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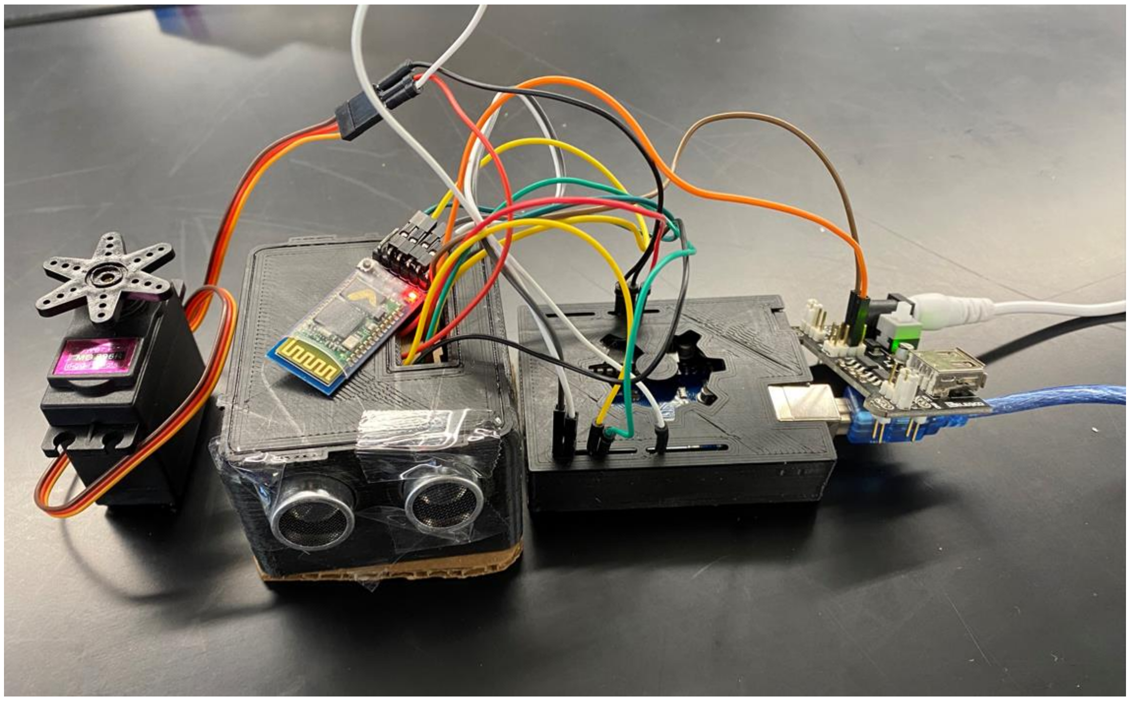
# HAPTIC WALKING DEVICE



## Purpose:

The goal for this project is to design a device that utilizes sensors to detect objects from a certain range and instruct an internal servo to vibrate in response to the distance from the sensor to the object. The closer the object is to the sensor, the stronger the servo will vibrate. Additionally, this project utilizes a mobile app to act as both a pedometer and an audio informant for the distance between the user and an oncoming object.

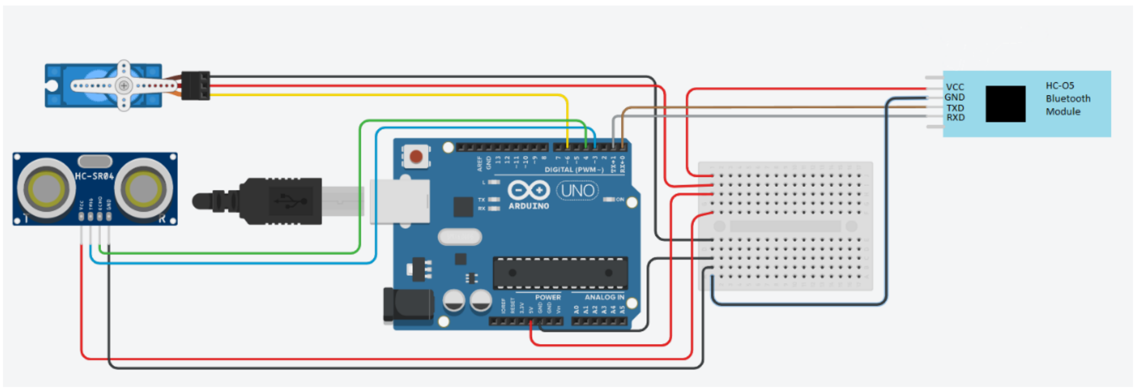
## Materials:

- Arduino UNO Microcontroller
- Wires (male to male & female to male)
- Ultrasonic Sensor – HC-SR04
- HC-05 Bluetooth module
- Power Supply Module
- Tower Pro MG996R Servo

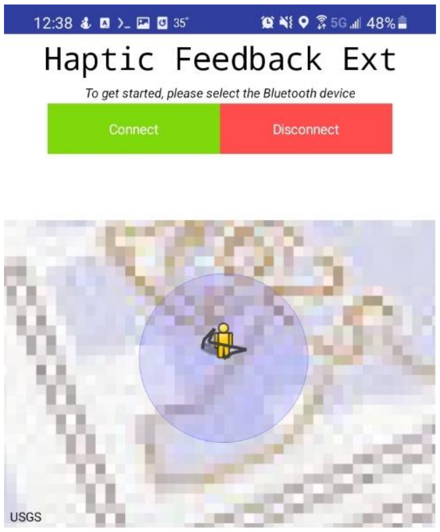
## Instructions:

1. Upload the c++ code to the Arduino microcontroller using the Arduino IDE software

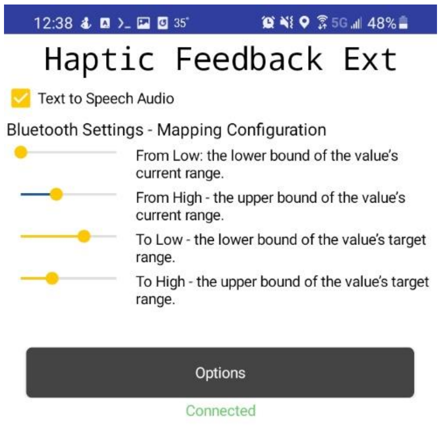
   a. Open Arduino IDE app > click file tab > open existing file > select This PC > click downloads > select downloaded code (CODE located below)
   b. https://zavaar.net/static/be1200/final_project/arduinoCode .
   c. Verify the code using the verify button on the IDE software
2. Download the .apk file on an android device to install mobile application https://zavaar.net/static/be1200/final_project/haptic_app.apk
3. Assemble components based on schematic



4. Power on the Arduino by connecting the Arduino to your computer via usb and open the mobile application
5. Click the "Upload" button on the IDE software
6. Press the "connect" button on the app.
7. Find the "HC-05" Bluetooth device in the device list for connection
   a. If you require a password to access the device, please use either "1234" or "0000"
8. If the connection was successful, you will see the green "Connected" text underneath the app container.
9. Turn the "trip" slider on to track distance traveled via the pedometer sensor and time elapsed for the trip. Turing that on also tracks location history and visualizes the path taken using the GPS on the mobile device.



*To get started, please select the Bluetooth device*



Text to Speech Audio

Bluetooth Settings - Mapping Configuration

From Low: the lower bound of the value's current range.

From High - the upper bound of the value's current range.

To Low - the lower bound of the value's target range.

To High - the upper bound of the value's target range.

10. When done, press the disconnect button to terminate the Bluetooth connection.

## Libraries used:

- Servo@^1.1.8
- Arduino

## Arduino C++ code

https://zavaar.net/static/be1200/final_project/arduinoCode
:

```
#include <Arduino.h>

#include <Servo.h>

Servo servo;


int usTrig = 3;

int usEcho = 4;

int duration = 0;

unsigned int distanceCM = 0;


unsigned int scaledServoValue = 0;

// constants

const char sep = '$';

const char def = '=';

// vars

char incoming = 0;

unsigned long time = millis();

String command = "";


struct Settings

{

  void setValue(char label, int val) { value[label - 'A'] = val; }

  int getValue(char label) const { return value[label - 'A']; }

  int value[5];
```

```
};

class IO
{
private:
  String pre;
  String post;
  Settings S;

public:
  void execute(String command)
  {
    this->pre = pre;
    this->post = post;
    this->S = S;
    for (unsigned int i = 0; i < command.length(); i++)
    {
      char ch = command[i];
      if (ch != def)
      {
        if (command.indexOf(def, i) > 0)
        {
          pre += ch;
        }
        else
        {
          post += ch;
        }
      }
    }
    if (post.toInt() < 1000) // filter out weird obfuscated data
    {
      S.setValue(pre[0], post.toInt());
    }
    reset();
  }
  void reset()
  {
    this->pre = pre;
    this->post = post;
    pre = "";
    post = "";
  }
  int get(char key)
  {
    this->S = S;
    return S.getValue(key);
  }
  void set(char key, int val)
  {
    S.setValue(key, val);
  }
};

IO io;

void setup()
{
  io.set('a', 3);
  io.set('b', 400);
  io.set('c', 150);
  io.set('d', 20);
  Serial.begin(9600);
  servo.attach(9);
  pinMode(usTrig, OUTPUT);
  pinMode(usEcho, INPUT);
}
```

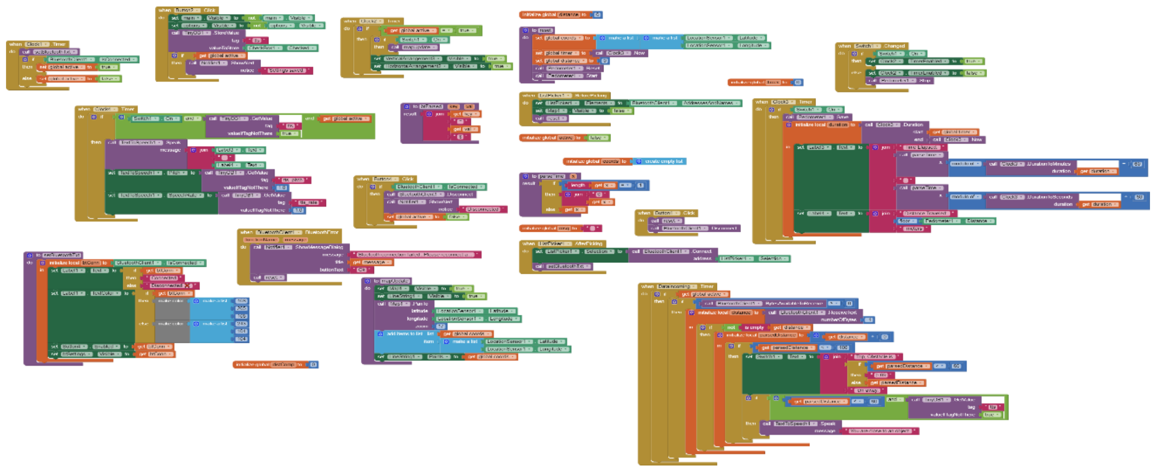
```
int dis = 0;


void loop() {
  digitalWrite(usTrig, LOW);
  delayMicroseconds(5);
  digitalWrite(usTrig, HIGH);
  delayMicroseconds(10);
  digitalWrite(usTrig, LOW);
  duration = pulseIn(usEcho, HIGH);
  distanceCM = (duration / 2) / 10;
  scaledServoValue = map(distanceCM, io.get('a'), io.get('b'), io.get('c') ,
io.get('d'));
  //Serial.println(scaledServoValue);
  servo.write(scaledServoValue);
  if (millis() - time > 750)
  {
    //int showDist = distanceCM/2.9;
    Serial.println((int)(distanceCM));
    time = millis();
  }
  if (Serial.available() > 0)
  {
    incoming = Serial.read();
    switch (incoming)
    {
    case sep: // command completed
      io.execute(command);
      command = ""; // reset command
      break;


    default:
      command += incoming;
```

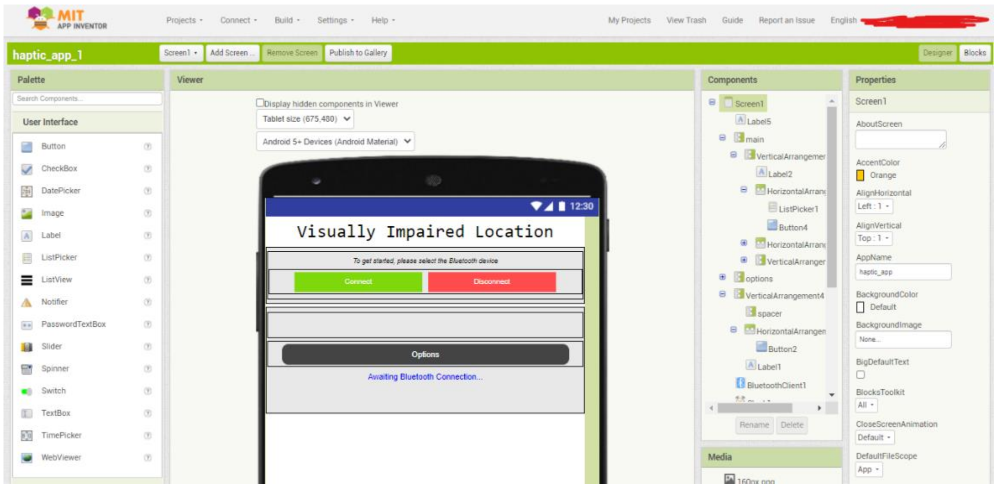
```
          break;
        }
      }
    }
```

Mobile application code & code blocks:
https://zavaar.net/static/be1200/final_project/blocks.png



Entire app project:
https://gallery.appinventor.mit.edu/?galleryid=fa4c4c43-bd20-4489-9493-90e3b034cd9e

Android Package File (.APK):
https://zavaar.net/static/be1200/final_project/haptic_app.apk


MIT APP INVENTOR
Projects
Connect
Build
Settings
Help
My Projects
View Trash
Guide
Report an Issue
English
[redacted]
haptic_app_1
Screen1
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Palette
Search Components...
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Viewer
Display hidden components in Viewer
Tablet size (675,480)
Android 5+ Devices (Android Material)
12:30
Visually Impaired Location
To get started, please select the Bluetooth device
Connect
Disconnect
Options
Awaiting Bluetooth Connection...
Components
Screen1
Label5
main
VerticalArrangemen
Label2
HorizontalArran
ListPicker1
Button4
HorizontalArran
VerticalArranger
options
VerticalArrangement4
spacer
HorizontalArrangen
Button2
Label1
BluetoothClient1
Rename
Delete
Media
160px.png
Properties
Screen1
AboutScreen
AccentColor
Orange
AlignHorizontal
Left : 1
AlignVertical
Top : 1
AppName
haptic_app
BackgroundColor
Default
BackgroundImage
None...
BigDefaultText
BlocksToolkit
All
CloseScreenAnimation
Default
DefaultFileScope
App