DIY Project (DY17003)

GROUP 4: SMART BLIND STICK

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ABSTRACT AND MOTIVATION

- Visually impaired individuals face many difficulties and one of the common difficulties is when they involve in self-navigating at an environment which is strange for them. In fact, physical movement is one of the biggest challenges for them. Besides that, while they travel around or walking at a crowded corridor, it may pose great difficulty.

- The **main objective** of this project is to provide an application for visually impaired people to **detect the obstacles in various directions**, including pits and manholes on the ground to create a safer surrounding for the user. Our stick also includes a **Bluetooth component**, which will help find the stick, when lost by simply clicking a button on your smart phone.

CONCEPT OF PROOF

- **How does an ultrasonic sensor work?**
  The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone).The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object. It uses the following mathematical equation:

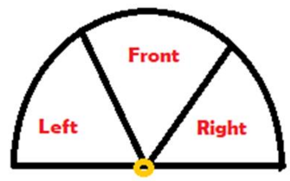
  $$\boxed{\text{Distance} = (\text{Time} \times \text{Speed of Sound})/2}$$

- **How does the Bluetooth system work?**
  Bluetooth devices communicate using low-power radio waves on a frequency band between 2.400 GHz and 2.483.5 GHz. This is one of a handful of bands that is set aside by international agreement for the use of industrial, scientific and medical devices (ISM). Many devices that you may already use take advantage of this same radio-frequency band, including baby monitors, garage-door openers and the newest generation of cordless phones.

METHODOLOGY ADOPTED

- **Use of Ultrasonic Sensors in our project.**
  The ultrasonic sensors, are used for obstacle detection in the path of the blind person and a buzzer/speaker is used to make the person alert. Visually impaired people can use this walking stick for safe navigation. It can detect obstacle within 5 to 35 cm range of distance.

Angle of sensor with the stick = 30˚
Distance of lower sensor from the ground = 15 cm
Distance of upper sensor from the ground = 55 cm



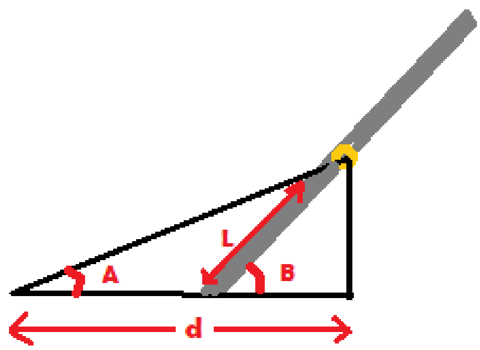
Ultrasonic Sensor(top)

For the lower Ultrasonic Sensor:

L sin B = d tan A
Suppose we want to detect at a distance of 30 cm, while B=60 degrees and A=30 degrees
We can place our sensor at L = 20 cm

To detect hump or pit:

If the distance detected by the sensor is
Greater than (d/cos A) => Ditch
Lower than (d/cos A) => Hump



- **Use of Bluetooth System in our project.**
  The Bluetooth system will help the Visually Impaired person or their relatives/caretaker to locate the stick, when it is lost with relative ease.

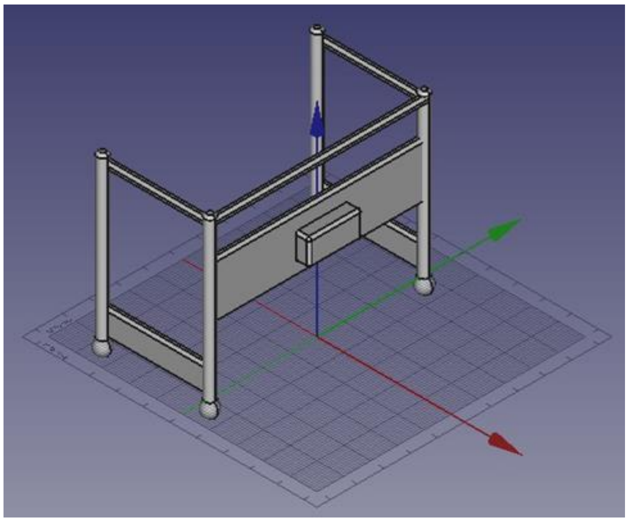
IMPORTANT OBSERVATIONS

- In the project, we observed an error in the ultrasonic sensor (~4 cm).
- Apart from this, we also realized that there is a huge amount of time and dedication required for one to make such projects. Also it is important to research on the basic working of all the components which are going to be used in the project.

CONCLUSIONS AND FUTURE SCOPE

- **In the future,**
  1. Rechargeable batteries can be used. These batteries can be charged using power banks/mobile phones and hence will make usage of the stick more efficient.
  2. Cost of the stick can be further reduced by using cheaper processors like esp8266. Also when produced in bulk, the cost will be lesser as the materials bought in bulk will cost less.
  3. Additional features can be added. Some of them are –
     - **a)** Sending a SOS signal.
     - **b)** Stick can also be designed such that its height can be adjusted according to the convenience of the user.
     - **c)** Flashlight can be implanted. This might help the crowd see the visually impaired person and will prevent chances of colliding.
     - **d)** Gripper tool facility can be added. It will help the person (especially old) to pick up objects on the ground without bending down.
     - **e)** Inbuilt power bank can be introduced.

4. This stick can also be converted into a walker for toddlers by making some changes in the design.



- **Conclusion**: Smart Blind Stick is a device of utmost importance. A smart blind stick can be customized in many ways to satisfy a person's needs. All of us (Amisha, Susanna, Suchi and Gunjana) enjoyed working on this project and certainly learnt a lot. We would like to thank all the professors of the DIY course for giving us this opportunity.

CREDITS AND RESPONSIBILITY OF GROUP MEMBERS

- Suchi Sharma – Made the TinkerCad circuit as well wrote and compiled the code for the physical model on Arduino IDE.
- Susanna Yeldo – Made the circuit as well as compiled the code for the Bluetooth system, made FreeCad models.
- Gunjana Dhakad – Made the physical model.
- Amisha Rathi – Prepared all the presentations, final report and compiled the final video.

Apart from this everyone contributed in resolving the doubts or errors which cropped up during the entire duration of the project. Also, everyone explained their respective parts in the final video.

REFERENCES

- https://www.researchgate.net/publication/329314266_Ultrasonic_Sensor_Based_Smart_Blind_Stick
- https://www.geeksforgeeks.org/all-about-hc-05-bluetooth-module-connection-with-android/
- https://www.dfrobot.com/blog-1302.html

LINK OF VIDEO : **https://youtu.be/84uY3X-m9G8**

APPENDIX-1

- **Code for the physical model**

```
// C++ code
//
#include <Servo.h>

int uppersensor = 0;

int lowersensor = 0;

int i = 0;

int j = 0;

long readUltrasonicDistance(int triggerPin, int
echoPin)
{
  pinMode(triggerPin, OUTPUT);  // Clear the trigger
  digitalWrite(triggerPin, LOW);
  delayMicroseconds(2);
  // Sets the trigger pin to HIGH state for 10
microseconds
  digitalWrite(triggerPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerPin, LOW);
  pinMode(echoPin, INPUT);
  // Reads the echo pin, and returns the sound wave
travel time in microseconds
  return pulseIn(echoPin, HIGH);
```

```
}

Servo servo_9;

void setup()
{
  Serial.begin(9600);

  servo_9.attach(9, 500, 2500);

  pinMode(8, OUTPUT);
}

void loop()
{
  i = 0;
  for (i = 0; i <= 180; i += 2) {
    uppersensor = 0.01723 *
readUltrasonicDistance(5, 6);
    lowersensor = 0.01723 *
readUltrasonicDistance(3, 4);
    Serial.println(i);
    servo_9.write(i);
    if (lowersensor < 15) {
      Serial.println("hump");
      tone(8, 523, 100); // play tone 60 (C5 = 523 Hz)
      delay(50); // Wait for 50 millisecond(s)
    }
    if (lowersensor > 16 && lowersensor < 30) {
```

```
      Serial.println("pit");
      tone(8, 165, 100); // play tone 40 (E3 = 165 Hz)
      delay(50); // Wait for 50 millisecond(s)
    }
    if (uppersensor <= 55) {
      Serial.println("obstacle");
      tone(8, 698, 50); // play tone 65 (F5 = 698 Hz)
      delay(100); // Wait for 100 millisecond(s)
      tone(8, 392, 100); // play tone 55 (G4 = 392 Hz)
      delay(50); // Wait for 50 millisecond(s)
    }
  }
  for (i = 180; i >= 0; i -= 2) {
    uppersensor = 0.01723 *
readUltrasonicDistance(5, 6);
    lowersensor = 0.01723 *
readUltrasonicDistance(3, 4);
    Serial.println(i);
    servo_9.write(i);
    if (lowersensor < 15) {
      Serial.println("hump");
      tone(8, 523, 100); // play tone 60 (C5 = 523 Hz)
      delay(50); // Wait for 50 millisecond(s)
    }
    if (lowersensor > 16 && lowersensor < 30) {
      Serial.println("pit");
      tone(8, 165, 100); // play tone 40 (E3 = 165 Hz)
      delay(50); // Wait for 50 millisecond(s)
    }
```

```
    if (uppersensor < 55) {
      Serial.println("obstacle");
      tone(8, 698, 50); // play tone 65 (F5 = 698 Hz)
      delay(100); // Wait for 100 millisecond(s)
      tone(8, 392, 100); // play tone 55 (G4 = 392 Hz)
      delay(50); // Wait for 50 millisecond(s)
    }
  }
}
```

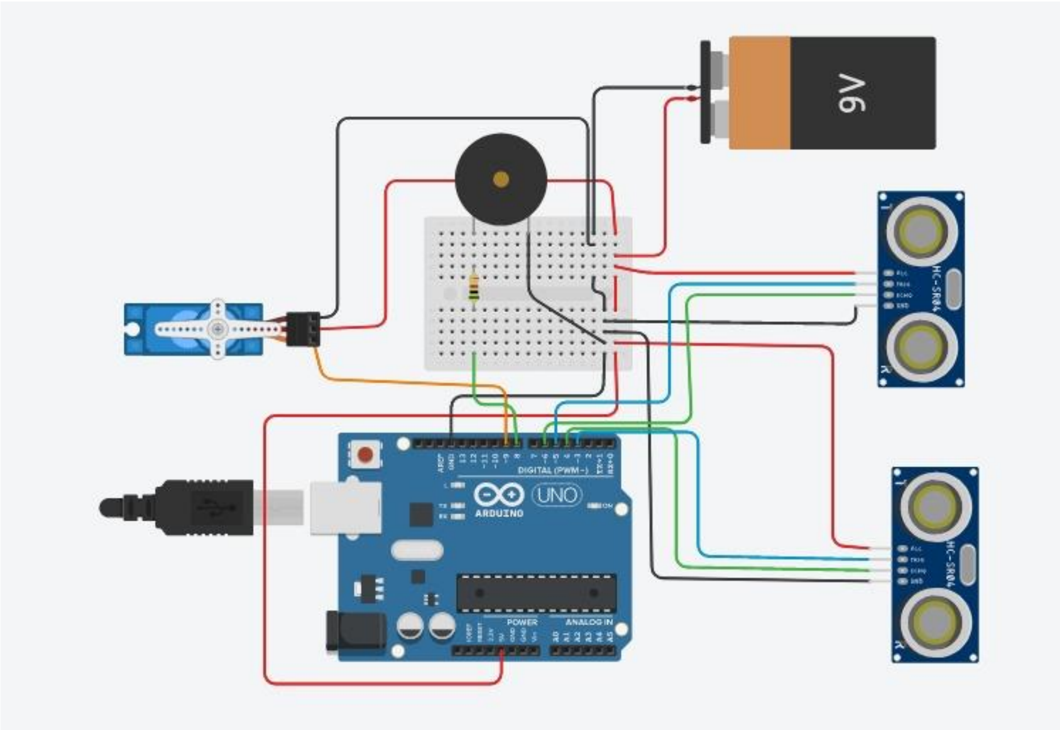
- **Code for the Bluetooth system –**

```
void setup()
{
Serial.begin(9600);
pinMode(12, OUTPUT);
 }
char data;
void loop()
{
 if(Serial.available()>0)
   {
      data= Serial.read();
      if (data=='1')
      {
        digitalWrite(12, HIGH);
        //I am using an active buzzer not a piezo
        Serial.println("ON");
```

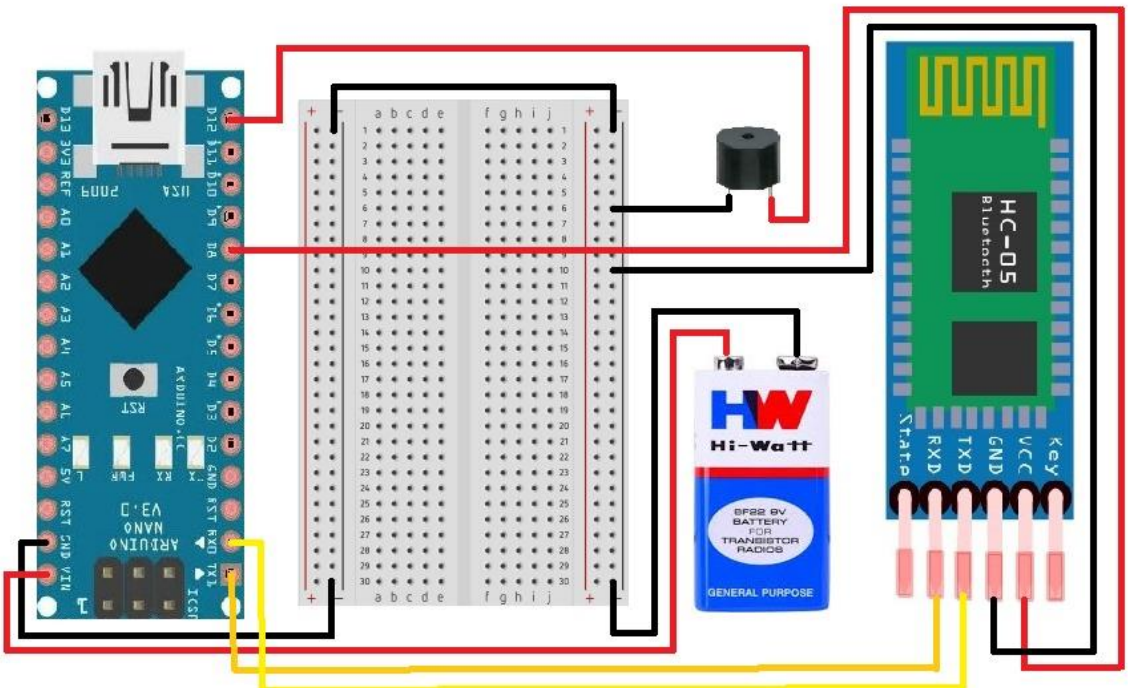
```
    }
    else
    {
      digitalWrite(12, LOW);
      Serial.println("OFF");
    }
  }
  delay(1000);
}
```

APPENDIX-2

- Circuit diagram of the physical model.



- Circuit diagram of the Bluetooth system



- Physical model

Front view

Side view

Close up

APPENDIX-3

- For the physical model

Part Name	Quantity	Cost
Arduino Board (Nano)	1	375
Ultrasonic Sensor	2	59*2 = 118
Battery	1	20
Wires	1 pack (40 pieces)	64
Motor	1	250
Breadboard	1	26
Buzzer	1	50
Resistor (450 ohms)	1	10
Switch	1	20
Jumper wires		160

- For the Bluetooth system

Part Name	Quantity	Cost
Arduino Nano (Board + Soldering)	1	440
Battery (+cap)	1	90
HC 05 Bluetooth module	1	210
Buzzer	1	30
Wires		60

COST = 1923 /-

APPROXIMATE COST (including taxes and shipping) = 2000 /-

QUESTIONS ASKED DURING CLASS PRESENTATION

- **What can be classified as an obstacle?**
  Any object or thing in close proximity (5 cm to 35 cm) which may hinder the walking person's path can be classified as an obstacle.
- **How can we locate obstacles at different distances?**
  There are three ways of doing the same –
  1. Multiple sensors can be used with each being allotted different distance ranges and output sounds on the speaker.
  2. Using the sensors with inbuilt differentiation of distances. Example – sensors in the parking lot
  3. Using only one sensor along with (amplifier + speaker) and allot different ranges, different sounds.