

# Team Arduino: Developing a Wearable Heart Health Monitor

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## Abstract

- Our goal is to predict critical medical conditions using affordable consumer technology
- It is important to develop some sort of wearable technology that can act as an early detection device that monitors heart health.
- What have we accomplished:
  - Coded a pulse and temperature sensor capable of averaging BPM and body temperature
  - Tested the accuracy of our pulse sensor.
  - Learned how to store the data collected from the sensors from the Arduino to an SQL database
  - Coded an ECG sensor
  - Applied a Fast Fourier Transform algorithm to filter out noise from ECG sensor
  - Learned about neural network that are capable of detecting heart conditions.

## Introduction

Why is there a need for Team Arduino:

- Heart attacks rank high amongst the leading causes of death
- Prevention relies on understanding and acknowledging the symptom linked to the disease
- Understanding of one's condition has a direct correlation with the prevention of a second heart attack

Our Plan:

- Build a device that can predict a heart attack
- Use open source software, to keep device affordable
- Integrate a temperature sensor, ECG sensor, and pulse sensor to monitor basic heart health
- Storing the user generated data
- Apply a filter to clean the raw signals
- Analyze sensor data using a back propagation algorithm
- Output to the user an accurate analysis of heart health

## Acknowledgements

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## Our Approach

- Decided that pulse would be one of the key sensors needed to determine heart health
- Also integrated a thermistor as measuring temperature is a key vital measured by health professionals
- Tested the accuracy of the pulse temperature in comparison to a Fitbit and Garmin Chest Strap
- Developed a basic way to store sensor data from Arduino into SQLite database
- Learned algorithms need to filter extraneous noise from sensors.
- Integrated a ECG sensor, which is key in detecting abnormalities in the heart.
- Integrated all the sensors onto a breadboard
- Displayed BPM, temp, and averages from sensor data onto an LCD
- Designed PCB for prototype
- Measured the accuracy of the ECG sensor

## Results

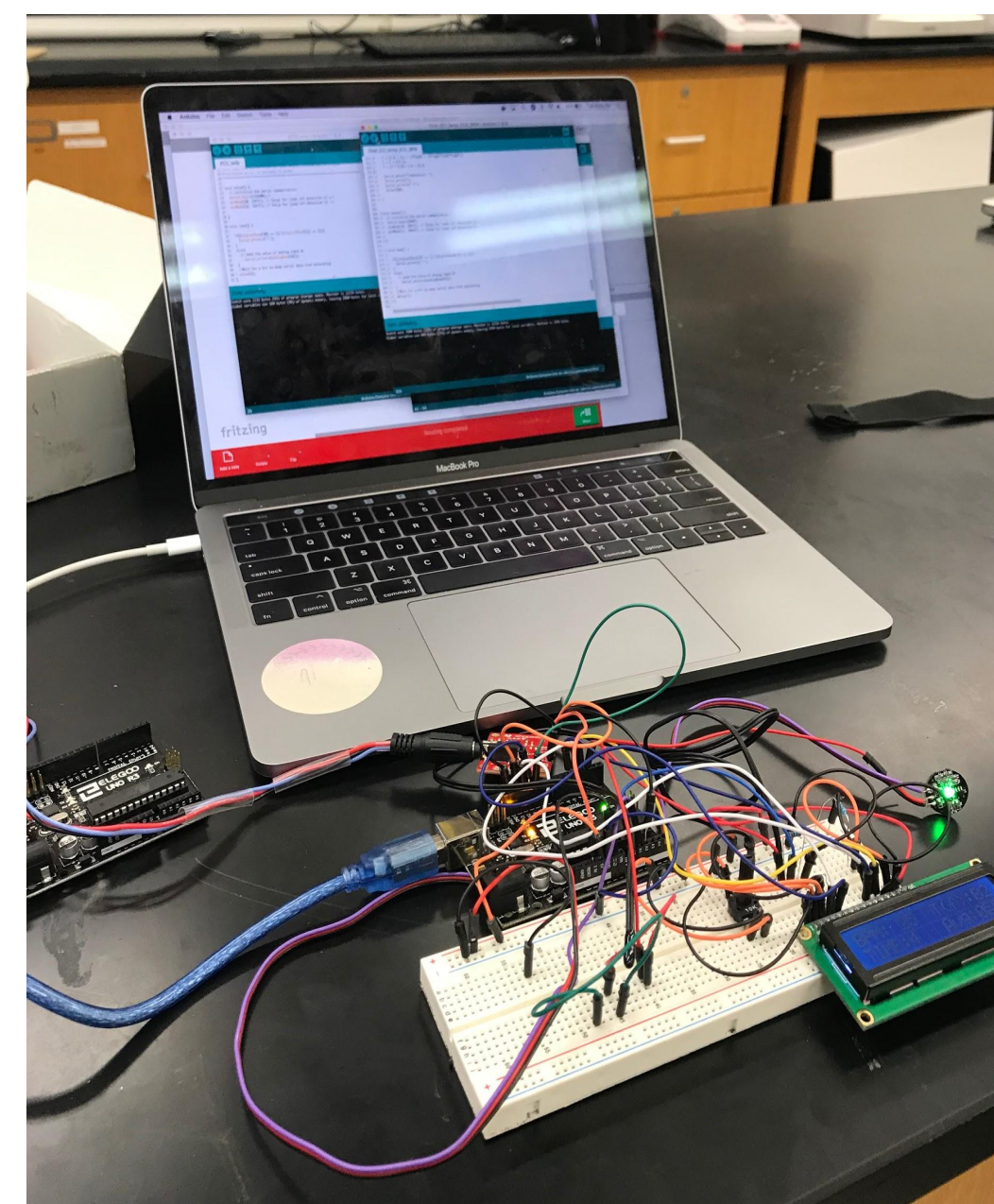


Figure 1. Working wearable prototype of device that will be used to predict heart attacks.

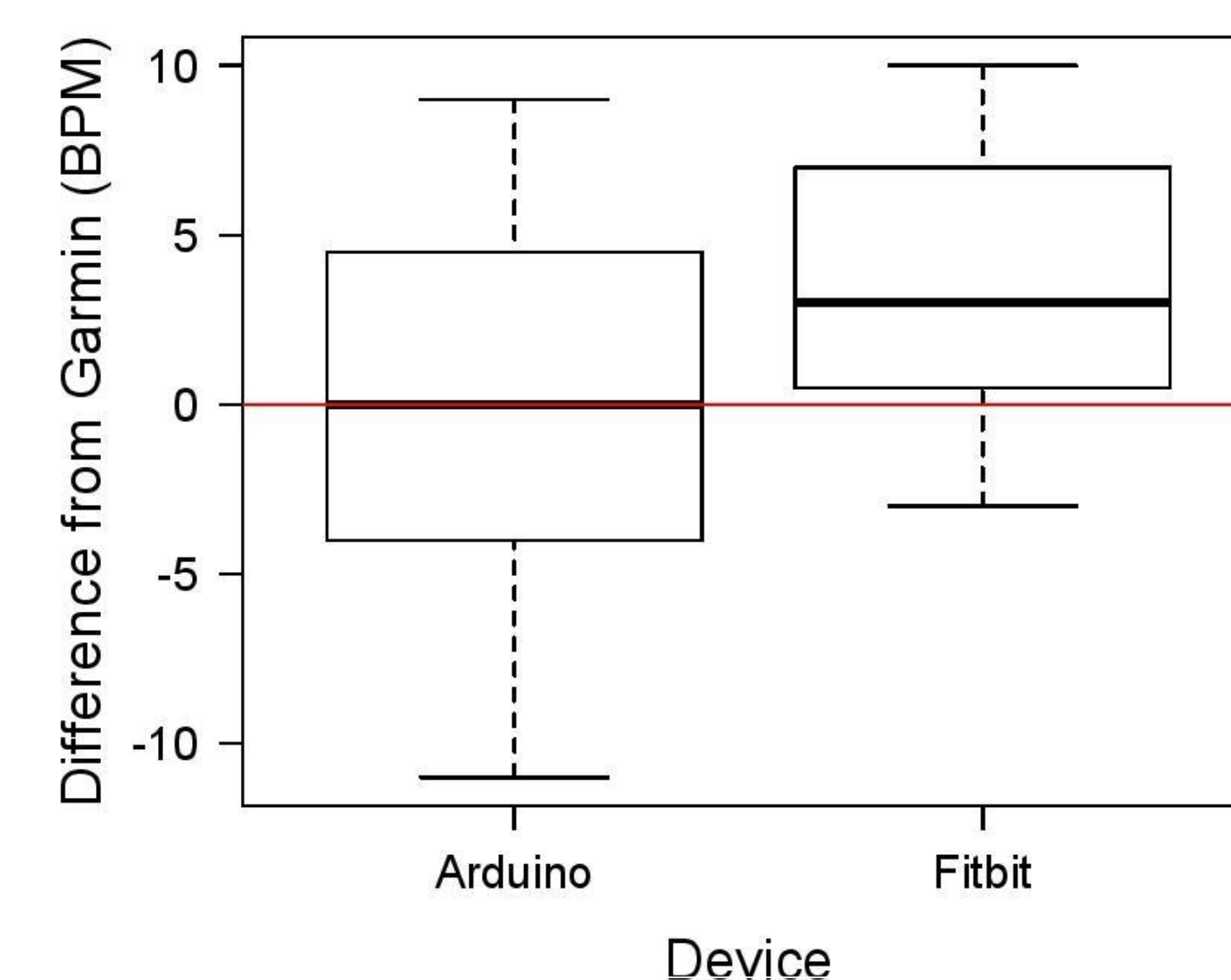


Figure 3. Graph depicting the accuracy of the pulse sensor in comparison to Fitbit and Garmin Chest Strap

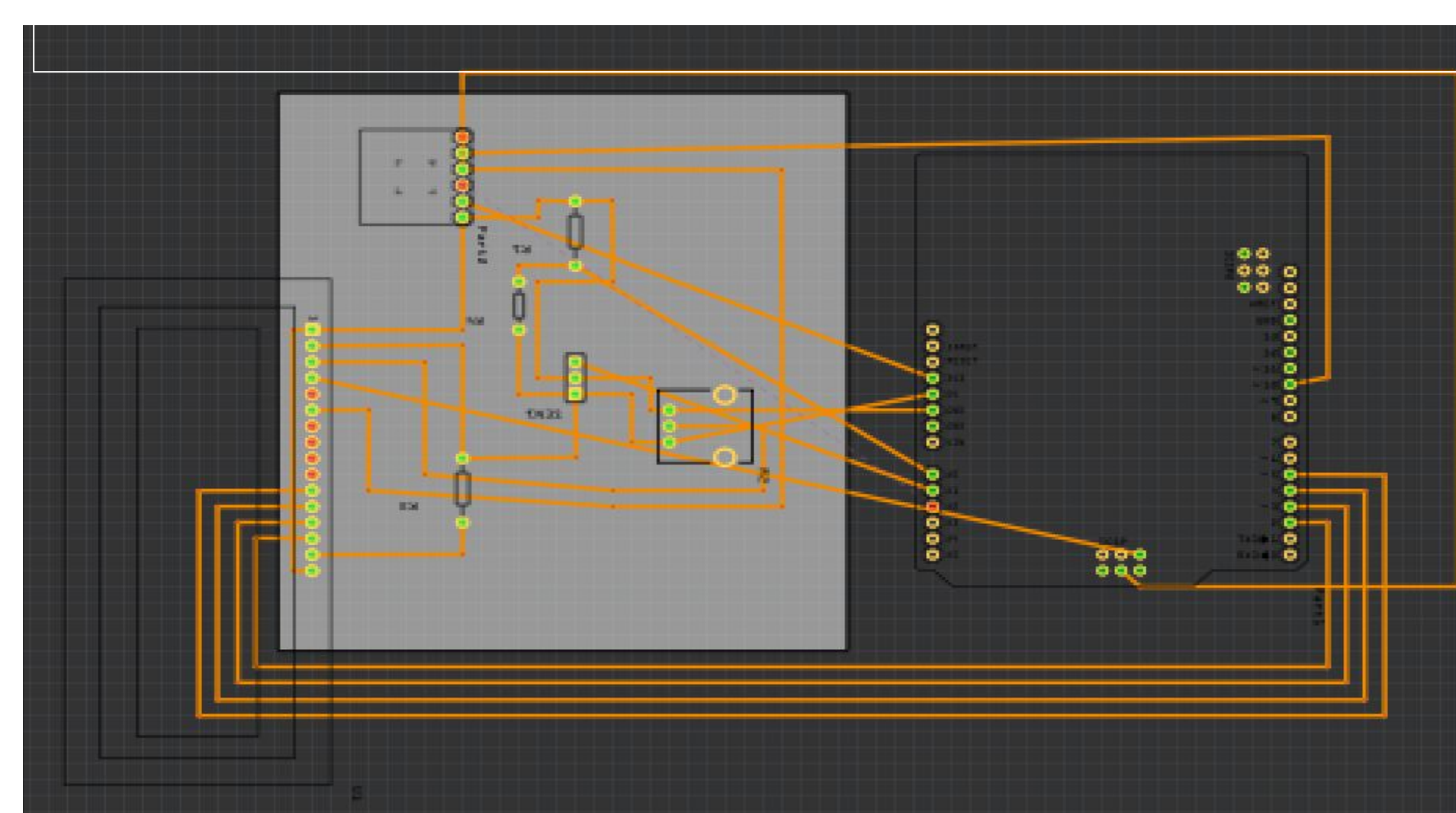


Figure 5. Schematic of the prototype on the breadboard.

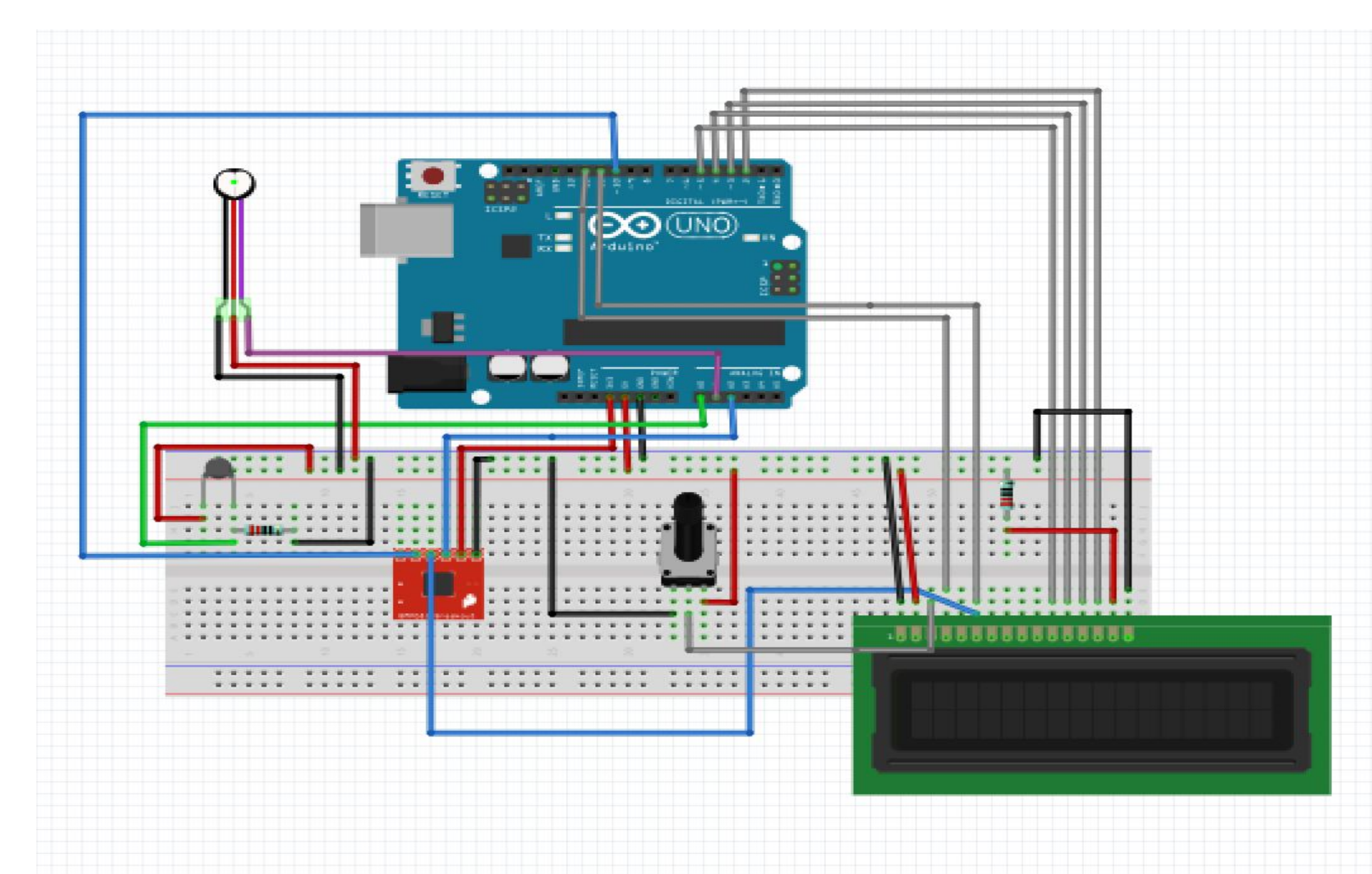


Figure 2. PCB design, which is based off of the prototype schematic.

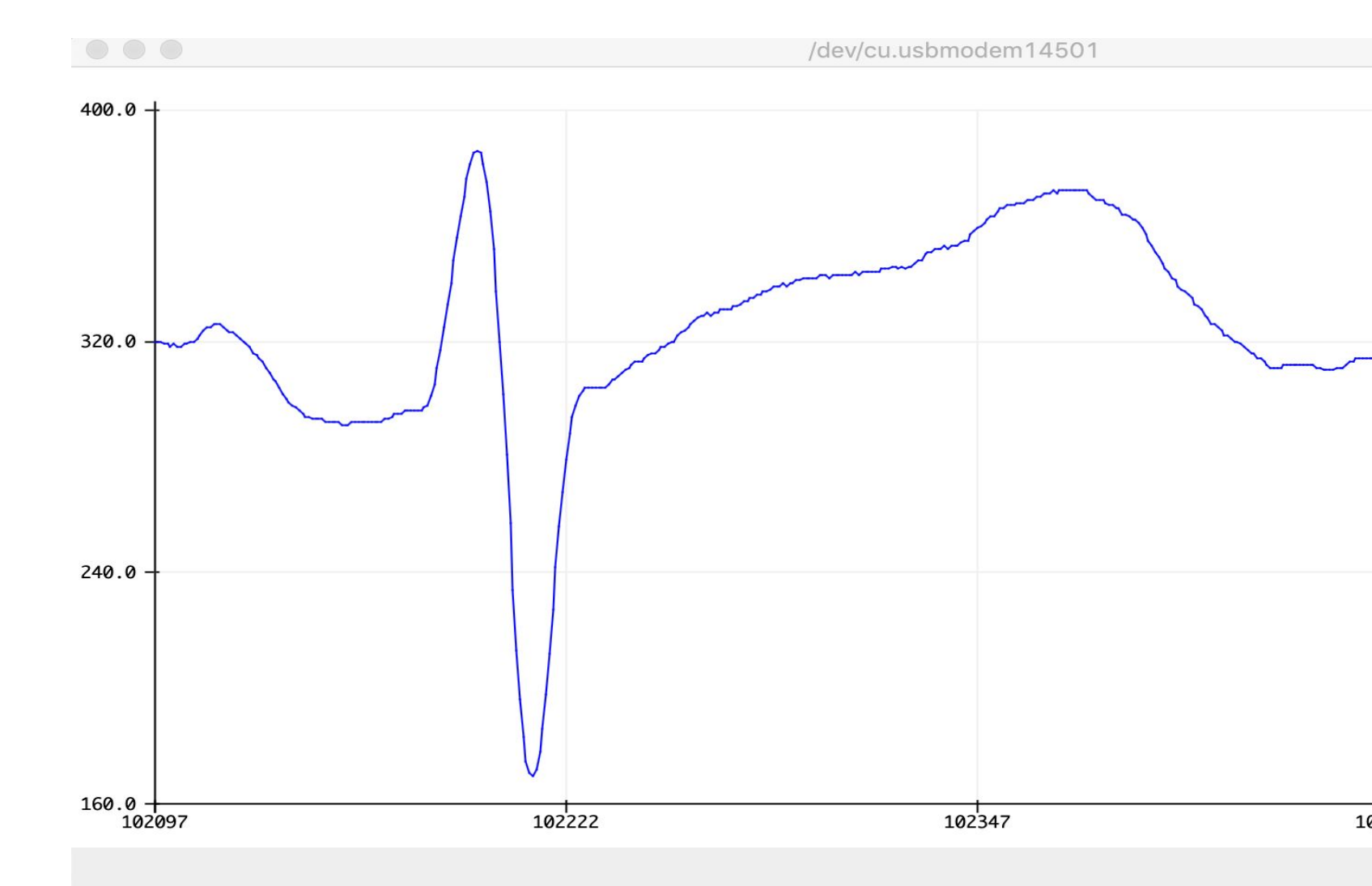


Figure 4. Example of QRS complex produced from ECG sensor

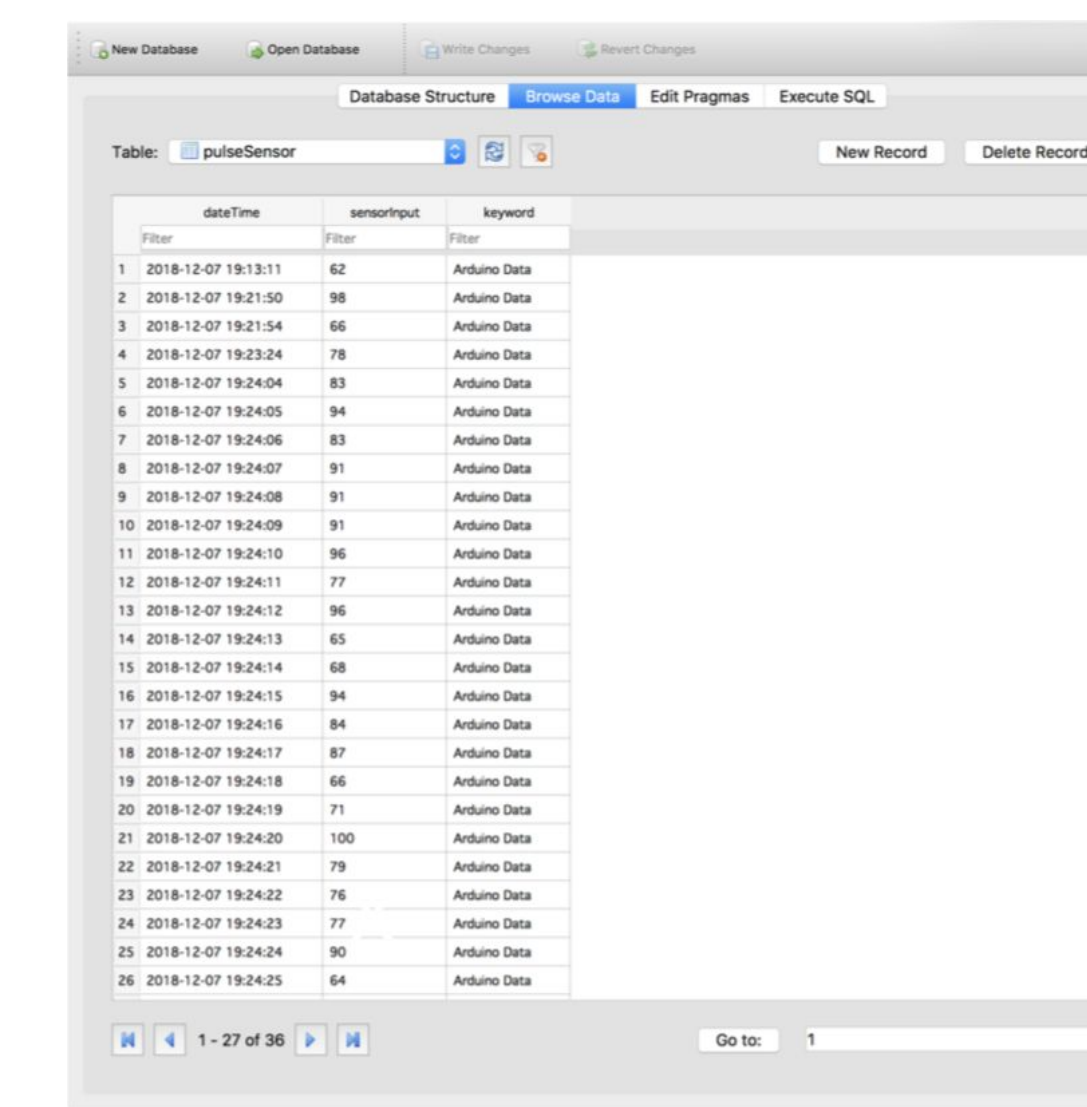


Figure 6. Example of SQLite database designed to store sensor data

## Things We Learned

- How to build a prototype using an Arduino
  - Coded 3 sensors working in parallel with each other
- How to 3D Print
  - Designed and printed a box to house the device
- How to create a SQLite database to store sensor data
- How to apply a filter to clean up signal noise
- How to determine the accuracy of our sensors

## Conclusion

Our completed project would give patients the means to recognize their symptoms and seek medical attention. The total cost of the prototype is projected to be \$80.00. Moreover, the production costs will be low because we use open source hardware. Team Arduino is different from mainstream health devices because we integrate sensors that measure key vitals and use this data to predict heart health. In the future, we plan to move to Raspberry Pi; we also want to make the device more portable by using a PCB.

## Citations

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