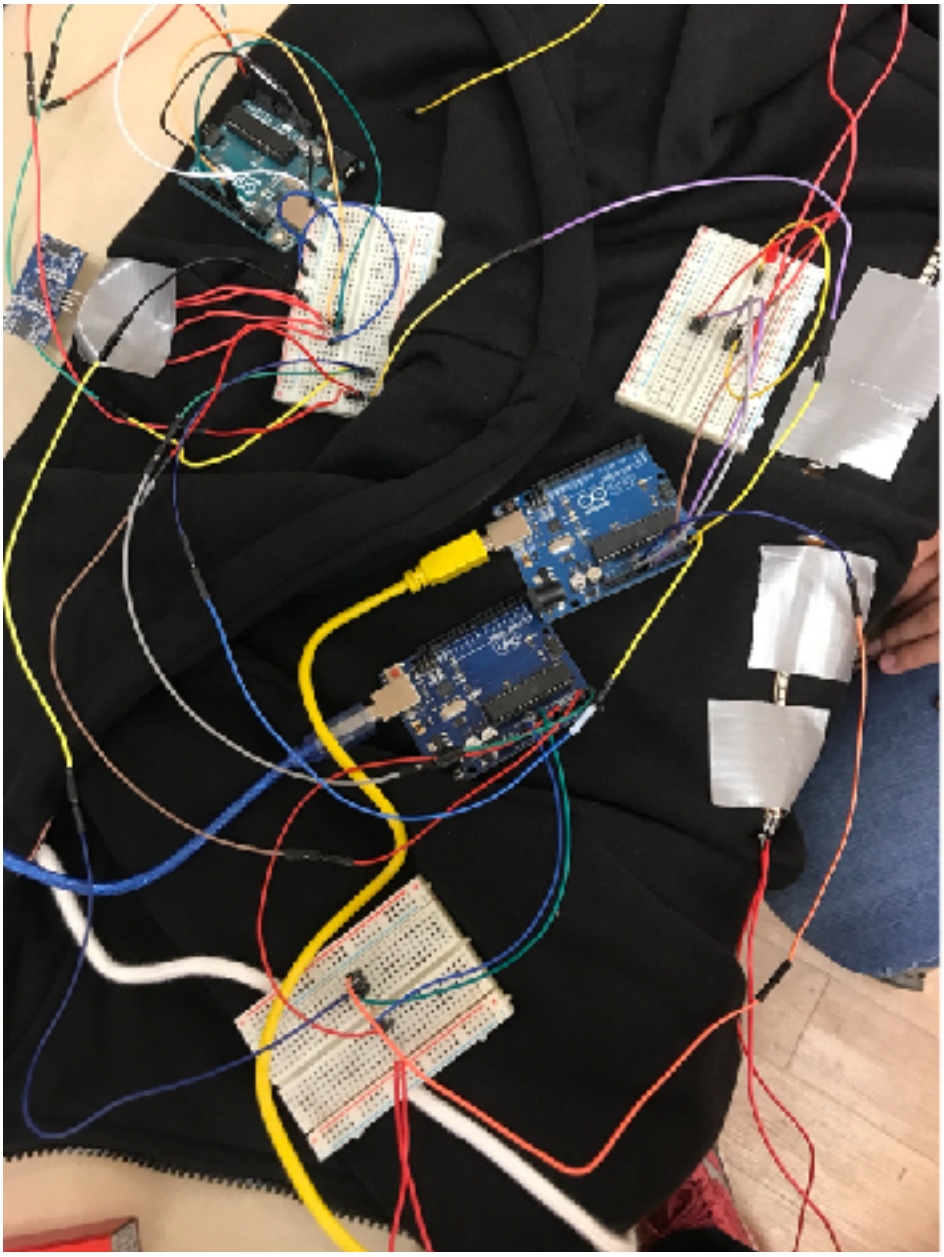
# Posture Monitoring jacket



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## Table of Context



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## Introduction:

As wearable technology grows popular the emphasis on building health related application has increased. Our motivation came from a startup called Athos. Athos has designed wearable technology for exercising. Also, according to the American Chiropractic Association, 31 million Americans experiment low-back pain at any given time. Back pain is one of the most common reasons for missed work and is the second most common reason for visit to the doctor. Furthermore, Americans spend at least $50 billion each year on back pain. And the major cause of back pain is weak abdominal and back muscles or poor posture or many who work a desk job can relate to poor posture.

The typical method in correcting posture is remembering to sit up straight. However until muscle memory has been formed, it is difficult to remember to sit up straight and may be uncomfortable at first. This usually leads to many not correcting their posture. Thus we have created a prototype of the Posture Monitoring Jacket. This jacket will tell the user when his or her posture starts to become poor.

## Hardware Parts Needed:

| Name of Part | Number Needed |
|---|---|
| Ardunio | 4 |
| Flex Sensor | 2 |
| Ultrasonic Sensor | 1 |
| Soldering iron | 1 |
| RGB LED | 3 |
| Ethernet Shield | 1 |
| power source (portable battery) | 1 |
| Electrical Tape | 1 |

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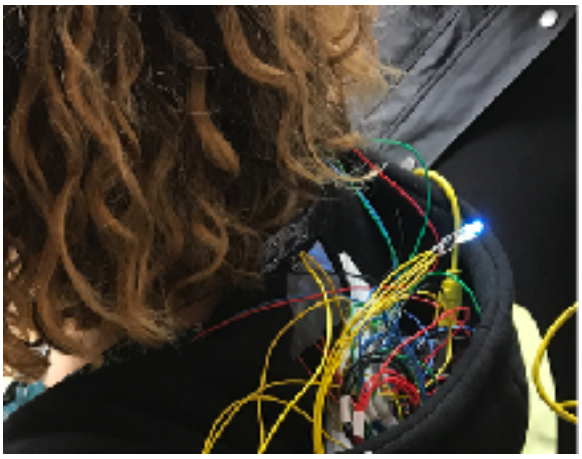
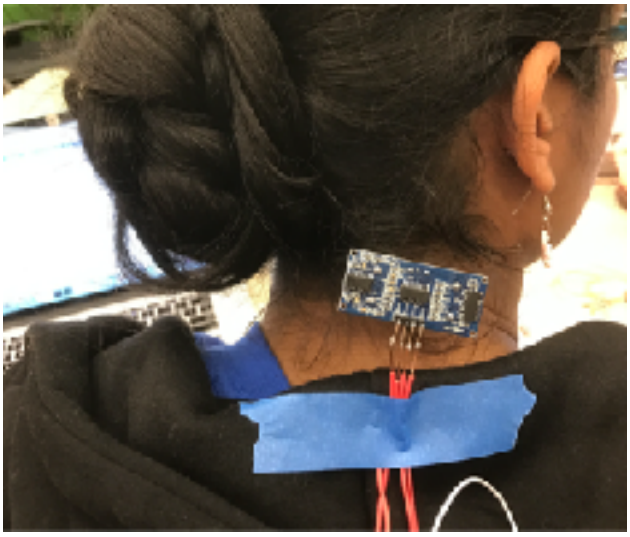
# Design:

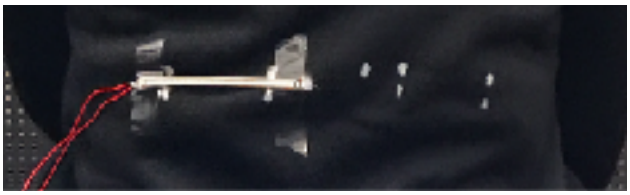
## Locations of the external devices:



RGB LEDS. Shown to the left is the locations where the LEDS are attached. One is on the hood for the neck, while the other two are on the cuff of the jacket for the mid-back.



Ultrasonic sensor that is attached to the back of the hood. This will be used to measure the posture of the neck.



Both flex sensors will be attached mid-back. Shown to the left is where the left flex sensor is attached.

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## Calibrating the Jacket:

When the user connects jacket (master Arduino) to a power source then whatever position the user is in will be considered good posture. Currently the feature on the jacket the user will have to un-plug and re-plug from the posture every time he or she will like to re-calibrate the jacket.

## LEDs

The LEDs are quite crucial to the posture monitoring jacket as the color of the LED indicates good posture. If the LEDs light up blue then the individual is maintaining good posture, otherwise the LEDs will light up red indicating good posture is not being maintained. We soldered the LEDS to the master Arduino.

## Master Arduino:

The master Arduino is located in the hood of the jacket. This Arduino is constantly fed data via I2C connection from both flex sensors and the ultrasonic sensor. The master will always light the LED blue unless it falls out of the good posture threshold, where then it will change the color of the LED from blue to red.

## Slave Arduino:

- **Left Flex Sensor:**

  The left flex sensor is located with in the left pocket of the jacket. This monitors the movement of the left wing of the back. It constantly feeds data to the master Arduino, and if the data sent to the master does not maintain the good posture threshold the LED on the left cuff of the jacket will change from blue to red.

- **Right Flex Sensor:**

  The right flex sensor is located with in the right pocket of the jacket. This monitors the movement of the right wing of the back. It constantly feeds data to the master Arduino, and if the data sent to the master does not maintain the good posture threshold the LED on the right cuff of the jacket will change from blue to red.

- **Ultrasonic Sensor:**

  The ultrasonic sensor is located in the hood as of right now. This monitors the movement of the neck to ensure the neck is also aligned and not doing something funny. It constantly feeds data to the master Arduino, and if the data sent to the master does not maintain the good posture threshold the LED will change from blue to red.

## Implementation:

## Challenges:

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## Soldering

The amount of soldering was not expected. Since we had more than two Arduinos we could not use serial communication, instead we used I2C. By using I2C we ran out of solder wire since we needed longer wire for the LEDs.
**Flex Sensor:** The more difficult sensor to solder. Also, we burned out one luckily we were prepared as we bought additional sensors.
**Ultrasonic Sensor:** The most annoying sensor to solder. Since the pins were very close together we would typically get 3 pins done, but when tried to get the 4th pin soldered two pins would generally fall off. So then we had to de-solder and re-solder. This was one of the most time consuming sensor to solder.
**LEDs:** The LEDs were the easiest to solder.

## Wiring

**I2C communication:** Since we had four Arduinos we used the I2C connections as the I2C protocol involves using two lines to send and receive data. For the Arduino Uno the 2 lines are the A4 and A5 pins.

since we can just share the same ground, A4, and A5 pins on one bread board. However since we had a huge mess of wires we ended up short-circuiting our circuit somewhere. As we got

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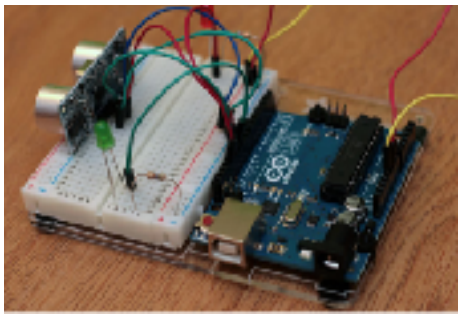
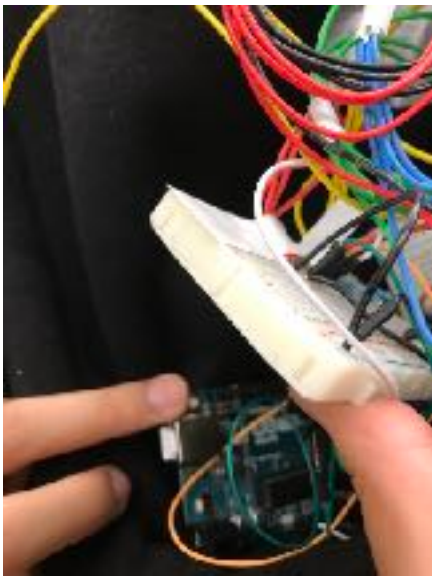
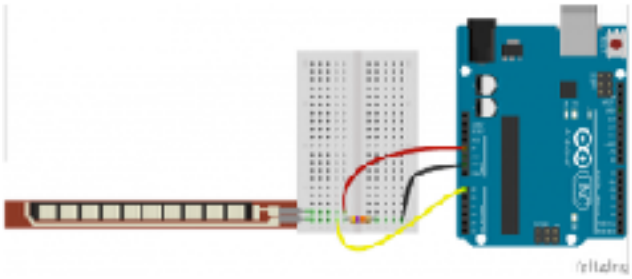
**LED**

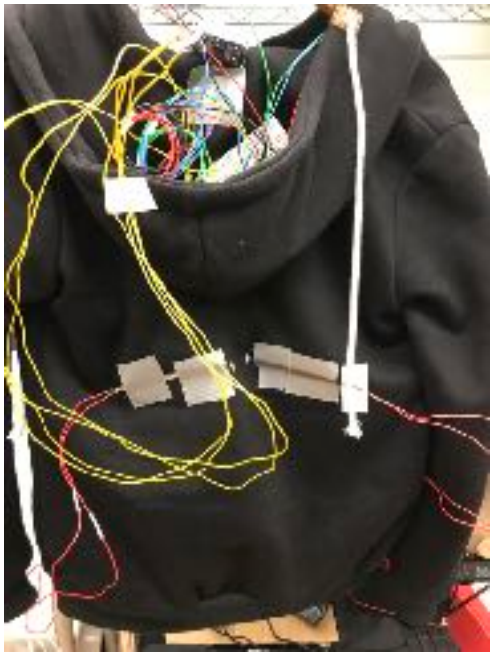
**Ultrasonic Sensor**





**Flex Sensor**





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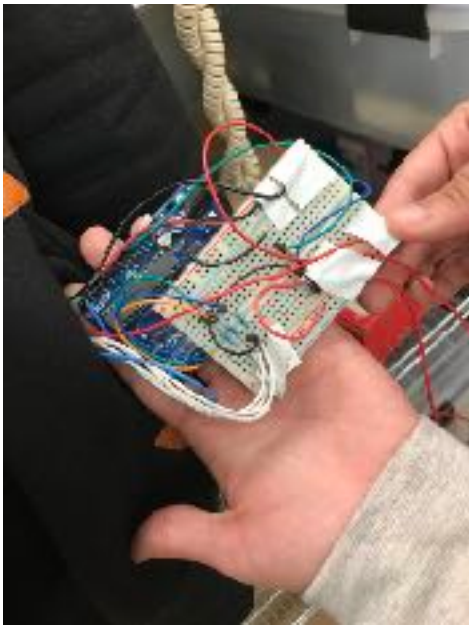

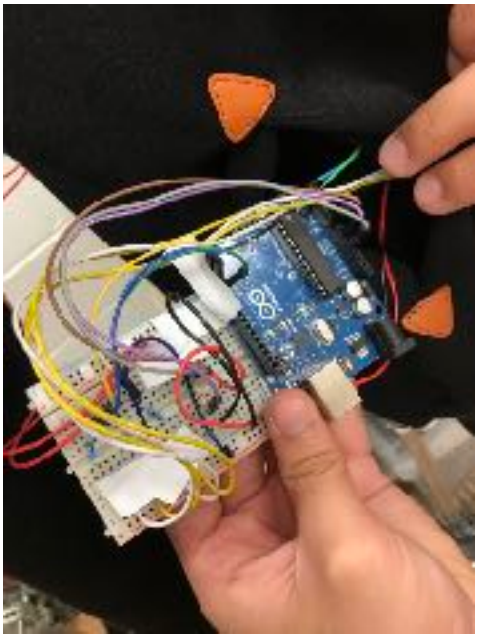

**Master Arduino**

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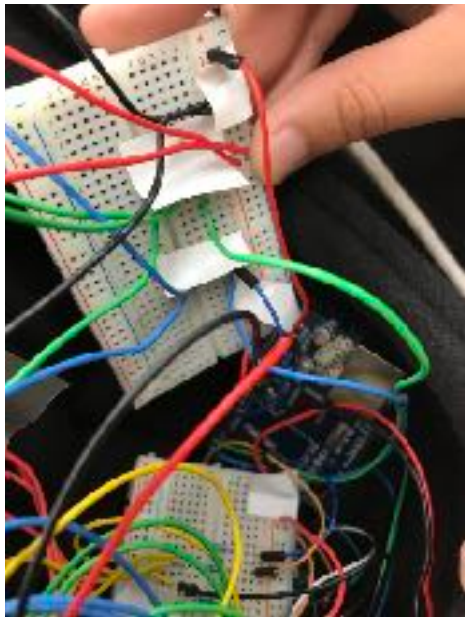

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### Web Application

Originally we had planned to grab data from each of the sensors and display a nice graph. In order to do this we used an ethernet shield which transmitted data over a LAN network. However due to the time constraint and the troubles in soldering and wiring the project we did not have enough time to finish the nice GUI display.

## Future Work:

## References:


- Flex Sensor: https://learn.sparkfun.com/tutorials/flex-sensor-hookup-guide
- Ultrasonic Sensor
  - http://playground.arduino.cc/Main/UltrasonicSensor
  - http://www.instructables.com/id/Simple-Arduino-and-HC-SR04-Example/
- Ethernet
- Something place holder
  - http://playground.arduino.cc/Main/UltrasonicSensor


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**Links to where we got the parts from:**

- HiLetgo New Version NodeMCU LUA WiFi Internet ESP8266 Development
- 16Hertz UNO R3 Ultimate Starter Kit - LED, LCD, Breadboard, Shield, Relay, 9V Adapter, Sensor, Guide for Arduino

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