

Smart Cane Project Report

Introduction

This project presents a Smart Cane designed to aid visually impaired individuals in navigating their environment more safely and independently. The cane uses ultrasonic sensors to detect obstacles and provides feedback via vibration and/or audio alerts. Additional features may include GPS tracking and water detection, making it a comprehensive mobility aid.

Objectives

- Assist visually impaired users in obstacle detection.
- Provide real-time feedback through vibrations or voice.
- Ensure ease of use, portability, and affordability.
- Optional: Include GPS tracking and water detection.

Components Used

1. Arduino Uno - 1
2. Ultrasonic Sensor (HC-SR04) - 2 or 3
3. Buzzer/Vibration Motor - 1
4. Battery (9V or Li-ion) - 1
5. Switch - 1
6. Jumper Wires - as needed
7. GPS Module (Optional) - 1
8. Water Sensor (Optional) - 1

Working Principle

Ultrasonic sensors emit sound waves and detect reflected signals from obstacles. The Arduino calculates the distance to the obstacle using time of flight. If the distance is less than a threshold

(e.g., 50 cm), it triggers a vibration or sound alert. Additional modules like GPS send the location to a mobile device, and water sensors detect puddles or slippery surfaces.

Block Diagram

[Ultrasonic Sensor]

|

[Arduino Uno] - [Buzzer/Vibration Motor]

|

[Power Supply]

(Additional: GPS and Water Sensor in parallel)

Arduino Code (Snippet)

```
const int trigPin = 9;
```

```
const int echoPin = 10;
```

```
const int vibMotor = 3;
```

```
void setup()
```

```
{  pinMode(trigPin, OUTPUT);
```

```
  pinMode(echoPin, INPUT);
```

```
  pinMode(vibMotor, OUTPUT);
```

```
  Serial.begin(9600);
```

```
}
```

```
void loop()
```

```
{  digitalWrite(trigPin, LOW);
```

```
  delayMicroseconds(2);
```

```
  digitalWrite(trigPin, HIGH);
```

```
  delayMicroseconds(10);
```

```
digitalWrite(trigPin, LOW);

long duration =

pulseIn(echoPin, HIGH); int

distance = duration * 0.034 / 2;

if (distance < 50)

{   digitalWrite(vibMotor, HIGH);

    } else

{   digitalWrite(vibMotor,

LOW);

    }

    delay(100);

}
```

Advantages

- Increases safety for visually impaired.
- Low cost and easy to build.
- Can be upgraded with more sensors or features.

Limitations

- Detection range limited by sensor type.
- May not work well in rain or noisy environments.
- GPS modules can consume more power.

Future Enhancements

- Voice navigation using Bluetooth and a mobile app.
- AI-based object recognition.
- Solar charging for portability.

- Integration with IoT for remote monitoring.

Conclusion

The Smart Cane offers a practical and affordable assistive device for the visually impaired. With real-time obstacle detection and alert systems, it significantly enhances mobility and independence.