DESIGN BRIEF

Company Information

We are a company that creates smart fitness gear to help customers reach their fitness goals. As a company, we make use of small additions to one's personal life to aid their journey in reaching peak performance and mobility - if it's at the gym, at home or at the office. Our vision is to make people feel more confident within their bodies and to ensure they are safe/healthy when working out. We value new technology, ease of use/integration and performance. Fitness can be a daunting thing to get into, so as a company, we want to make sure the customer feels sure of themselves and comfortable in this new journey.

Product Overview

We are looking to design small and functional external tags (like the AirTag), that are placed at important parts of the human body - feet, lower back, upper back, chest, abdomen, and neck. The tags will be used as a way to monitor the posture of the user when engaging in different exercises and movements, to ensure they are doing it correctly and preventing harm to themselves. The tags should be small, convenient, durable, hygienic and non-obstructive. They should be easily integrated into one's lifestyle and workout ritual. The tags should have a way to be attached/removed easily and include a convenient storage solution. The tags should include haptic feedback to communicate with a user in a non-distracting way. The tags will sync up to a mobile application for the user to assess their form and posture and eventually monitor improvements. The UI/UX should be simple, intuitive and easy to use. Think of something minimalistic and modern.

DESIGN BRIEF

Problem To Solve:

The goal of the project is to use the tags to track body movement and posture. Posture and movement are important when engaging in any form of fitness activity, as improper form can lead to bodily harm and injury. The outcome will help inform the user when they are doing something improperly and make fitness more accessible to newcomers.

Users

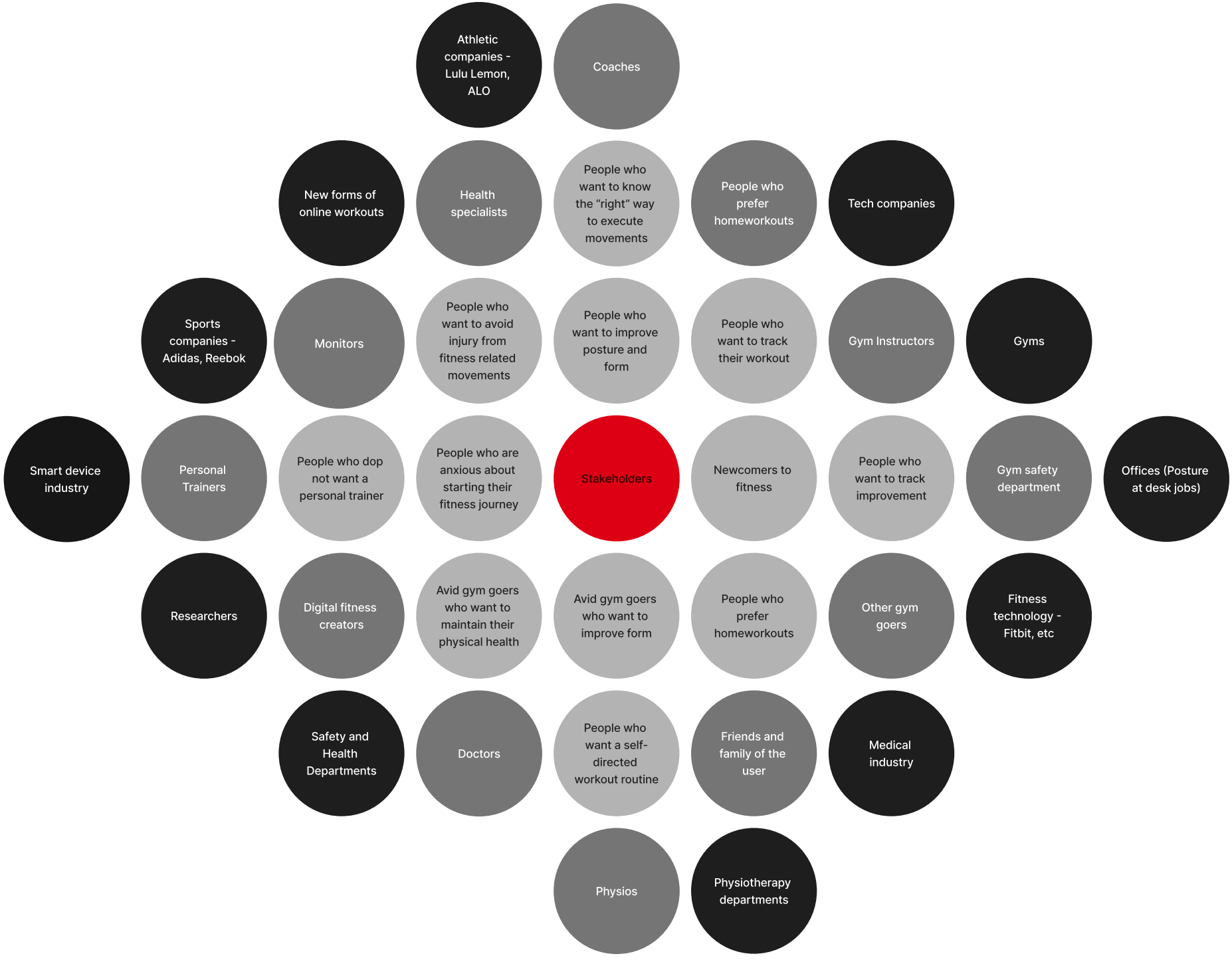
- Gen Z - They account for 35% of total gym members.
- Millennials - They account for 45% of total gym goers.
- Newcomers to fitness feel anxious when engaging in fitness-related activities, especially at the gym. The outcome will give them confidence within spaces and their abilities as they know they are doing what's right for their bodies.
- People who want a self-directed fitness routine do not have the technical knowledge to execute every movement properly. Improper form can lead to harm and an unbalanced/disproportionate figure.
- Avid gymgoers who want to maintain and protect their bodies.

Style Considerations

The design should be clean and minimalistic. Each tag should be uniform and thereby interchangeable. The design should evoke feelings of hygiene and modernism. The outcome should be easy to clean, and handle, and should not be obstructive. The tags are to be worked close to and/or placed on the body, so an ergonomic form might be the right direction.

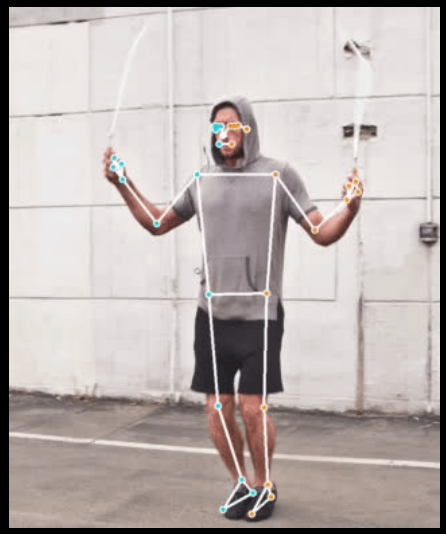
For colours, think similarly to the Apple ecosystem and maybe incorporate skin tones to make the outcome more discreet.

Avoid making the tags look medical. Avoid making them bulky. The tag should be made of durable plastic or silicon, and have a form of anti-microbial coating. The materials should feel and be perceived as luxurious.

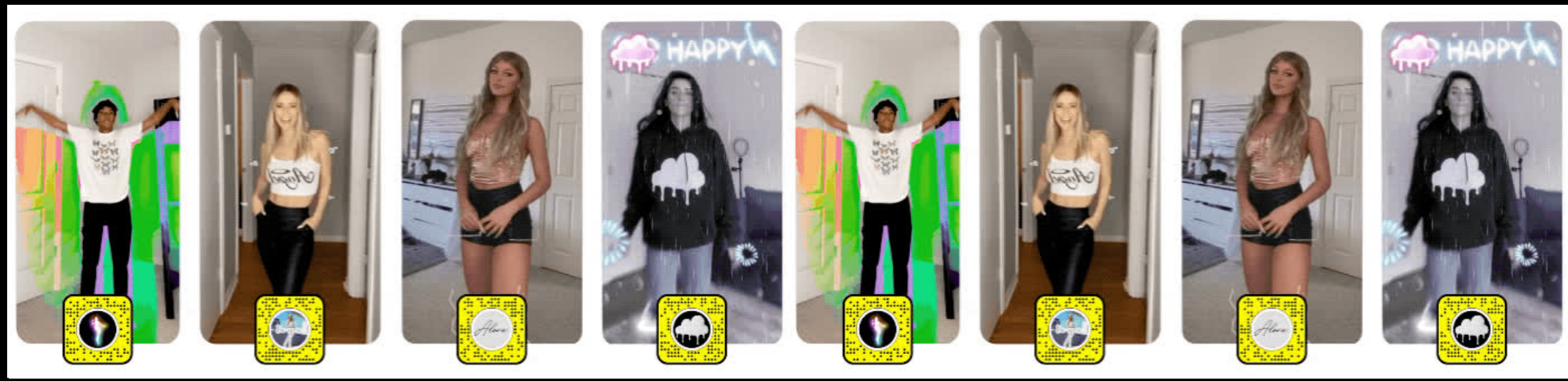

Athletic companies - Lulu Lemon, ALO
Coaches
New forms of online workouts
Health specialists
People who want to know the "right" way to execute movements
People who prefer homeworkouts
Tech companies
Sports companies - Adidas, Reebok
Monitors
People who want to avoid injury from fitness related movements
People who want to improve posture and form
People who want to track their workout
Gym Instructors
Gyms
Smart device industry
Personal Trainers
People who dop not want a personal trainer
People who are anxious about starting their fitness journey
Stakeholders
Newcomers to fitness
People who want to track improvement
Gym safety department
Offices (Posture at desk jobs)
Researchers
Digital fitness creators
Avid gym goers who want to maintain their physical health
Avid gym goers who want to improve form
People who prefer homeworkouts
Other gym goers
Fitness technology - Fitbit, etc
Safety and Health Departments
Doctors
People who want a self-directed workout routine
Friends and family of the user
Medical industry
Physios
Physiotherapy departments

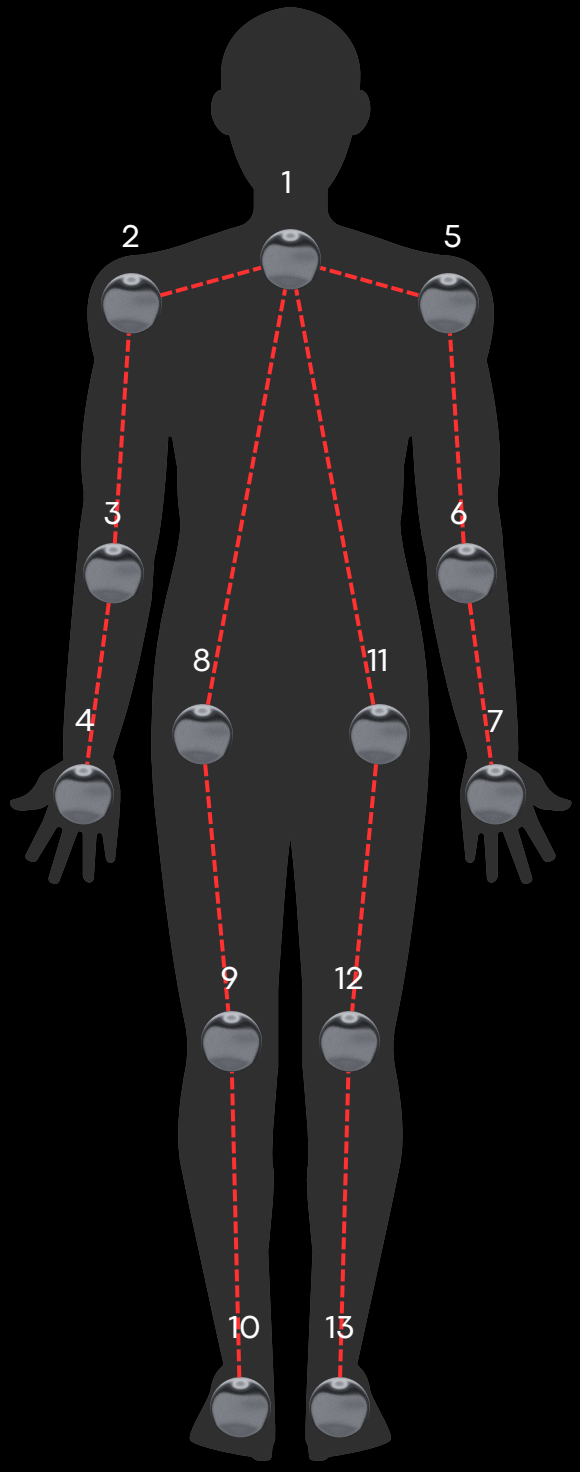
RESEARCH

Body Tracking



Currently, body tracking is carried out by tracking key points in the human body. These key points help communicate the body's movement, posture, velocity and action. Companies including Meta are bringing body tracking into our daily lives through the use of social media lenses, popularised by Snapchat and Instagram. The current technology uses cameras, machine learning and depth sensors to accurately perceive human body tacking. The area of expansion companies like Google are looking at is augmented reality and taking human beings and transforming them into augmented personas.





Key Points

1 - Neck

2 - Right Shoulder

3 - Right Elbow

4 - Right Wrist

5 - Left Shoulder

6 - Left Elbow

7 -Left Wrist

8 - Rigt Hip

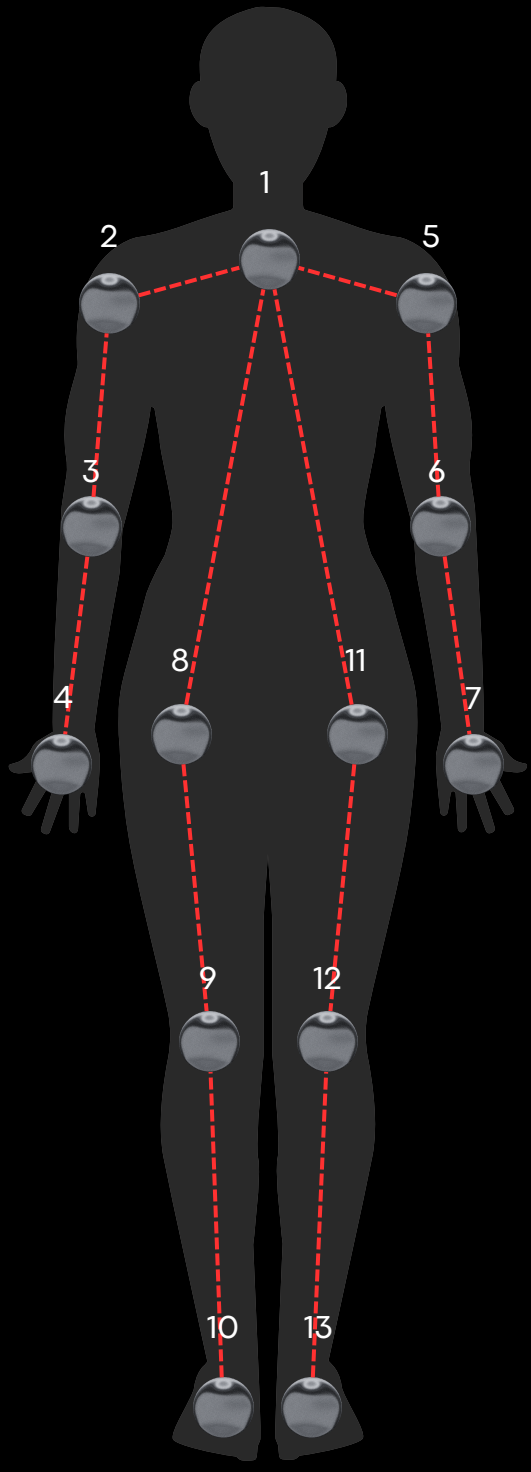
9 - Right Knee

10 - Right Ankle

11 -Left Hip

12 - Left Knee

13 - Left Ankle



MARKET RESEARCH

Lulu Lemon Mirror

- A smart mirror that uses a camera to assess the individual's workout
- 1 - 1 personal training session with a coach.
- Uses Bluetooth and can sync to your fitness device i.e. Apple watch.
- Includes a sound system to replicate a fitness class atmosphere.
- Connects to the internet and had built-in workouts.

Smart Wearables

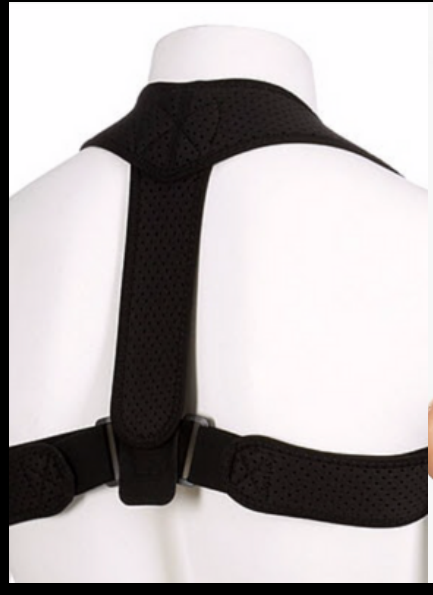
- **Tracks fitness with heart rate monitors and dedicated exercise modes.**
- **Track health using ECG, blood oxygen, etc.**
- **Tracks wellness and sleep.**
- **Lack of tracking of the quality and safety of workouts as they are based on physical monitors.**
- **Attempts to have an all-encompassing device without focusing on fitness.**

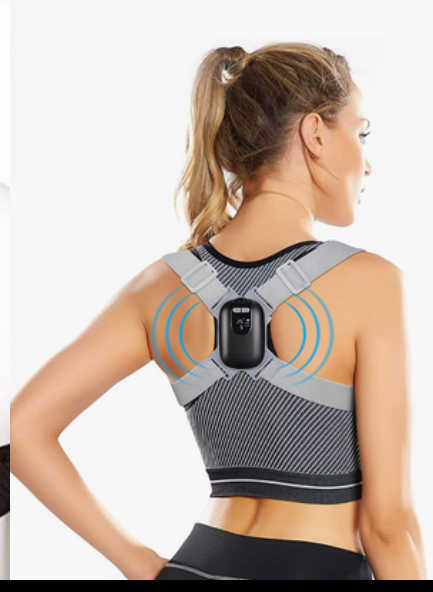
L to R - Fitbit Charge 5, Apple Watch, Oura Ring

MARKET RESEARCH

Upright Go S

- Built-in sensor for tracking posture in real-time.
- It uses vibration to communicate.
- Syncs with the app to track posture.
- Sticks to the body with an adhesive or a neck attachment.
- It only tracks neck and back posture.





Posture Brace

- Using a physical method to straighten the back posture.
- Not discreet.
- Does not take into consideration other parts of the body.

MARKET RESEARCH

Airtag

- **Compliant with the Apple ecosystem.**
- **It uses secure Bluetooth to pink its location via the 'Find My" application.**
- **Uses proximity to your phone to track distance.**
- It has a speaker to use audio as a tracking tool.
- Long battery life and is water resistant.
- Created an ecosystem of accessories to use the Airtag, eg. wallet attachment.

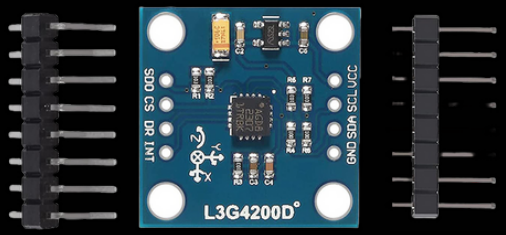
Tile Mate

- Bluetooth functionality.
- 'Modern" form.
- Non-replaceable battery.
- Has a voice assistant.
- Water-resistant.
- Has an in-house application.

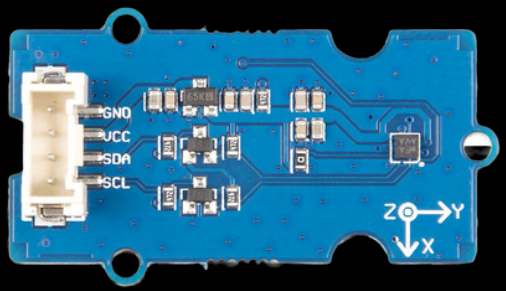
CIRCUIT

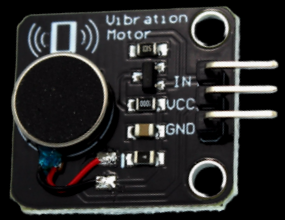
Required Components:

- Arduino board - This is the brain of the device and controls all the other components.
- Inertial Measurement Unit (IMU) - This is a sensor that can measure the orientation and movement of an object. You would need a 6 Degrees of Freedom (DOF) or 9 DOF IMU sensor that can measure both acceleration and rotation in all three axes.
- Breadboard - This is a board that allows you to connect and prototype your circuit without soldering. You can use a mini breadboard or a full-size breadboard depending on your needs.
- Jumper wires - These are wires with pins on both ends that allow you to connect the components on the breadboard.
- Vibration motor to provide haptic feedback (e.g. a small DC motor with an eccentric weight attached to it)
- Bluetooth module (e.g. HC-05 or HC-06) to communicate with a phone
- Battery - You would need a power source for your Arduino board and IMU sensor. You can use a 9V battery or a rechargeable lithium-ion battery.
- Enclosure - To protect your device and make it portable, you would need an enclosure. You can 3D print or buy an enclosure that fits your Arduino board and IMU sensor.



Gyroscope and Accelerometer





Haptic Motor

Bluetooth Module

Battery

Arduino

CIRCUIT

STEP 1

Connect the IMU sensor to the Arduino board

- Connect the VCC pin of the MPU6050 sensor to the 5V pin on the Arduino
- Connect the GND pin of the MPU6050 sensor to the GND pin on the Arduino
- Connect the SDA pin of the MPU6050 sensor to A4 pin on the Arduino
- Connect the SCL pin of the MPU6050 sensor to A5 pin on the Arduino

STEP 2

Connect the HC-05 Bluetooth module to the Arduino board

- Connect the VCC pin of the HC-05 Bluetooth module to the 5V pin on the Arduino
- Connect the GND pin of the HC-05 Bluetooth module to the GND pin on the Arduino
- Connect the TXD pin of the HC-05 Bluetooth module to the RXD pin (pin 0) on the Arduino
- Connect the RXD pin of the HC-05 Bluetooth module to the TXD pin (pin 1) on the Arduino

STEP 3

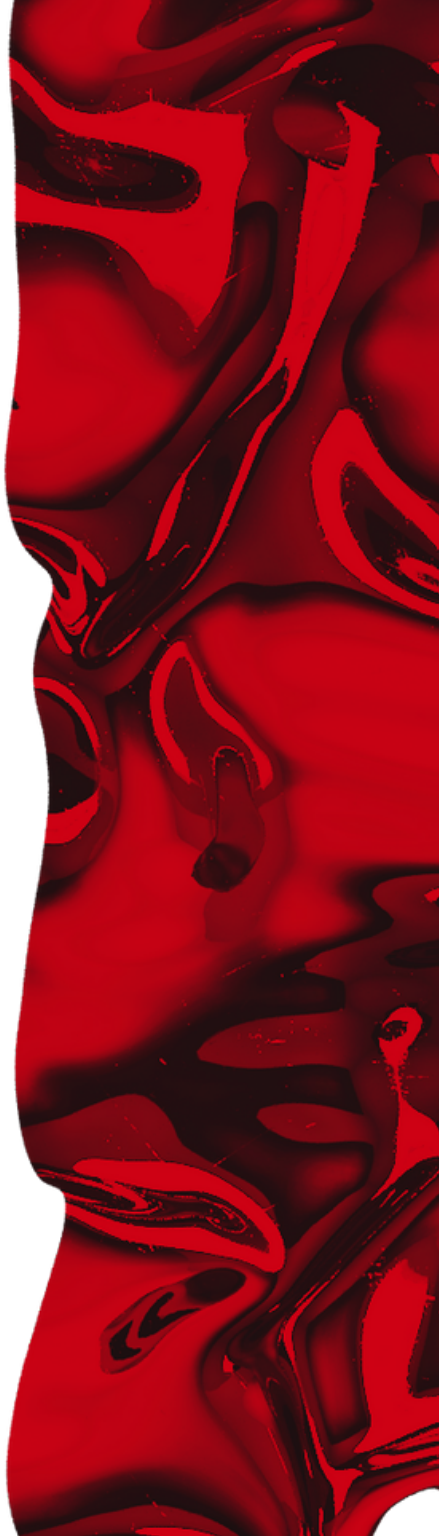
Connect the vibration motor to the Arduino board

- Connect one leg of the vibration motor to pin 8 on the Arduino
- Connect the other leg of the vibration motor to the GND pin on the Arduino

STEP 4

Upload the code to the Arduino board

- Use the Arduino IDE to upload the code to the Arduino board. You can use the code example I provided earlier, or modify it according to your needs.



CIRCUIT

STEP 5

Power the circuit

- Power the circuit using a 9V battery or a USB cable connected to a power source.

STEP 6

Connect the device to a phone

- Turn on Bluetooth on your phone and search for nearby devices.
- Pair your phone with the HC-05 Bluetooth module by entering the default pairing code (usually 1234 or 0000).

STEP 7

Use haptic feedback to alert the user about posture

- Modify the code to include haptic feedback when the user's posture is incorrect.
- For example, you can set a threshold angle for the sensor and if the user's posture falls below the threshold, the vibration motor will turn on to alert the user.

STEP 8

Send the data to the phone

- Once the device is paired, the Arduino board will start sending data to the phone through the Bluetooth module.
- You can use an app on your phone to receive and display the data in real-time.

SAMPLE CODE

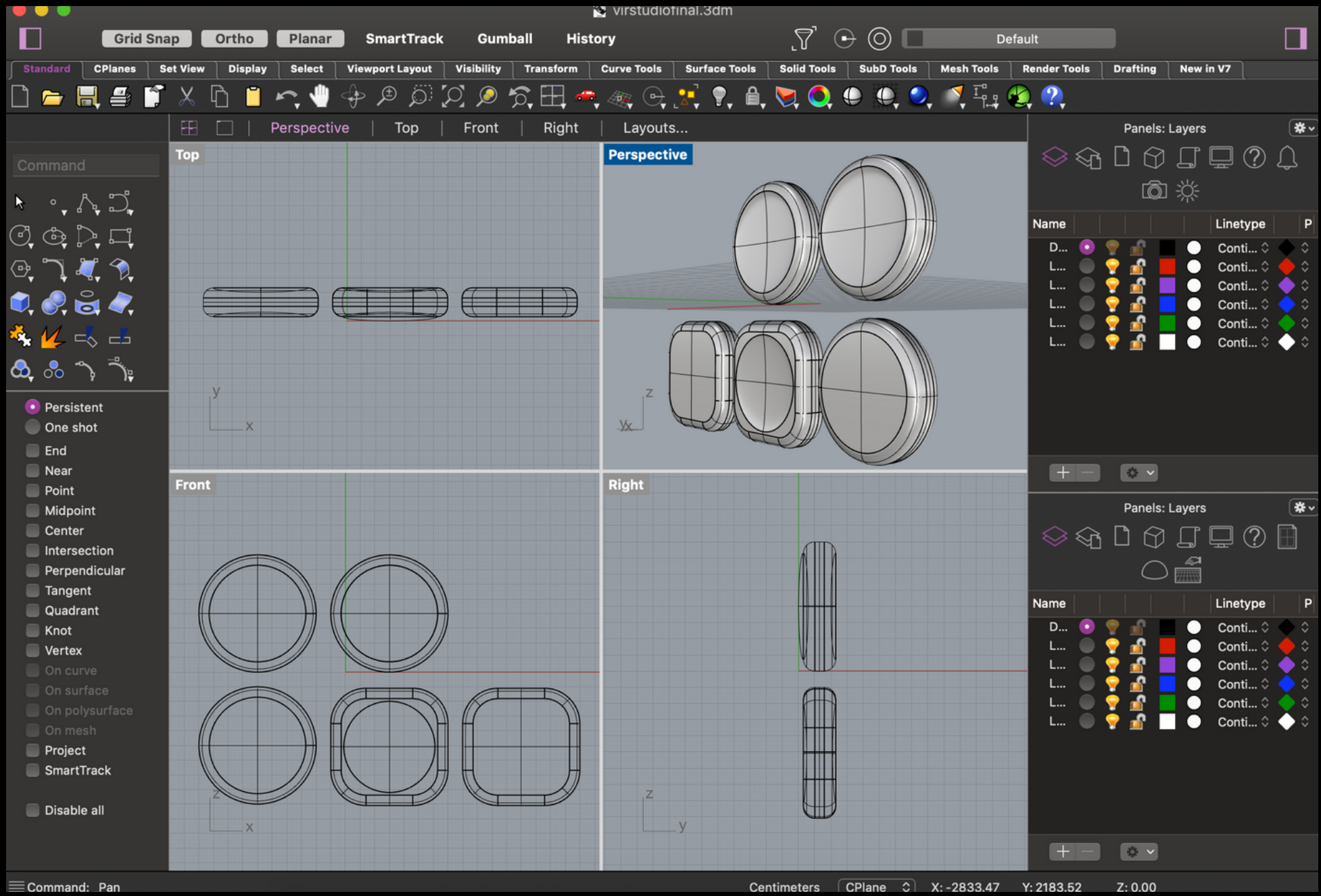
Reading data from the IMU sensor

```
#include <Wire.h>
#include <SoftwareSerial.h>

SoftwareSerial BTserial(0, 1); // RX, TX pins for HC-05 Bluetooth module
const int MPU_addr = 0x68; // I2C address of the MPU6050 sensor

int16_t accelerometer_x, accelerometer_y, accelerometer_z;
int16_t gyro_x, gyro_y, gyro_z;

void setup() {
  Serial.begin(9600);
  Wire.begin();
  Wire.beginTransmission(MPU_addr);
  Wire.write(0x6B); // PWR_MGMT_1 register
  Wire.write(0); // set to zero to wake up the MPU6050 sensor
  Wire.endTransmission(true);

  BTserial.begin(9600); // initialize Bluetooth serial communication
}

void loop() {
  Wire.beginTransmission(MPU_addr);
  Wire.write(0x3B); // starting with register 0x3B (ACCEL_XOUT_H)
  Wire.endTransmission(false);
  Wire.requestFrom(MPU_addr, 14, true); // request 14 bytes from MPU6050 ser

  // read accelerometer data
  accelerometer_x = Wire.read() << 8 | Wire.read();
  accelerometer_y = Wire.read() << 8 | Wire.read();
  accelerometer_z = Wire.read() << 8 | Wire.read();

  // read gyro data
  gyro_x = Wire.read() << 8 | Wire.read();
  gyro_y = Wire.read() << 8 | Wire.read();
  gyro_z = Wire.read() << 8 | Wire.read();

  // send accelerometer and gyro data over Bluetooth
  BTserial.print("A:");
  BTserial.print(accelerometer_x);
  BTserial.print(",");
  BTserial.print(accelerometer_y);
  BTserial.print(",");
  BTserial.print(accelerometer_z);
  BTserial.print(" G:");
  BTserial.print(gyro_x);
  BTserial.print(",");
  BTserial.print(gyro_y);
  BTserial.print(",");
  BTserial.print(gyro_z);
  BTserial.println();
  delay(100);
}
```

Using haptic feedback to alert the user about posture

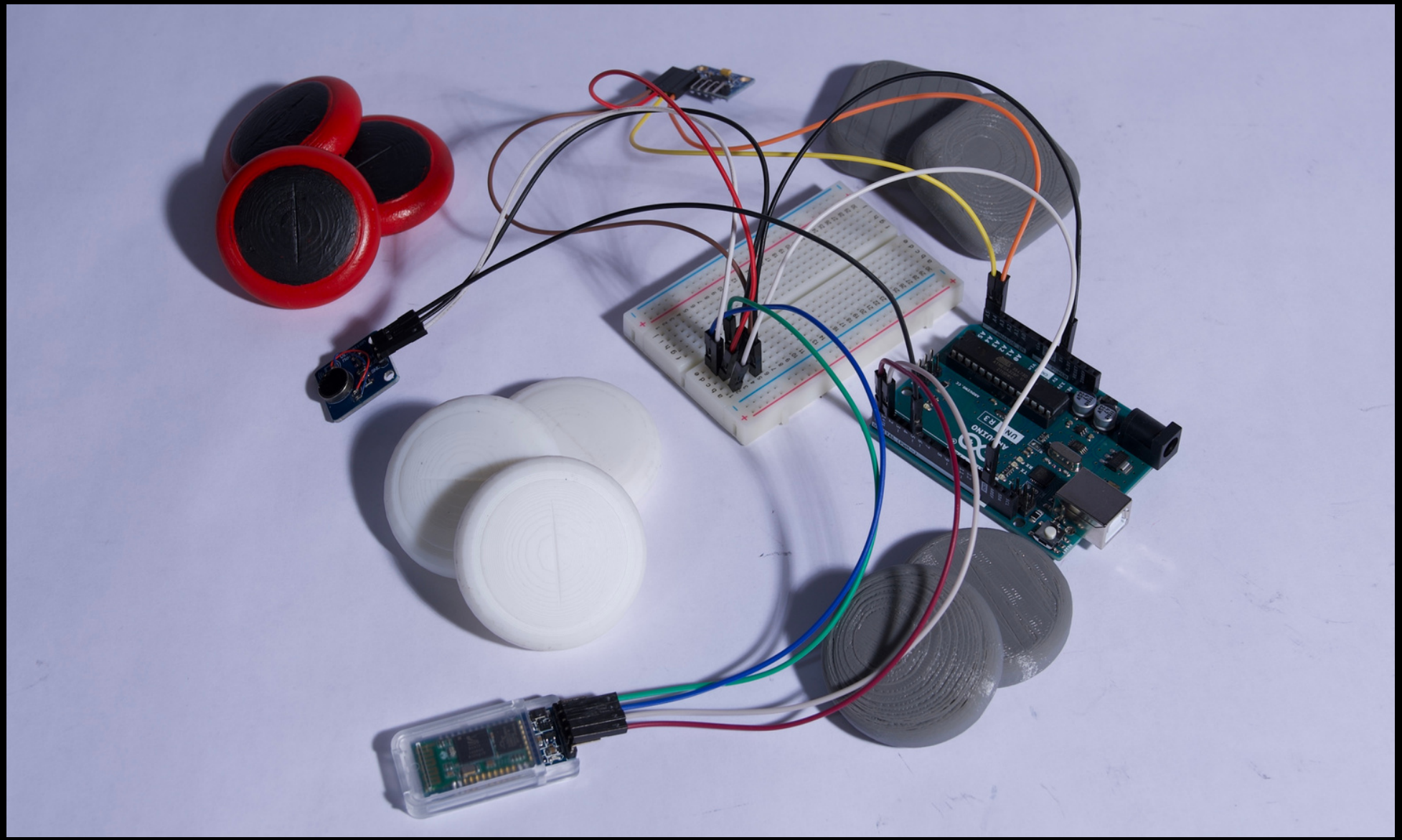
```
#include <Wire.h>
#include <SoftwareSerial.h>

SoftwareSerial BTserial(0, 1); // RX, TX pins for HC-05 Bluetooth module
const int MPU_addr = 0x68; // I2C address of the MPU6050 sensor
const int VIBRATION_PIN = 8; // pin for the vibration motor

int16_t accelerometer_x, accelerometer_y, accelerometer_z;

void setup() {
  Serial.begin(9600);
  Wire.begin();
  Wire.beginTransmission(MPU_addr);
  Wire.write(0x6B); // PWR_MGMT_1 register
  Wire.write(0); // set to zero to wake up the MPU6050 sensor
  Wire.endTransmission(true);

  pinMode(VIBRATION_PIN, OUTPUT);
  BTserial.begin(9600); // initialize Bluetooth serial communication
}

void loop() {
  Wire.beginTransmission(MPU_addr);
  Wire.write(0x3B); // starting with register 0x3B (ACCEL_XOUT_H)
  Wire.endTransmission(false);
  Wire.requestFrom(MPU_addr, 6, true); // request 6 bytes from MPU6050 sensc

  // read accelerometer data
  accelerometer_x = Wire.read() << 8 |
```

FORM EXPLORATION



FORM DEVELOPEMENT

FINAL CIRCUIT



FINAL CODE

Arduino Uno

SKETCHBOOK

ClosestCode

GoodBadFeedbackWHaptic

ClosestCode.ino

```ino
#include <Wire.h>
#include <SoftwareSerial.h>
#include <MPU6050.h>

// Define the pins used for Bluetooth communication
#define BT_RX_PIN 0
#define BT_TX_PIN 1

// Define the pins used for the vibration motor
#define VIBRATION_MOTOR_PIN 5

// Create a SoftwareSerial object for Bluetooth communication
SoftwareSerial BTSerial(BT_RX_PIN, BT_TX_PIN);

// Create an MPU6050 object
MPU6050 mpu;

void setup() {
  // Initialize the serial communication for debugging
  Serial.begin(9600);

  // Initialize the Bluetooth serial communication
  BTSerial.begin(9600);

  // Initialize the vibration motor pin
  pinMode(VIBRATION_MOTOR_PIN, OUTPUT);

  // Initialize the MPU6050
  mpu.initialize();
}

void loop() {
  // Read the accelerometer and gyroscope data
  int16_t ax, ay, az, gx, gy, gz;
  mpu.getMotion6(&ax, &ay, &az, &gx, &gy, &gz);

  // Calculate the pitch and roll angles
  float pitch = atan2(ax, sqrt(ay * ay + az * az)) * 180 / PI;
  float roll = atan2(ay, sqrt(ax * ax + az * az)) * 180 / PI;

  // Check if the posture is bad
  if (pitch < -15 || pitch > 15 || roll < -15 || roll > 15) {
    // Activate the vibration motor
    digitalWrite(VIBRATION_MOTOR_PIN, HIGH);
  } else {
    // Deactivate the vibration motor
    digitalWrite(VIBRATION_MOTOR_PIN, LOW);
  }

  // Send the posture data over Bluetooth
  Serial.print("Accelerometer (x, y, z): ");
  Serial.print(ax);
  Serial.print(", ");
  Serial.print(ay);
  Serial.print(", ");
  Serial.print(az);
  Serial.print("\t");
  Serial.print("Gyroscope (x, y, z): ");
  Serial.print(gx);
  Serial.print(", ");
  Serial.print(gy);
  Serial.print(", ");
  Serial.println(gz);


  // Wait for a short time before reading the data again
  delay(100);
}
```


REDEFINE YOUR FITNESS JOURNEY.
EXPERIENCE THE FUTURE OF FORM.

ACCURATELY TRACK 3D MOVEMENT AND POSTURE
WITH THE 6-AXIS IMU SENSOR

CONSISTING OF A 3-AXIS ACCELEROMETER AND 3-AXIS GYROSCOPE TO MEASURE ACCELERATION, VELOCITY, ORIENTATION AND DISPLACEMENT


54

SEAMLESS CONNECTIVITY WITH YOUR MOBILE DEVICE

THROUGH BLUETOOTH 2.0 + EDR

CONNECTIVITY UPTO A 100 METERS AND AN ENHANCED DATA RATE TO MAKE SURE YOU NEVER MISS THE ACTION.


COMMUNICATES WITH
HAPTIC FEEDBACK
SO YOU CAN FOCUS ON WHAT MATTERS, UNINTERRUPTED.


STAND OUT
WITH THE VIBRANT RED FINISH.
BEAUTIFULLY SIMPLE
WITH AN ERGONOMIC DESIGN
TO HARMONIOUSLY INTEGRATE INTO YOUR WORKOUT.


(DUAL)RABILITY
MADE FROM A HIGH-SHINE, IMPACT-RESISTANT PLASTIC
PAIRED WITH RUBBER TO PROVIDE GRIP.
MADE TO LAST.