Smart wheelchair

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Problem Statement

People with disabilities and the elderly often face daily challenges related to mobility, independence, and safety. Traditional wheelchairs lack smart features such as obstacle detection, path planning, and emergency response. Most advanced solutions are either too expensive or not user-friendly. There's a clear need for an affordable smart wheelchair that integrates intelligent navigation with path planning, flexible control options, real-time obstacle avoidance, and emergency assistance—empowering users to move safely and independently in various environments.

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Smart Solution

An Arduino-based intelligent mobility solution designed to enhance independence, safety, and usability for individuals with physical disabilities. The system is affordable, adaptive, and packed with essential smart features.

Key Features:

- Multi-Mode Control: Joystick, Mobile App (Gyro), Voice, and Touch controls for flexible, user-friendly operation.
- Fall Detection & Emergency Alerts: Detects falls and sends instant SMS alerts to registered contacts.
- Camera-Based Emergency Reporting: Captures and uploads real-time images to the user's registered Gmail Drive during emergencies.
- Obstacle Avoidance & Path Planning: Ensures smooth navigation through smart sensors and intelligent path planning.
- Affordable & Accessible: Combines functionality with cost-effectiveness to reach a broader user base.

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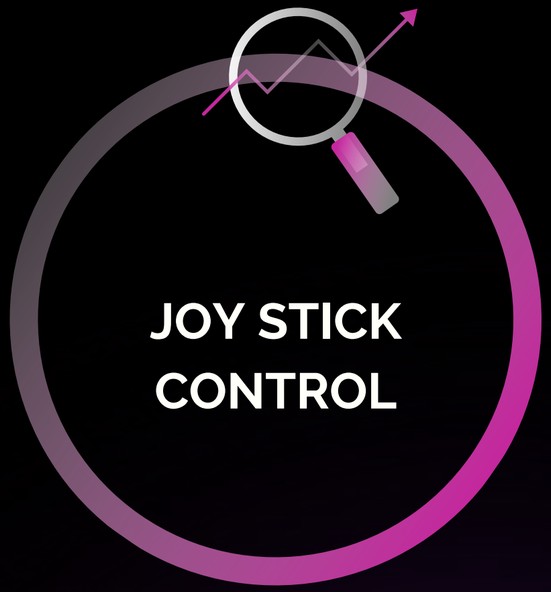
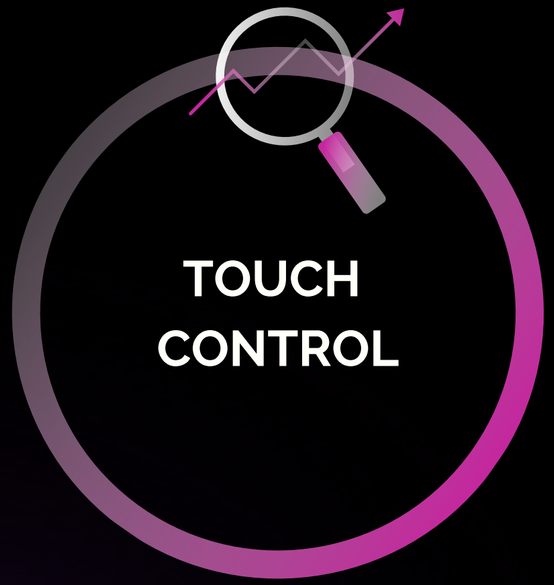
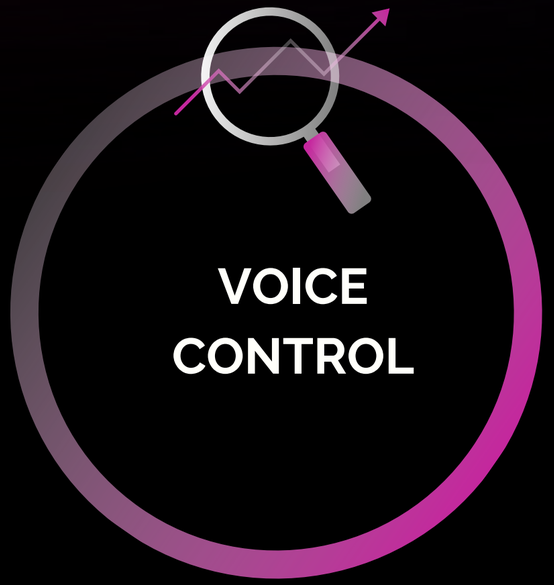
Smart Control Features







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SMART FEATURES

Fall Detection with SMS Alerts:

An IR sensor detects falls or absence and instantly sends SMS alerts to registered contacts for quick assistance.

Obstacle avoidance

IR sensors detect obstacles, and the Arduino processes inputs to prevent collisions and guide the wheelchair safely.

GPS Tracking

A custom mobile app with GPS enables real-time tracking of the wheelchair, helping caregivers monitor the user's safety and location.

SOS Emergency button

The SOS button sends emergency alerts with location to registered contacts when the user needs urgent help.

Long range control

Long-range control allows the wheelchair to be operated from a distance of up to 50–70 meters, providing greater mobility and flexibility.

Seat occupancy detection

Seat occupancy detection ensures the user is seated properly and alerts if the seat is unoccupied or if the user falls off.

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SMART FEATURES

Camera-Based Emergency Reporting

Automatically captures images during emergencies triggered by fall detection or SOS button and uploads them to the registered Gmail Drive.

Staircase Avoidance

Use depth camera or IR sensor to detect staircase and prevent accidental descent.

Smart Path Planning

Automatically navigates safe and efficient routes by detecting obstacles and avoiding collisions.

User Authentication

Uses biometric authentication to ensure only authorized users can operate the wheelchair, adding an extra layer of security.

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Technical Overview

1

CENTRAL CONTROL UNIT: ARDUINO BOARD

Acts as the brain of the system

INTERFACES WITH-
Voice Module
Joystick
Mobile App
GPS Module
Sensors

2

DECISION MAKING

Arduino processes the input

Determines direction or stop command

3

MOTOR CONTROL

Commands sent to L298N Motor Driver

Four DC Motors attached to wheels

4

POWER SUPPLY

Entire system powered by two 3.7V Batteries

Enables portability and energy efficiency

5

SAFETY ENHANCEMENT

IR sensors--
Detects obstacles
Enables collision avoidance

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Technical Overview

6

PATH PLANNING

Responsible for determining optimal routes and ensuring safe navigation.

Uses real-time sensor data to plan the best path, avoiding obstacles and adapting to environmental conditions.

7

CAMERA MONITORING

Captures real-time images during emergencies and uploads them to the registered Gmail Drive.

Activated automatically during a fall or SOS button press to provide visual context for assistance.

8

AUTHENTICATION

Verifies user identity using Fingerprint Sensor (R305) or Camera Module (OV2640) for face recognition.

Grants access automatically through fingerprint or face recognition.

9

STAIRCASE DETECTION

Detects stairs or uneven surfaces using Camera Depth Module or IR Sensors to prevent falls.

- Stops the wheelchair automatically when stairs or obstacles are detected.

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Real Life Applications

Emergency Monitoring (Fall Detection System)

The fall detection system helps in emergencies by detecting sudden movements and sending GPS-based alerts to caregivers, ensuring fast response if the user falls.

Obstacle Avoidance for Outdoor Safety

Obstacle avoidance ensures safer outdoor movement by detecting and avoiding people, pets, and uneven surfaces, making navigation smooth and accident-free.

Remote Caregiving (GPS + SMS Alerts)

GPS tracking and SMS alerts allow remote caregiving by updating caregivers about the user's location and sending alerts if they leave a safe zone.

Use in Hospitals/Rehab/Eldercare Facilities

In hospitals and rehab centers, smart wheelchairs improve efficiency by allowing staff to track, control, and assist patients remotely via a central system.

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Future Scope

1

AI-POWERED NAVIGATION

Learns from past journeys to improve path planning and adapt to obstacles and user preferences.

2

SELF-CHARGING SYSTEM

Automatically navigates to a charging station when the battery is low.

3

BRAIN-COMPUTER INTERFACE (BCI)

Allows users with severe mobility impairments to control the wheelchair with brain signals.

4

INTEGRATION WITH SMART HOME SYSTEMS

Controls home devices (lights, doors, etc.) directly from the wheelchair.

5

HEALTH MONITORING AND ALERTS

Monitors health metrics and sends alerts to caregivers in case of abnormalities.

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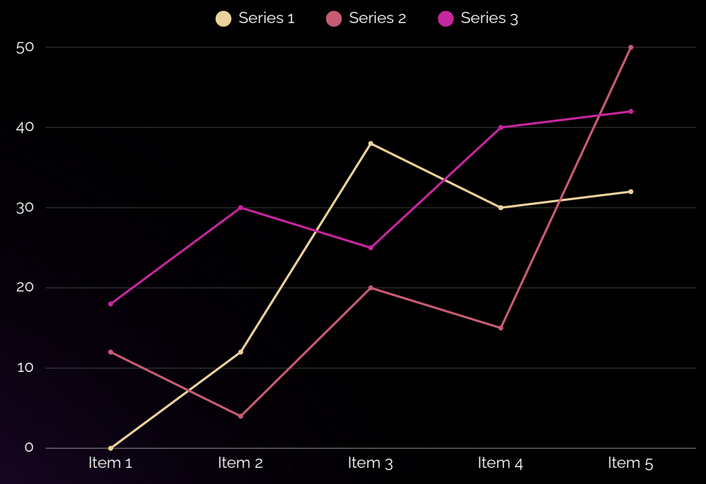
Market Overview



Function	Prototype Component	Production-Level Alternative	Why It's Better	Prototype Cost (INR)	Production Cost (INR)
Motor Driver	L293D module	BTS7960 or VNH2SP30 high current driver	Handles high current, smooth PWM, durable	₹80-₹100	₹250-₹400
Power Supply	2 × 3.7V 18650 cells (~7.4V)	12V/24V Li-ion pack with BMS (e.g., 6S 18650)	High capacity, stable, battery management	₹200-₹300	₹1200-₹2500
Microcontroller	Arduino Uno	STM32 (e.g., Blue Pill) / ESP32 (Wi-Fi+BLE)	More GPIOs, faster, multitasking, BLE/Wi-Fi	₹400-₹600	₹600-₹1000
Motors	4 × BO motors (100 RPM)	2 × 12V Geared DC motors with encoders	High torque, durable, speed/position control	₹400-₹500 total	₹800-₹1500 total
Control Interface	Joystick module + HC-05	Industrial joystick / ESP32 app control / touchscreen	More durable, customizable, wireless control	₹250-₹300	₹600-₹2000
Sensors	2 × IR sensors	Ultrasonic (HC-SR04), LIDAR (e.g., RPLidar A1), Camera (OV2640 + ESP32)	Longer range, precise mapping, better safety	₹100-₹150	₹300 (ultrasound) to ₹6000 (LIDAR)
Path Planning	Ultrasonic HC-SR04 array (4-6 sensors)	RPLIDAR A1/A2 or Intel RealSense D435	360° mapping, higher precision, longer range detection	₹600-₹900	₹6,000-₹20,000
Authentication	Fingerprint Scanner Module (R307)	Capacitive Fingerprint Scanner with Secure Element	Faster recognition, more secure, tamper-resistant	₹800-₹1,200	₹2,500-₹4,000
Camera Monitoring	ESP32-CAM module	OV5647 camera module with Raspberry Pi Zero	Higher resolution, better low-light, more processing	₹500-₹700	₹1,500-₹3,000
Emergency Reporting	GSM SIM800L module	4G LTE module with cloud integration	Faster data transfer, more reliable connection, global coverage	₹300-₹400	₹1,200-₹2,000
Fall Detection	MPU6050 accelerometer/gyroscope	9-axis IMU (BMI160) with dedicated processor	More accurate detection, fewer false positives, configurable sensitivity	₹200-₹250	₹800-₹1,500
User Interface	16x2 LCD Display with buttons	5" Touch LCD with custom UI	Better user experience, more intuitive interaction	₹300-₹400	₹1,500-₹3,000

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Conclusion

We're not just building a wheelchair.
We're building dignity, freedom, and safety—using accessible technology that can change lives.

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Thank You!

This is more than a project—it's a mission.

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