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HAND GESTURES RESPONSIVE GLOVE

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Title

Using sensors to record hand and finger gestures through a wearable glove

Required elements

- 1x Arduino Uno
- 1x Breadboard
- 1x Set of jumper wires
- 5x Flex Sensors
- 1x MPU6050
- Glove
- Glue

Assembly steps

Step 1 Hardware Setup

First of all, we require to set up the glove by attaching the sensors to the gloves. The picture below depicts how this was done.

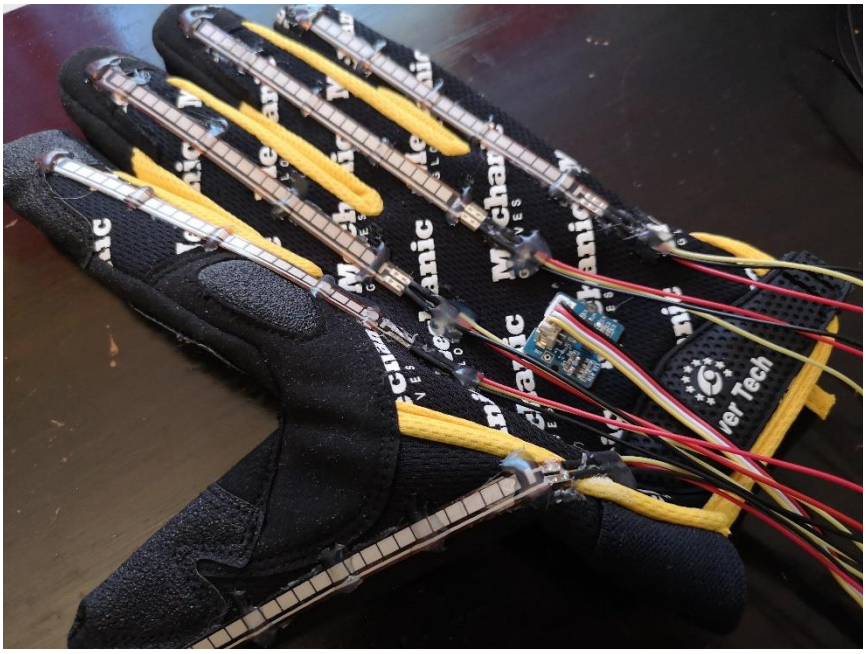

Figure 1 Glove Setup

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Step 2 Finger movement tracking

The hardware is quite straightforward to set up. What will be used for tracking the fingers will be Flex sensors. These work by changing their resistance depending on how much flexing the finger will be doing. Figure 1 depicts the wire configuration, we will be using a pull-up 10Kohm resistor configuration so there will be a resistance between the supply and the sensing pin. Flex sensors typically have a range of 10K to 35K ohm.

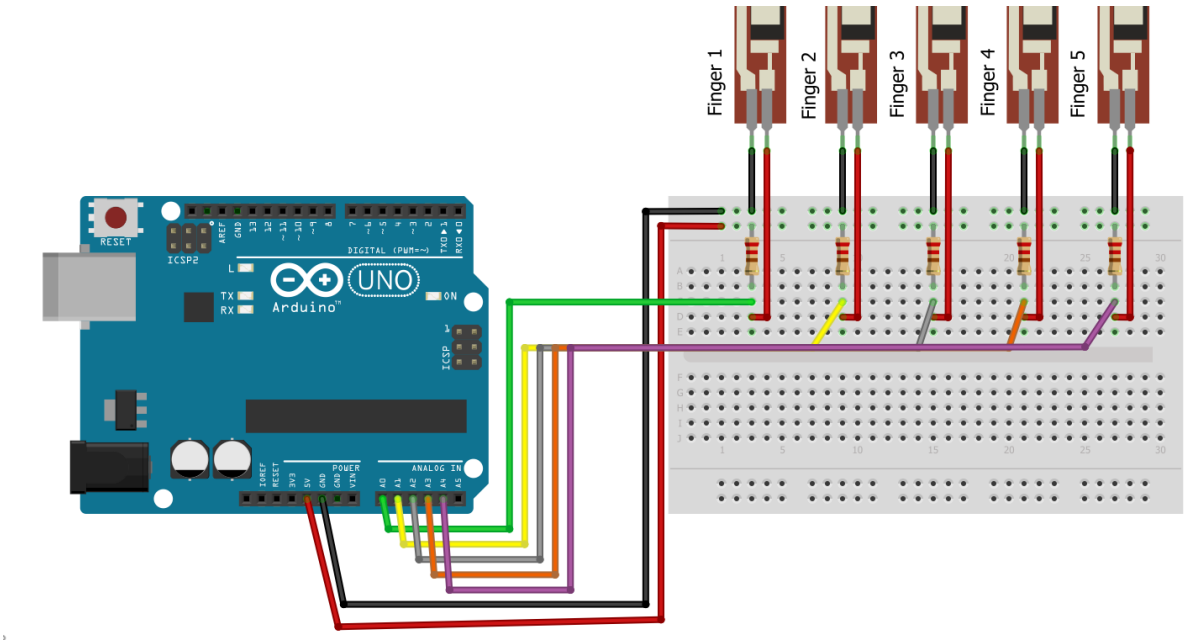

Figure 2 - Flex Sensor Wiring Diagram

The following code explains how the flex sensors will be used. We will be using pins A0 to A4 for reading the values and then displaying the values onto the computer via the serial cable. The comments inside the code explain what each part is doing what.

```
int flexSensor1 = A0;
int flexSensor2 = A1;
int flexSensor3 = A2;
int flexSensor4 = A3;
int flexSensor5 = A4;
//Declare the inputs for the flex sensors
int finger1, finger2, finger3, finger4, finger5;
//declaring the variables to store the sensor values
void setup()
{
  Serial.begin(9600); //Declaring Baud Rate
}
```

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```
void loop()
{
  finger1 = analogRead(flexSensor1);
  finger2 = analogRead(flexSensor2);
  finger3 = analogRead(flexSensor3);
  finger4 = analogRead(flexSensor4);
  finger5 = analogRead(flexSensor5);
  //Reading the sensor value and storing them

  Serial.print(finger1);
  Serial.print(",");
  Serial.print(finger2);
  Serial.print(",");
  Serial.print(finger3);
  Serial.print(",");
  Serial.print(finger4);
  Serial.print(",");
  Serial.print(finger5);
  Serial.println();
  //Transmitting values through SerialMonitor
  delay(20);
  //delay by 20mS
}
```

Step 3 Tracking the motion of hand

For the motion of the hand, we will be using a separate Arduino board since there aren't enough analog input pins on the Arduino Uno (Note: we are using 5 for the flex sensors already).

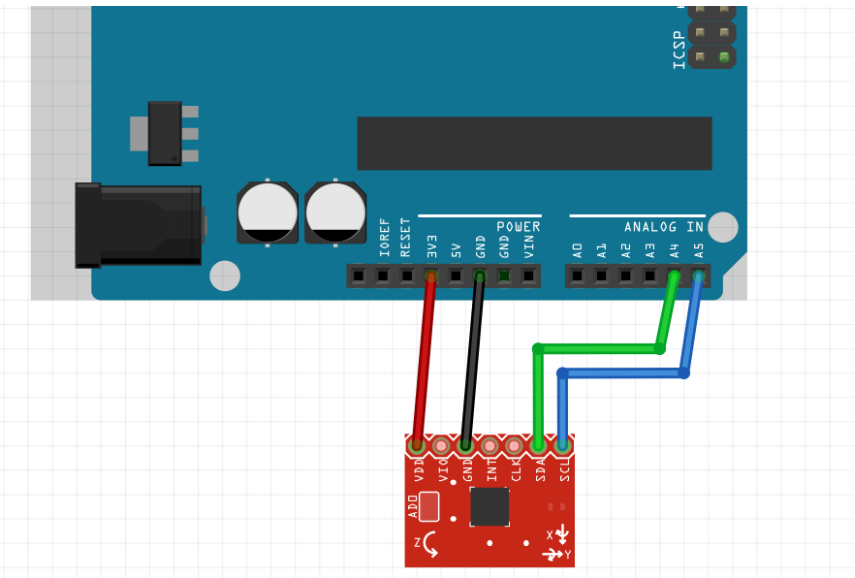

Figure 3 Acceleromoter wiring

The Arduino board will be connected to the computer via the USB serial cable. Due to this, we will be using two separate serial monitors to track the data (One for the flex sensor data and the other for the accelerometer).

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The Code below depicts the workings of the accelerometer. The first part of the code is used to initialize the accelerometer via the “acc.init()” code. Since the accelerometer reads at very high speeds, the values tend to be inaccurate sometimes, so we will be using a simple averaging code to reduce the noise of the values that it outputs.

```
#include <Wire.h>
#include "MMA7660.h"
MMA7660 acc;

float X,Y,Z;

void setup()
{
acc.init(); //initialize the acceleromter
pinMode(13, OUTPUT);
Serial.begin(9600);
}

void loop()
{

X=0;
Y=0;
Z=0;

static long cnt = 0;
static long cntout = 0;
float ax,ay,az;
int8_t x, y, z;
int i;

for(i=0; i<=50; i++)
{
  acc.getAcceleration(&ax,&ay,&az); //get the values from the acceleromoter
  X = X+ax;
  Y = Y+ay;
  Z = Z+az;
}
//read 50 values from the accelerometer and store the totals in X,Y,Z
X=X/i;
Y=Y/i;
Z=Z/i;
//average the values to reduce the noise from the acceleromoter
Serial.print("x = ");
Serial.print(X);
Serial.print("  ");
Serial.print("y = ");
Serial.print(Y);
Serial.print("  ");
Serial.print("z = ");
Serial.println(Z);
//print the values using he serial println code
}
```

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Step 4 Analysis

The pictures below depict the glove wiring, and also it working. This was used to track the movement of the hand as it was moving. There are various applications for this type of movement, mimicking robotics or else even analysis of hand gestures. See the video attached in the file for a more thorough demonstration.

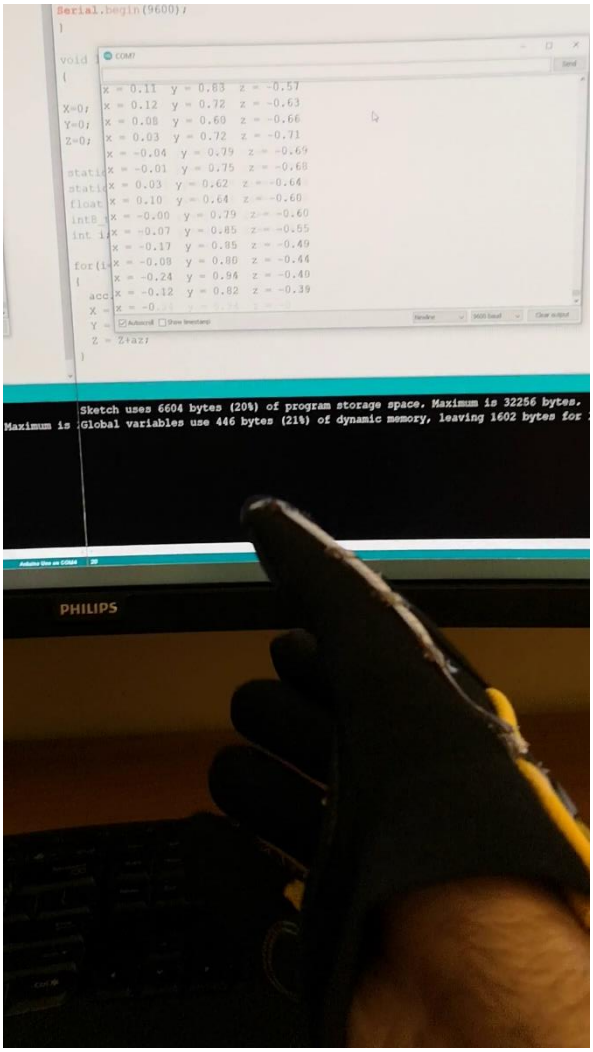

Figure 5 Acceleromoter Demonstration

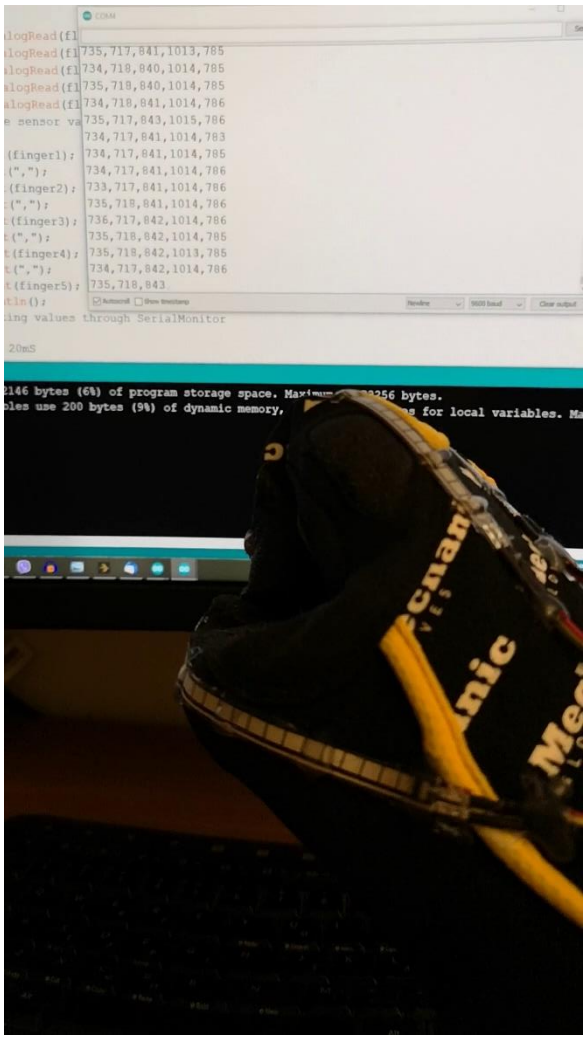

Figure 4 Flexomter Demonstration

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