Smart system for visual impaired people

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***Abstract*—This report is about a smart system for visual impaired people using a white cane with some sensor to detect obstacles.**

I. Introduction

This project is about a system that uses an ultrasonic sensor, an Arduino nano, a buzzer and two vibration motors on a white cane to help a blind person detect objects with more anticipation, this includes other people without accidentally hitting them with the cane. To make this project I first had to select which cane to use. There are several types and colors of canes, the three most popular are white, red-white, and green canes. The white cane is for totally blind people, red and white is for blind and deaf people, and the green cane is for the low vision person. I selected the white cane because I want to make the cane vibrate and to make a noise to alert the person who uses it.

Fig. 1. White Cane.

Fig. 2. Red and White Cane

Fig. 3. Green Cane

II. DEVELOPMENT

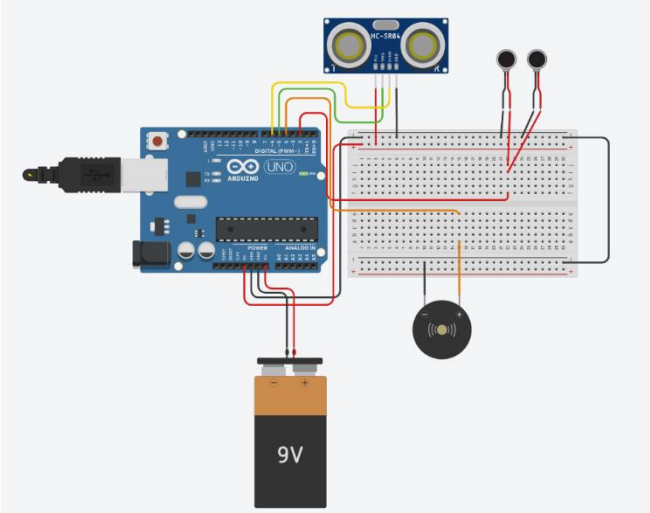

Fig. 4. Circuit

In this circuit the ultrasonic sensor is connected to the 5V port and ground from the Arduino, the trigger pin is connected to port 5 and the Echo to the port 6 of the Arduino. The buzzer is connected to port 4 while the vibration motors are connected in parallel to the port 2. This circuit is powered by a 9V battery connected to the Arduino.

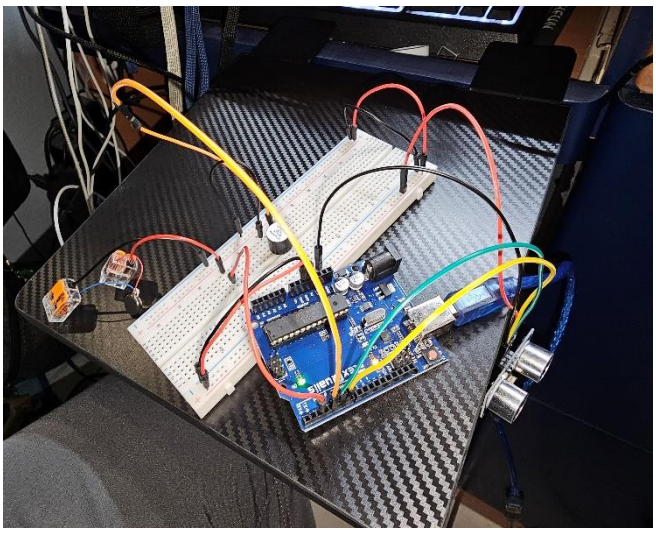

Fig. 5. Testing the circuit on a breadboard

The circuit works while the ultrasonic sensor detects an object closer than 45cm, it makes the buzzer and the vibration motors works for 150 milliseconds, then turn off for the same amount of time, and repeats.

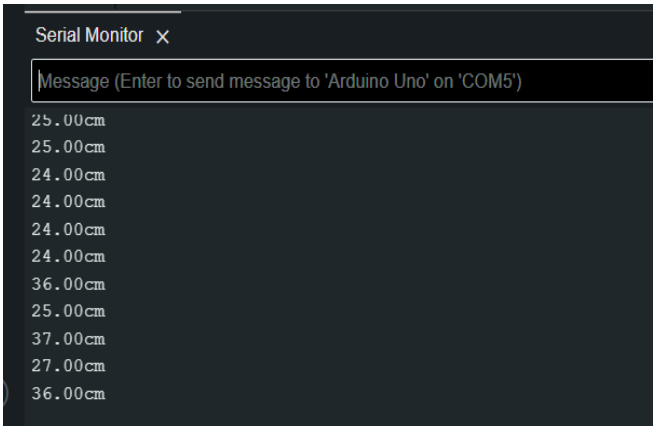

Fig. 6. When the ultrasonic sensor reads less than 45cm.

When the distance is reduced to 20cm, the sound and vibration works continuously. When the distance is greater than 45cm, both are turned off.

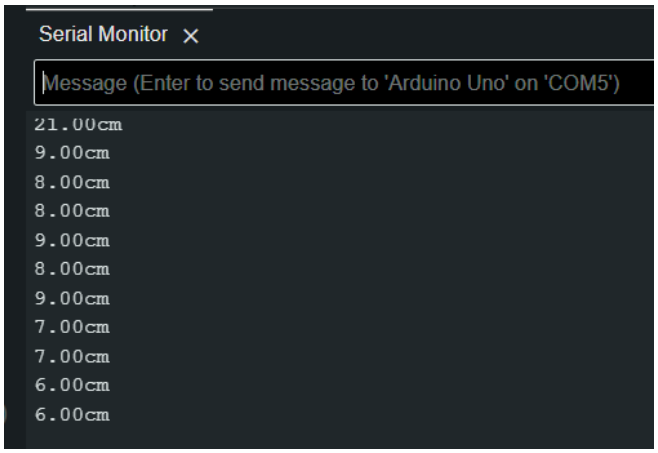

Fig. 7. When the ultrasonic sensor read less than 20cm

Some of the issues working with this project were:

a. Getting the correct angle and adjusting the sensitivity for the ultrasonic sensor on the cane because it was giving false positives and delaying the real ones.
b. Adjusting and adding vibration motor, so they would be felt when they worked.

After setting the ultrasonic sensor at about 20° on the cane and the vibration motor at the correct place on the handle, the project finally works successfully.

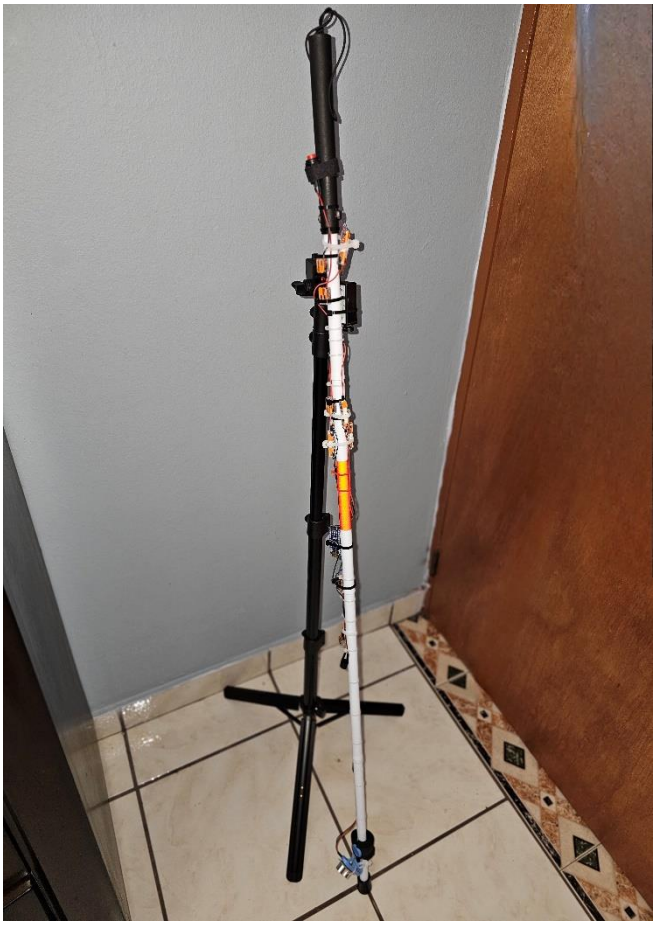

Fig. 8. Final result

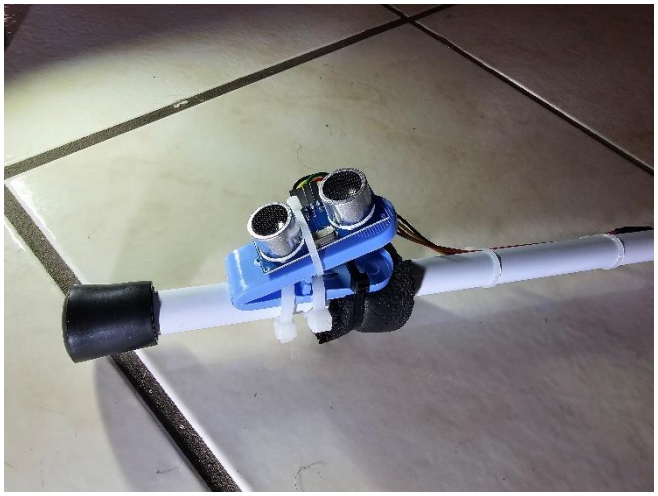

Fig. 9. Ultrasonic sensor at approximate 20°.

Fig. 10. Buzzer

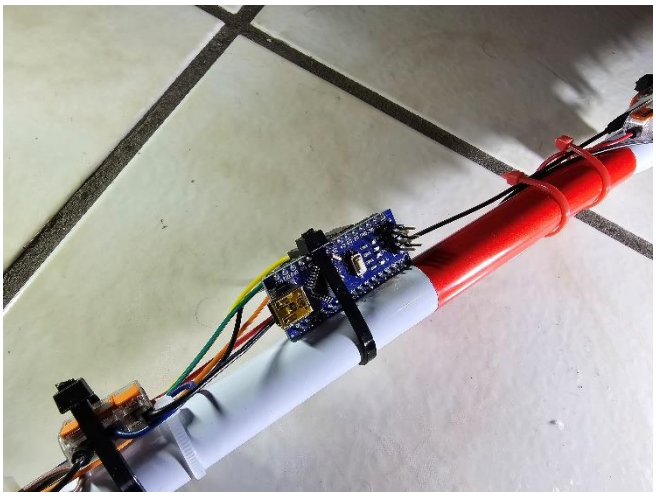

Fig. 11. Arduino Nano

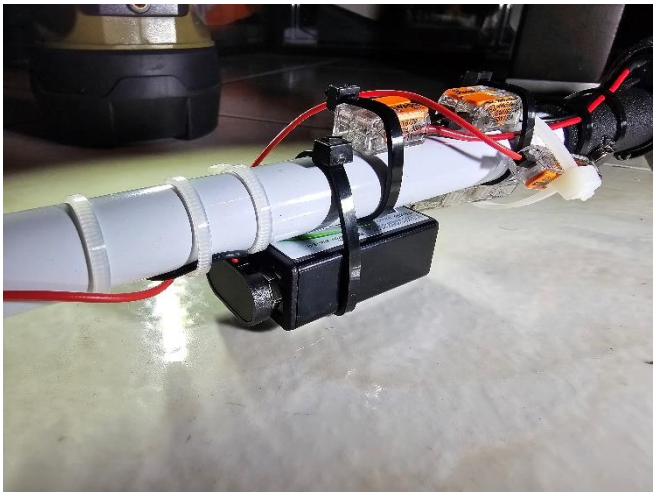

Fig. 12. 9V battery

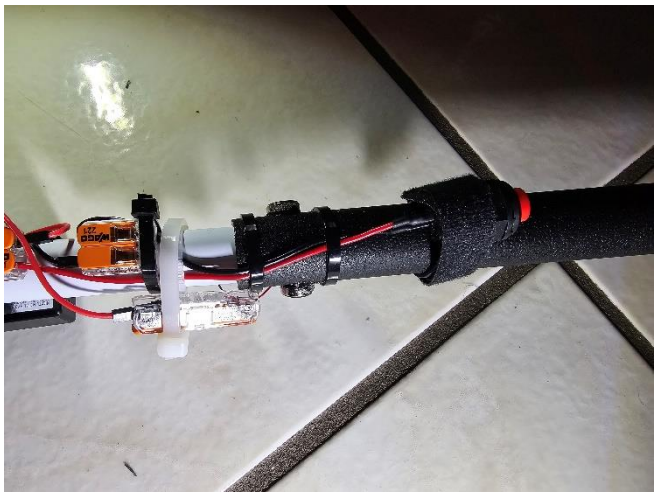

Fig. 13. Handle with switch and both vibration motors.

Conclusion

In this project was applied several things we learned in class like the use of a microcontroller. It was fun working with the ultrasonic sensor which we only had use in simulation in Tinkercad. It was interesting making it sound a buzzer and vibrates the motors according to some specific distance. Also it was a big challenge getting set the complete circuit on the cane, without using a breadboard

References

[1] "What Are The Different Types of White Canes?", 2020. https://www.cabvi.org/articles/what-are-the-different-types-of-white-canes/#:~:text=An%20all%2Dwhite%20cane%20means,totally%20blind%20and%2For%20deaf.

[2] "Red and whites canes", 2023. https://deafblind.org.uk/get_support/red-and-white-canes/#:~:text=If%20you%20see%20a%20person,both%20sight%20and%20hearing%20impairments).

[3] "Decoding the colors of blindness canes". https://veroniiiica.com/decoding-the-colors-of-blindness-canes/

[4] "Getting started with the HC-SR04 Ultrasonic sensor", 2017. https://projecthub.arduino.cc/Isaac100/getting-started-with-the-hc-sr04-ultrasonic-sensor-7cabe1.

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[6] "Nano". https://docs.arduino.cc/hardware/nano/.

[7] "Arduino Nano". https://store-usa.arduino.cc/products/arduino-nano.

[8] "How to drive a Vibration Motor with Arduino", 2021. https://www.precisionmicrodrives.com/how-to-drive-a-vibration-motor-with-arduino-and-genuino.

Code used for this project:

```
const int TrigPin = 5;
const int EchoPin = 6;
const int VibratorMotor = 2;
const int Buzzer = 4;
float cm;

void setup()
{
  Serial.begin(9600);
  pinMode(TrigPin, OUTPUT);
  pinMode(EchoPin, INPUT);
  pinMode(VibratorMotor, OUTPUT);
  pinMode(Buzzer, OUTPUT);
}

void loop()
{
  digitalWrite(TrigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(TrigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(TrigPin, LOW);

  cm = pulseIn(EchoPin, HIGH) * 0.017;
            // Echo time conversion into cm
  cm = (int(cm * 100)) / 100;           // Keep
two decimal places
  Serial.print(cm);
  Serial.println("cm");

  if (cm <= 20 && cm > 0)
  {
    digitalWrite(VibratorMotor, HIGH);
    digitalWrite(Buzzer, HIGH);
    delay(500);
  }

  else if (cm <= 45 && cm >0)
  {
    digitalWrite(VibratorMotor, HIGH);
    digitalWrite(Buzzer, HIGH);
    delay(150);

    digitalWrite(VibratorMotor, LOW);
    digitalWrite(Buzzer, LOW);
    delay(150);
  }

  else if (cm > 45)
  {
    digitalWrite(VibratorMotor, LOW);
    digitalWrite(Buzzer, LOW);
  }
}
```

Tinkercad link:
https://www.tinkercad.com/things/kurLizvJ26R-sizzling-leelo-stantia/editel

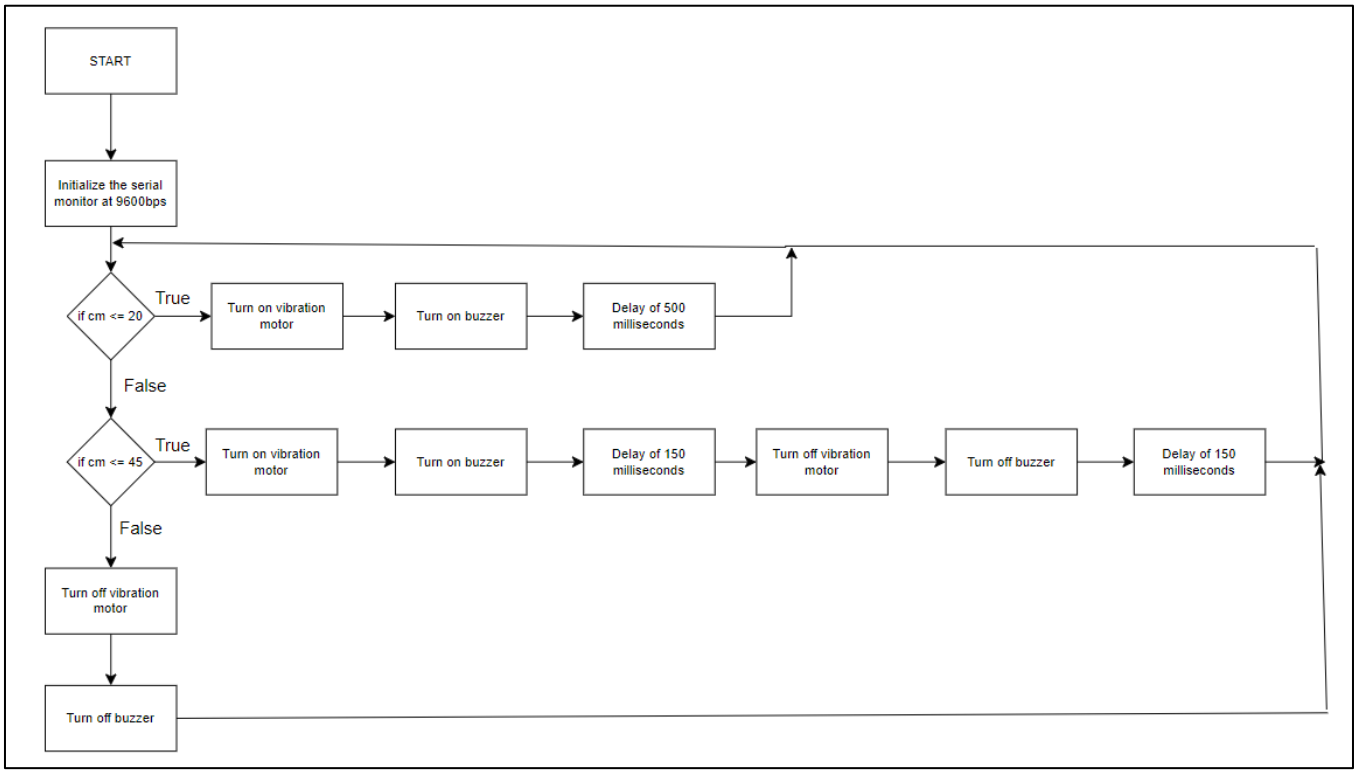

Fig. 14. Flowchart.