PROJECT EXPO'25

SMART WALKING CANE FOR THE VISUALLY IMPAIRED

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Key Terms: ESP32 control, Obstacle Detection, IoT based assistive robotics , Haptic feedback

Introduction

Mobility is a critical challenge for visually impaired individuals. Traditional white canes provide tactile feedback but lack real-time obstacle detection.

This project introduces a Smart Walking Cane equipped with

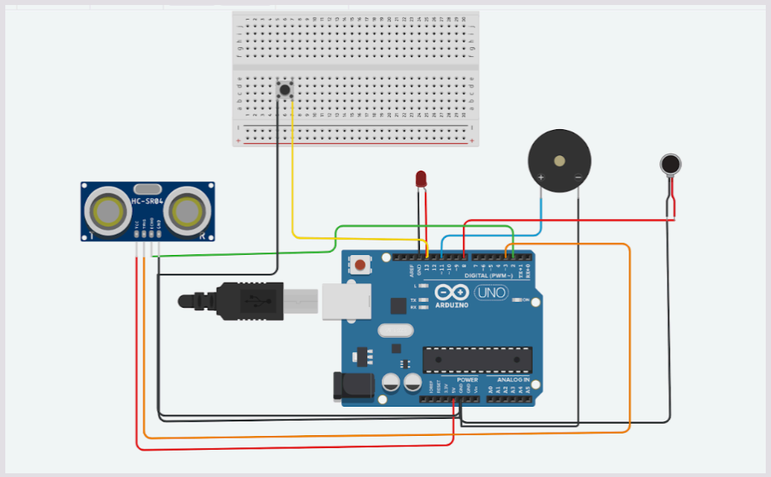
- ESP32 microcontroller
- ultrasonic sensors, buzzers, GPS module
- IoT connectivity to ThingsBoard to enhance independent mobility.

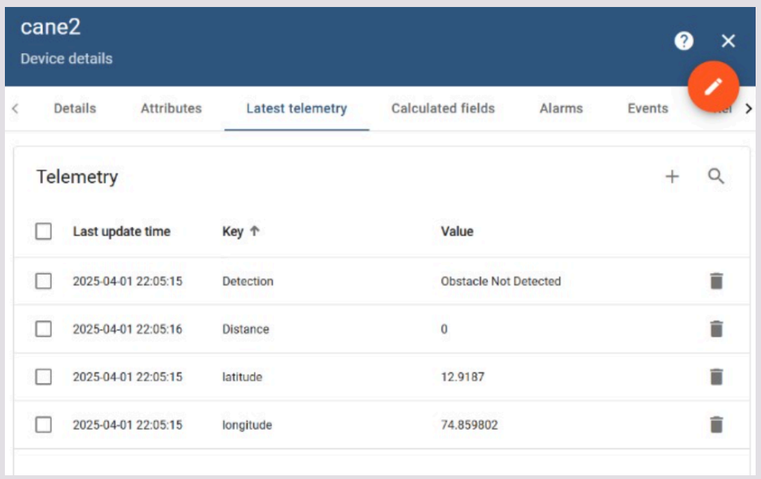
By integrating real-time obstacle detection and vibration alerts, the cane provides a safer navigation experience.

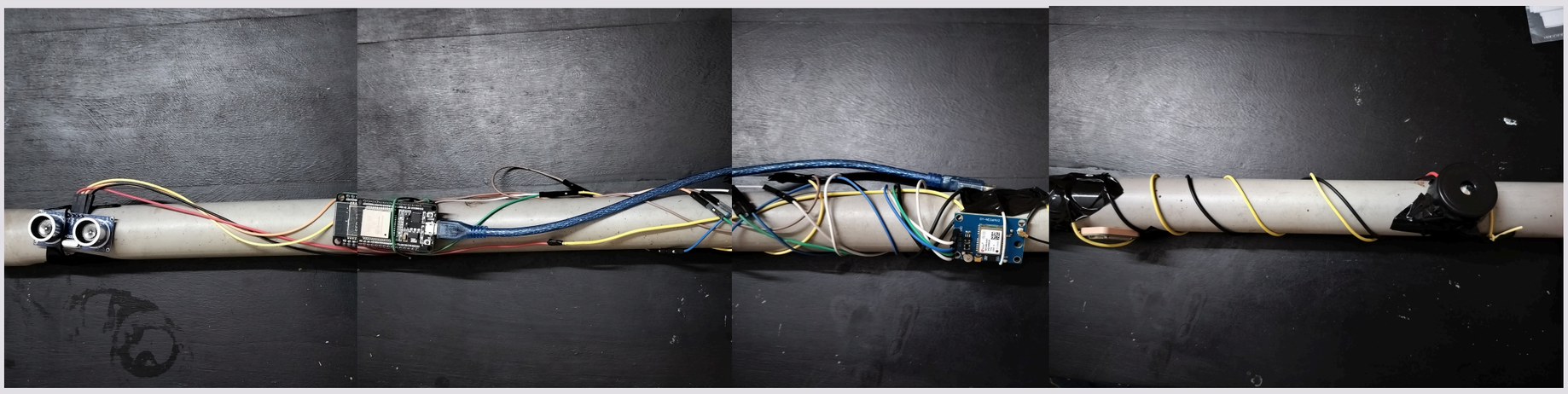
Methodology

- Conceptual Design: Built CAD models with ESP32 micro-controller, ultrasonic sensor, GPS module, Battery, Vibration motor and Buzzer along with TinkerCad circuit diagrams.
- Hardware implementation: Assembled the sensors and modules to the cane with appropriate wiring ensuring efficient power management with battery.
- Software implementation:
    a) Programmed the ESP32 and each sensor to read and process inputs (Sensor Data Processing)
    b) Integrated bluetooth and Wi-fi to the GPS module for tracking and fall detection via ThingsBoard
    c) Implement vibration for warnings.

Results and Analysis







The smart walking cane successfully detects obstacles and provides real-time alerts through vibration and sound. Testing in controlled environments showed accurate obstacle detection within a range of 100 cm. The GPS tracking system, integrated with ThingsBoard, effectively transmits location data for remote monitoring.

Conclusion

The Smart Walking Cane project enhances the mobility and safety of visually impaired individuals through ESP32-based IoT and sensor technology. By using ultrasonic sensors for obstacle detection and haptic feedback for guidance, the cane improves navigation in unfamiliar environments. The system provides real-time alerts, ensuring user safety. Future improvements could include additional sensors for better precision and features like GPS for outdoor navigation, further empowering users and enhancing their independence.

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