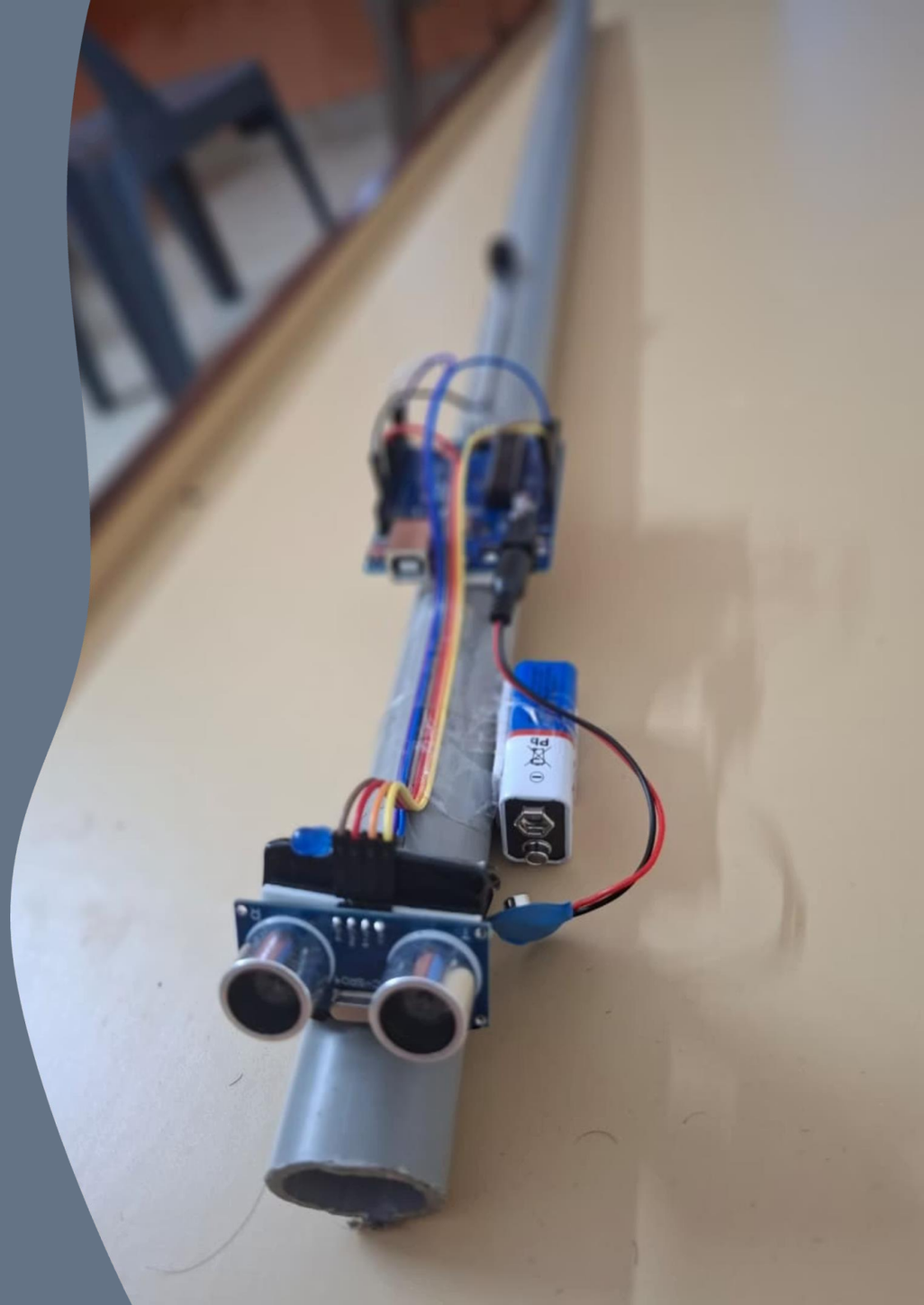
Arduino Smart Cane

Obstacle Detection for the Visually Impaired



Problem Statement: Navigating Navigating the World Blindfolded

285 Million People

Worldwide face visual impairment, encountering daily obstacles that threaten their safety and independence

Touch-Based Detection

Traditional white canes only detect obstacles upon contact, creating risk of injury and limiting confidence

Accessibility Gap

Urgent need for affordable, intuitive technology that enhances mobility without complex training

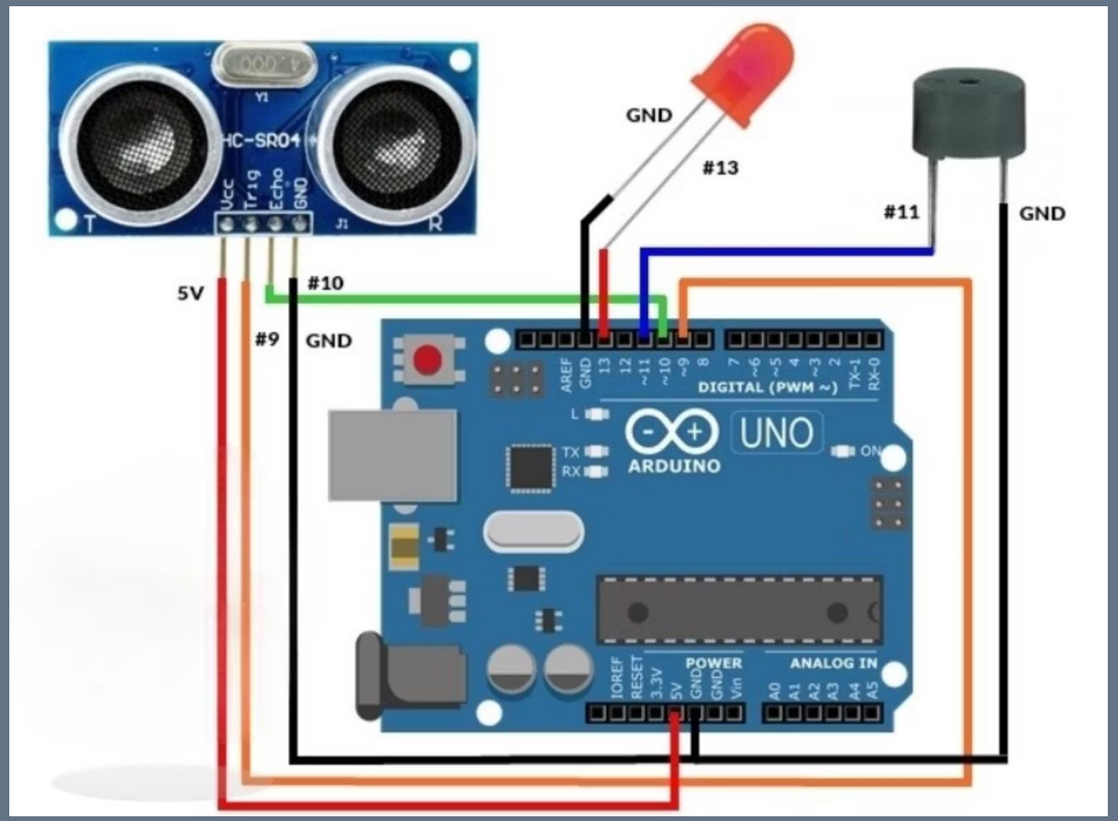
Proposed Solution: The Arduino Smart Cane

Intelligent Obstacle Detection

Our Arduino Smart Cane revolutionizes mobility assistance by integrating ultrasonic sensors that detect obstacles **before** physical contact occurs.

The system provides instant, multi-sensory feedback through buzzer sounds and vibration motors, alerting users to potential hazards in their path.

Built on the versatile Arduino microcontroller platform, the design remains compact, affordable, and fully customizable to individual needs.



CODE (c/c++)

```c
// === Pin Definitions ===
const int trigPin = 9;
const int echoPin = 10;
const int ledPin = 3;
const int buzzerPin = 4;

// === Variables ===
long duration;
int distance;

void setup() {
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(ledPin, OUTPUT);
  pinMode(buzzerPin, OUTPUT);
  Serial.begin(9600); // For monitoring distance
}

void loop() {
  // --- Trigger ultrasonic pulse ---
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // --- Measure the echo duration ---
  duration = pulseIn(echoPin, HIGH);
  distance = duration * 0.034 / 2;  // Convert to cm

  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.println(" cm");

  // --- If object is close enough ---
  if (distance <= 50 && distance > 0) {
    // Faster blinking & higher tone as object gets closer
    int delayTime = map(distance, 2, 25, 50, 500);   // speed of beep/blink
    int pitch = map(distance, 2, 25, 2000, 500);     // tone frequency

    digitalWrite(ledPin, HIGH);
    tone(buzzerPin, pitch);  // Play buzzer at mapped pitch
    delay(delayTime);
    digitalWrite(ledPin, LOW);
    noTone(buzzerPin);       // Stop buzzer
    delay(delayTime);
  }
  else {
    digitalWrite(ledPin, LOW);
    noTone(buzzerPin);
  }
}
```

Key Features

Extended Detection Range

Ultrasonic sensor detects obstacles up to 13 feet ahead, providing ample warning time for navigation adjustments

Proximity-Based Alerts

Feedback intensity escalates as obstacles approach—faster beeps and stronger vibrations indicate closer hazards

Visual Indicators

Optional LED alerts provide additional cues for users with partial vision or for caregiver monitoring

Durable Construction

Lightweight PVC cane body houses embedded electronics, ensuring durability while maintaining ease of use

Target Audience

Visually Impaired Individuals

Primary users seeking safer, more confident navigation in daily environments—from busy sidewalks to indoor spaces

Caregivers & Rehabilitation Rehabilitation Centers

Healthcare professionals and facilities searching for practical assistive technology solutions that enhance patient independence

Educational Institutions

Schools and universities promoting STEM education through meaningful projects with real-world social impact

Technology Stack

Arduino Controller

Uno or Nano microcontroller processes sensor data and coordinates feedback systems

HC-SR04 Sensor

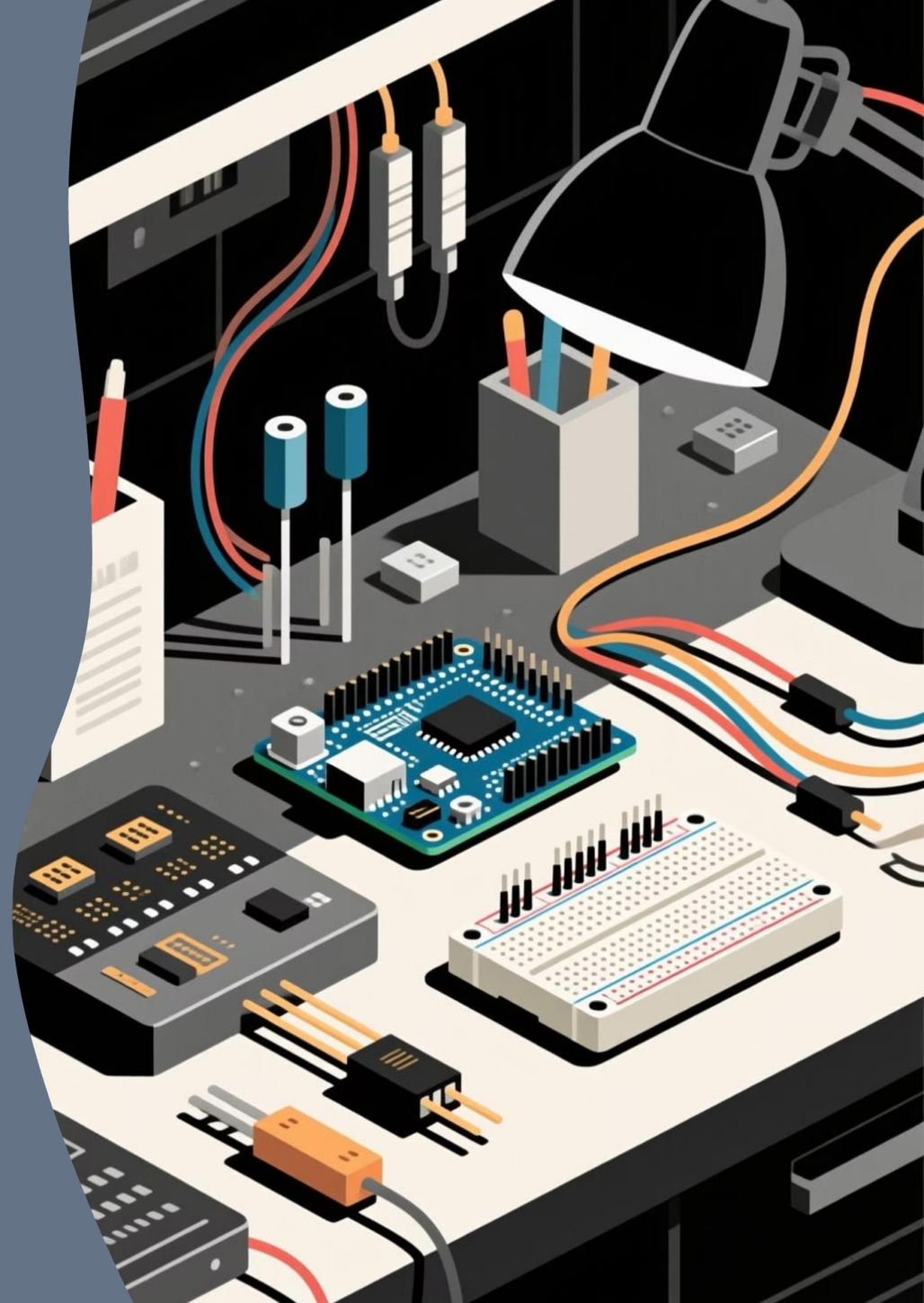
Ultrasonic distance sensor provides accurate obstacle detection in real-time

Feedback

led and piezo buzzer deliver multi-sensory alerts to the user

Power System

9V battery with voltage regulation ensures reliable, portable operation



Implementation Plan

Hardware Assembly

Gather and organize all components: sensor, Arduino board, buzzer, vibration motor, and power supply

Circuit Integration

Wire components following detailed schematics; upload obstacle detection code to Arduino microcontroller

Testing & Calibration

Verify sensor accuracy and feedback responsiveness in controlled indoor and outdoor environments

Physical Integration

Embed electronics into cane body with ergonomic design considerations for comfortable daily use

User Trials

Conduct real-world testing with target users; iterate design based on comprehensive feedback

Impact & Benefits

Enhanced Safety

Alerts users *before* obstacles are reached, dramatically reducing accidents and injuries during navigation

Greater Independence

Empowers visually impaired users with confidence to navigate unfamiliar environments autonomously

Affordable Solution

Total cost of $10-$15 makes this technology accessible to low-income communities globally

Innovation Catalyst

Encourages DIY culture and raises awareness about assistive technologies in STEM education

Future Scope

Multi-Directional Sensors

Detect overhead branches and ground-level hazards for comprehensive environment awareness

Bluetooth Integration

Connect to smartphones for GPS navigation, route planning, and location sharing with caregivers

Mobile Application

Develop companion app for personalized settings, usage analytics, and remote monitoring capabilities

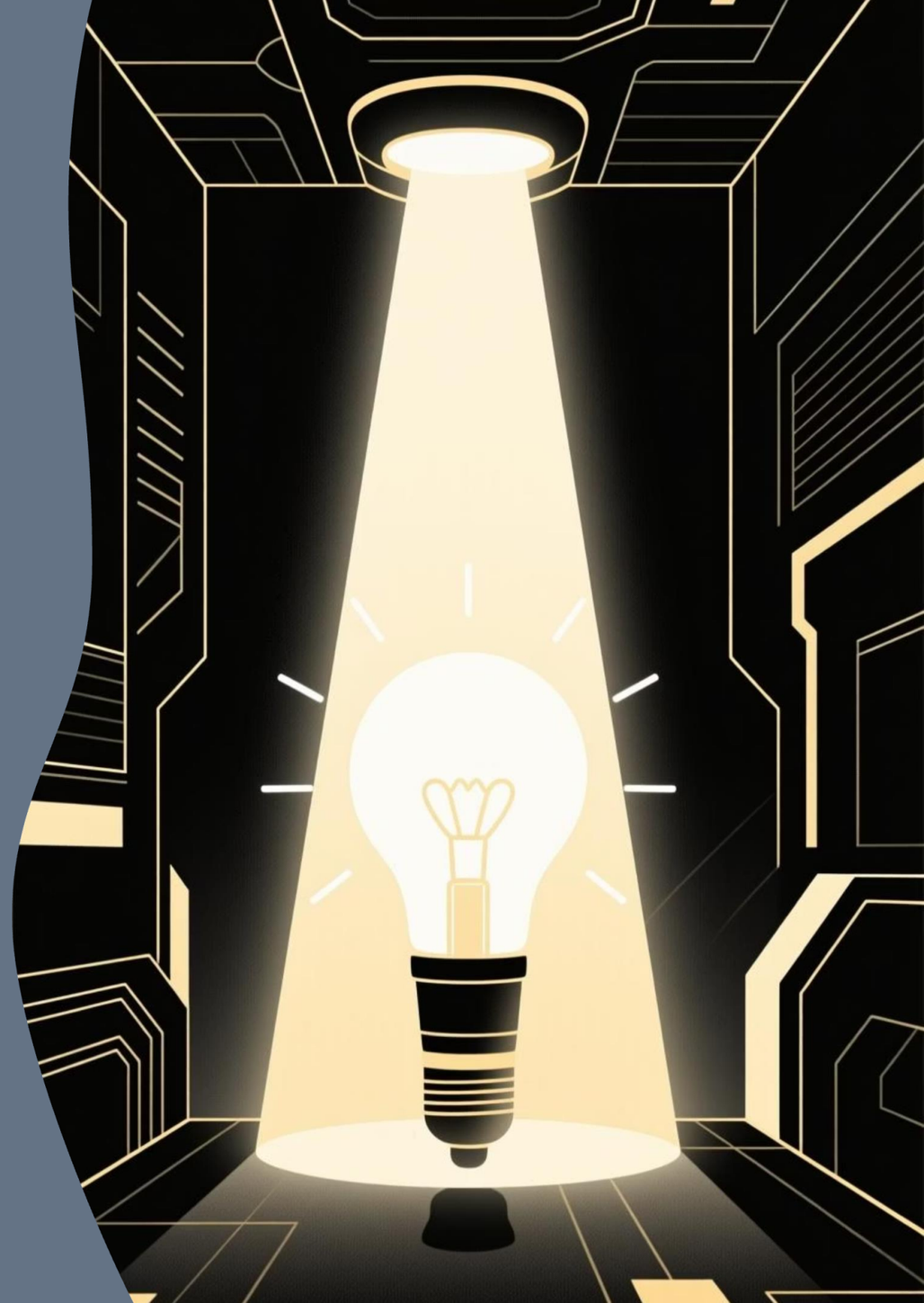
AI Recognition

Implement machine learning for intelligent object identification and context-aware obstacle classification

Empowering Independence Through Innovation

The Arduino Smart Cane transforms a traditional mobility tool into an intelligent assistive device, combining **affordability**, **simplicity**, and **effectiveness** to improve lives.

Join us in advancing accessible technology for a safer, more inclusive world where independence is within everyone's reach.



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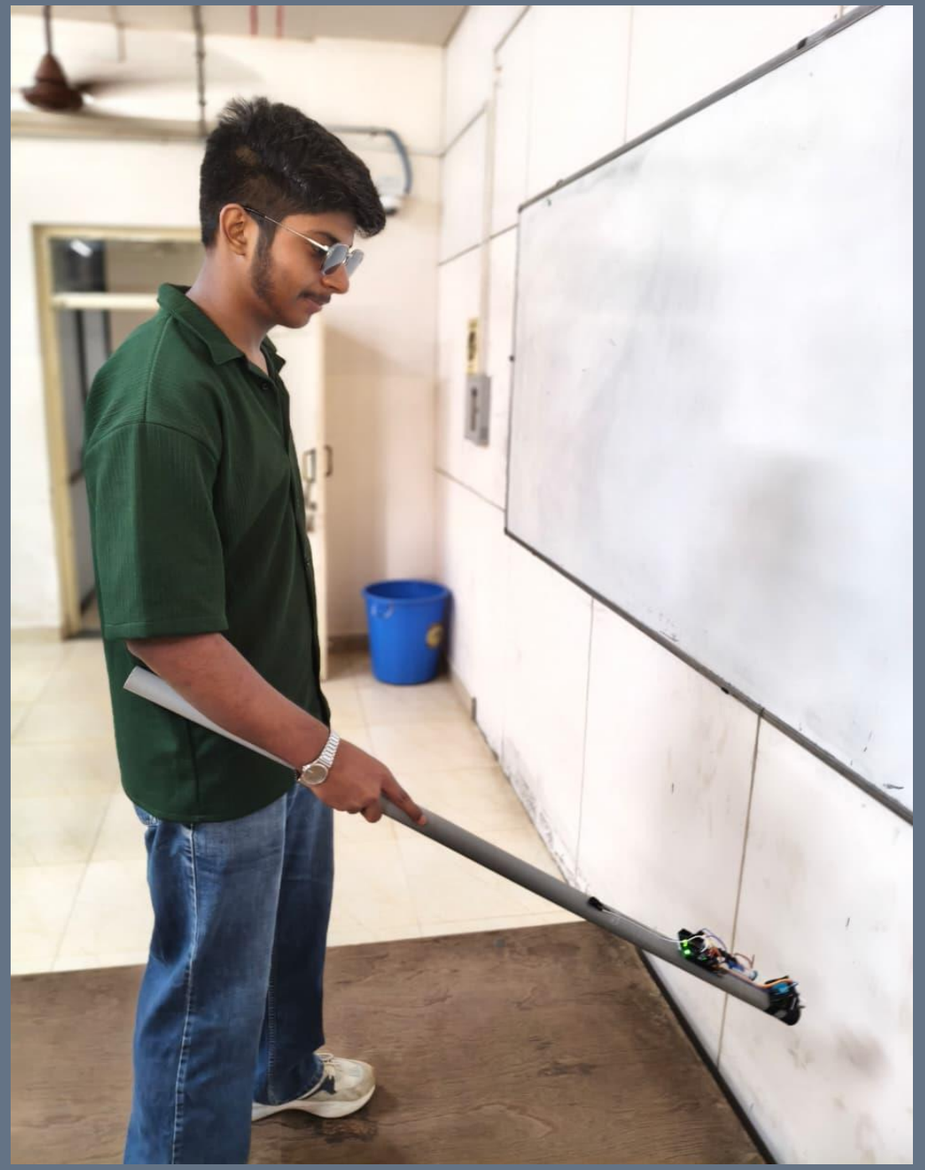

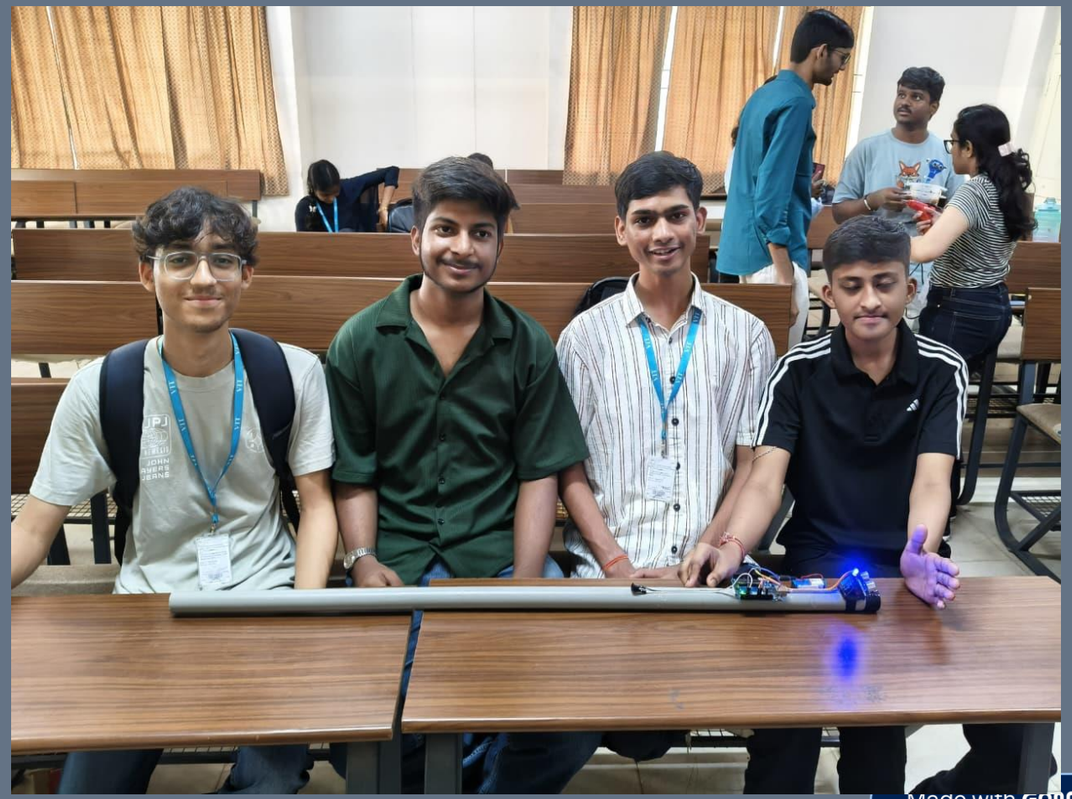


Thank You!