements of the wheelchair.
4. **GPS and GSM Module:** Enables real-time tracking and communication.
5. **Cloud/Mobile Interface:** Displays live location and status updates.



**Fig.5.1** Block diagram of proposed model

**ARUDINO:**

The Arduino is a family of microcontroller boards to simplify electronic design, prototyping and experimenting for artists, hackers, hobbyists, but also many professionals. People use it as brains for their robots, to build new digital music instruments, or to build a system that lets your house plants tweet you when they're dry. Arduinos (we use the standard Arduino Uno) are built around an ATmega microcontroller — essentially a complete computer with CPU, RAM, Flash memory, and input/output pins, all on a single chip. Unlike, say, a Raspberry Pi, it's designed to attach all kinds of sensors, LEDs, small motors and speakers, servos, etc. directly to these pins, which can read in or output digital or analog voltages between 0 and 5 volts. The Arduino connects to your computer via USB, where you program it in a simple language (C/C++, similar to Java) from inside the free Arduino IDE by uploading your compiled code to the board. Once programmed, the Arduino can run with the USB link back to your computer, or stand-alone without it — no keyboard or screen needed, just power.

Starting clockwise from the top center:

- Analog Reference pin (orange)
- Digital Ground (light green)
- Digital Pins 2-13 (green)
- Digital Pins 0-1/Serial In/Out - TX/RX (dark green) - These pins cannot be used

for digital i/o (Digital Read and Digital Write) if you are also using serial communication (e.g. Serial.begin).

- Reset Button - S1 (dark blue)
- In-circuit Serial Programmer (blue-green)
- Analog In Pins 0-5 (light blue)
- Power and Ground Pins (power: orange, grounds: light orange)
- External Power Supply In (9-12VDC) - X1 (pink)
- Toggles External Power and USB Power (place jumper on two pins closest to desired supply) - SV1 (purple)

**DIGITAL PINS**

- In addition to the specific functions listed below, the digital pins on an Arduino board can be used for general purpose input and output via the [pin Mode\(\)](#), [Digital Read\(\)](#), and [Digital Write\(\)](#) commands. Each pin has an internal pull-up resistor which can be turned on and off using digital Write() (w/ a value of HIGH or LOW, respectively) when the pin is configured as an input. The maximum current per pin is 40mA.

**ANALOG PINS**

In addition to the specific functions listed below, the analog input pins support 10-bit analog-to-digital conversion (ADC) using the [analog Read\(\)](#) function. Most of the analog inputs can also be used as digital pins: analog input 0 as digital pin 14 through analog input 5 as digital pin 19. Analog inputs 6 and 7 (present on the Mini and BT) cannot be used as digital pins.

## VI. IMPLEMENTATION



**FIG. 6.1:** Prototype



**FIG. 6.2:** Implementation

The Voice Recognition-Based Intelligent Wheelchair with GPS Tracking System is an assistive technology designed to enhance mobility and independence for elderly and physically challenged individuals. The system integrates voice recognition technology with microcontroller-based motor control to enable movement through simple spoken commands such as “forward,” “backward,” “left,” and “right.” The microcontroller (such as Arduino, Raspberry Pi, or NodeMCU) processes the recognized voice inputs and drives the wheelchair’s motors accordingly through a motor driver circuit. Additionally, a GPS module is embedded to continuously track the wheelchair’s real-time location, which can be transmitted via a GSM or IoT-based cloud platform to caregivers or family members for monitoring and safety purposes. In case of an emergency or abnormal situation, the system can

automatically send an alert with the current location coordinates to predefined contacts. Optional obstacle detection sensors such as ultrasonic or infrared modules can be included to avoid collisions and ensure smooth navigation. Overall, this intelligent wheelchair system provides a smart, safe, and user-friendly mobility solution that combines voice control, automation, and real-time tracking to significantly improve the quality of life for users with limited physical movement.

## VII. CONCLUSION

The proposed Voice Recognition-Based Intelligent Wheelchair with GPS Tracking offers an innovative and practical mobility solution for differently-abled individuals. It enables hands-free control, real-time monitoring, and safety assurance through integrated IoT features. The system’s cost-effective and modular design allows easy customization for diverse user needs. By merging voice control with GPS tracking, this project provides both independence and peace of mind for users and caregivers.

## VIII. FUTURE SCOPE

- Integration of AI-based speech recognition for multiple language and accent support.
- Implementation of obstacle detection using ultrasonic or LiDAR sensors for autonomous navigation.
- Real-time data visualization using mobile apps with Google Maps API.
- Integration of health monitoring sensors (e.g., heart rate, temperature) for medical alerts.
- Development of solar-powered versions for extended battery life.

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