



# WEARABLE CARDIAC MONITOR

## Members of Team 24

- Andrew O'Brien
- Peyton Sher
- Ruiyu Sun
- Scott Beard
- Sam Kimball
- Vincent Lazzaro

## Client/Adviser

- Dr. Cheng Huang

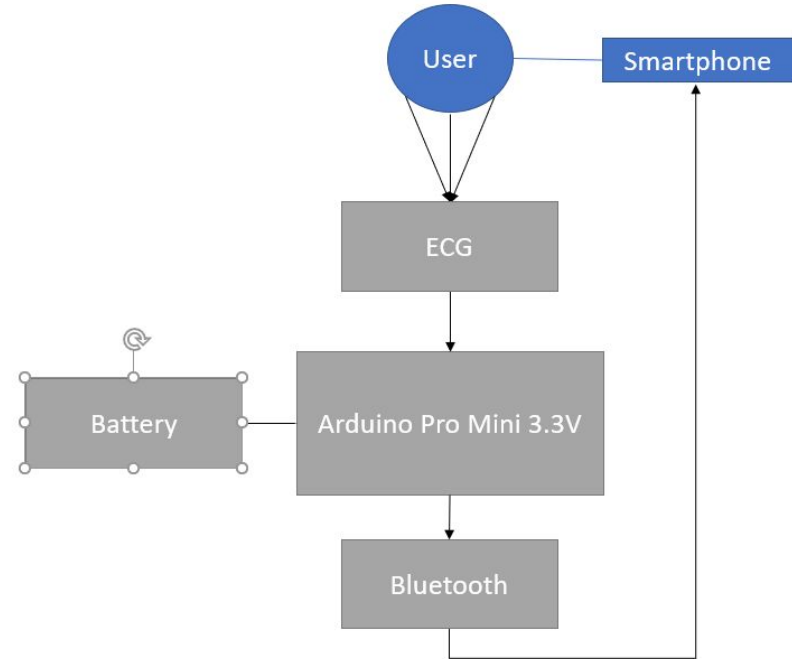
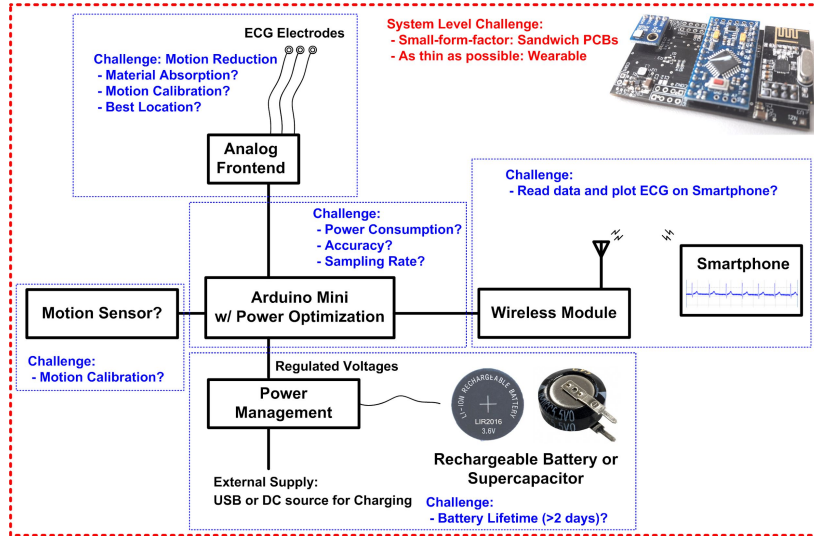
<http://sdmay20-24.sd.ece.iastate.edu/>

# Project Vision

Our team spent the last two semesters building a compact, energy efficient, and user friendly heart rate monitor. This monitor was to be smaller than the typical heart rate monitor to allow the user to wear it in their normal daily lives.



# Concept Sketch



# Design Requirements

- Measurements
  - Continuous
  - Quality
- ECG display
  - Send data via Bluetooth
  - View on smartphone (Android)
- Runtime
  - 48+ hour battery life
- Wearability
  - Size
  - Comfort
  - Accessories
- Memory
  - Android Device
- App
  - Usability
  - User interface

# Technical Requirements

- Bluetooth connectivity
- Low power usage
  - Minimum operating voltages
- Minimum Sizing
  - 50 mm x 70 mm
- Adequate sampling
- Rechargeable

# Operating Environment

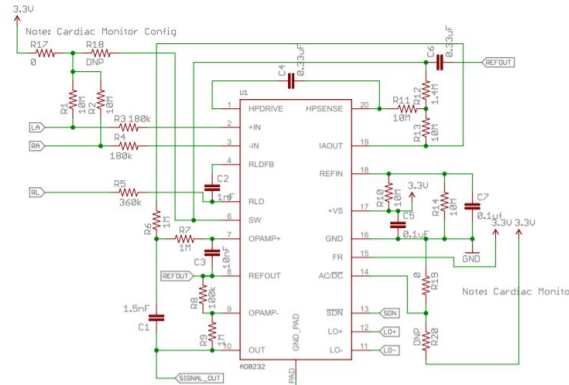
- Connected to the body
- Handle condition involving physical activities, sweat, weather
- Average daily conditions.
- Able to wear to bed and while showering. 48 hrs continuous



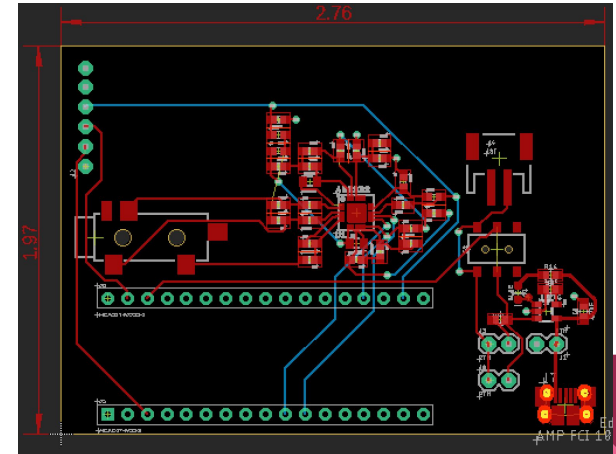
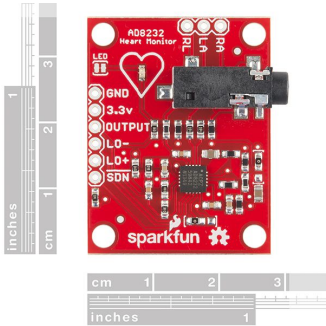
# Hardware Design



- 3-lead ECG reading
  - TRS Auxiliary connector



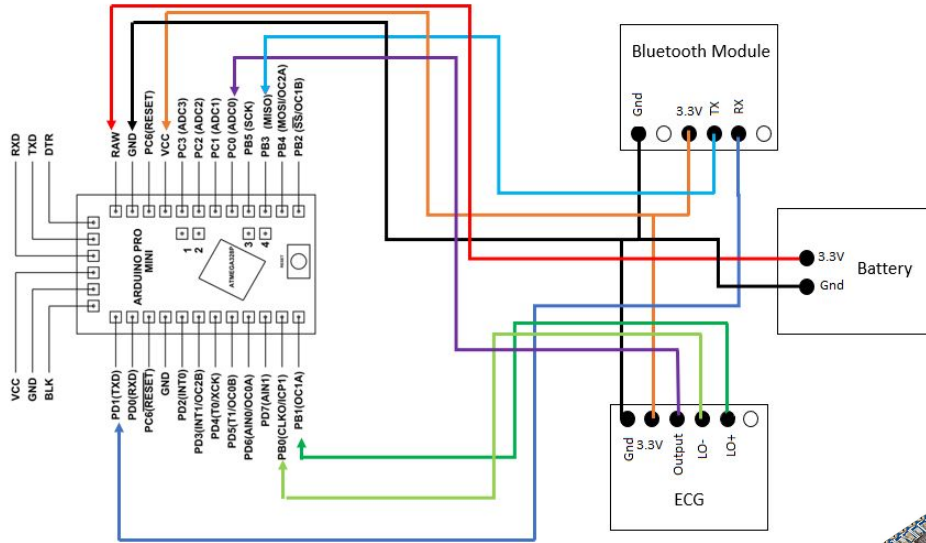
- AD8232 Chip
- New gel pad increases accuracy
- 3.7 V battery
- Regulated VDD from Arduino



<https://learn.sparkfun.com/tutorials/ad8232-heart-rate-monitor-hookup-guide/all>

[https://cdn.sparkfun.com/datasheets/Sensors/Biometric/AD8232\\_Heart\\_Rate\\_Mo](https://cdn.sparkfun.com/datasheets/Sensors/Biometric/AD8232_Heart_Rate_Mo)

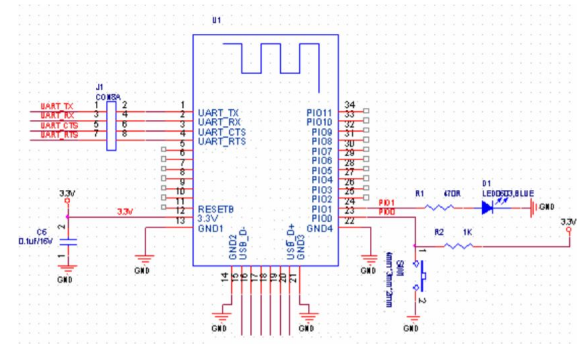
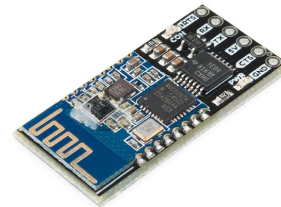
# Communication Design



<https://www.sparkfun.com/products/14839>



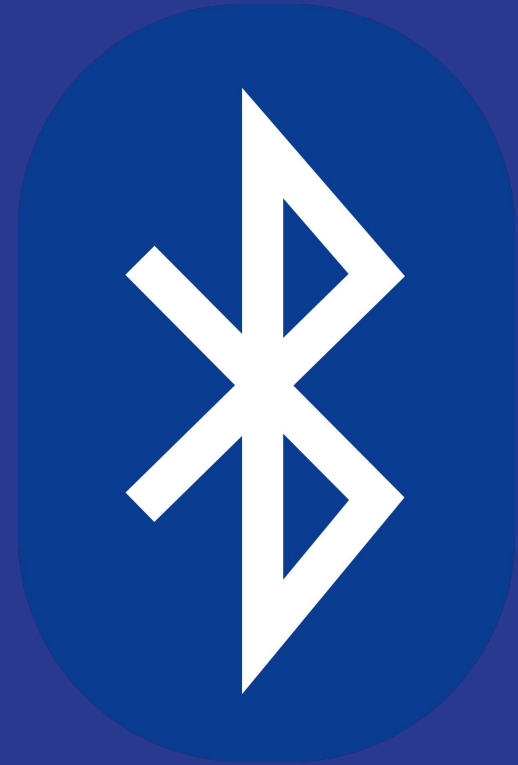
<https://www.arduino.cc/>





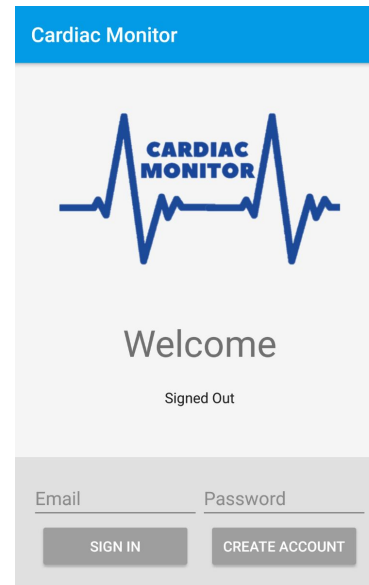
# Communication Design Issues

- Maintaining bluetooth connectivity
- Only send or receive data but not both causes a delay in data being sent over to the application
- Redesigned bluetooth connection to help

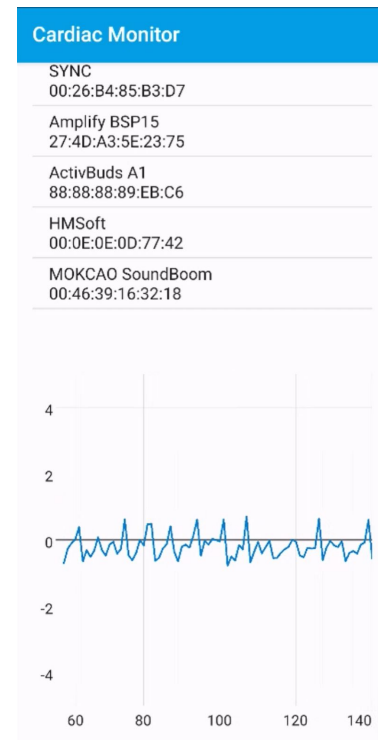


# Software Design

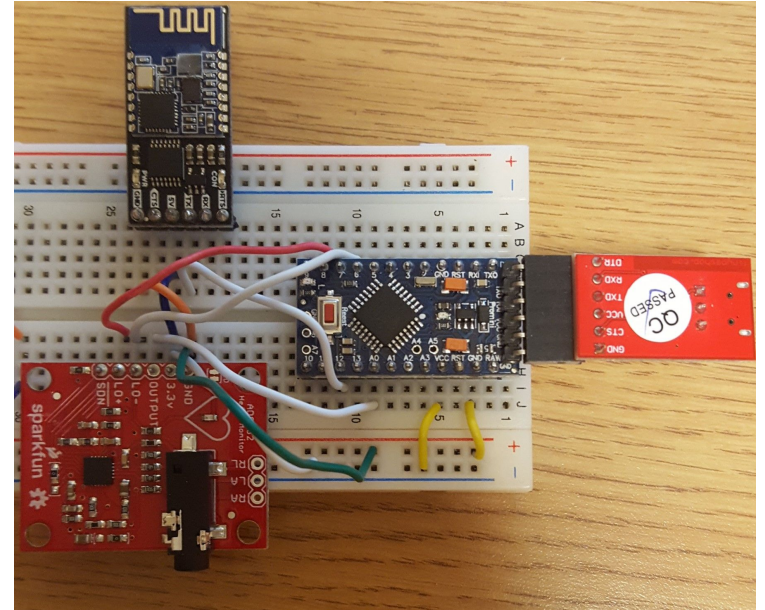
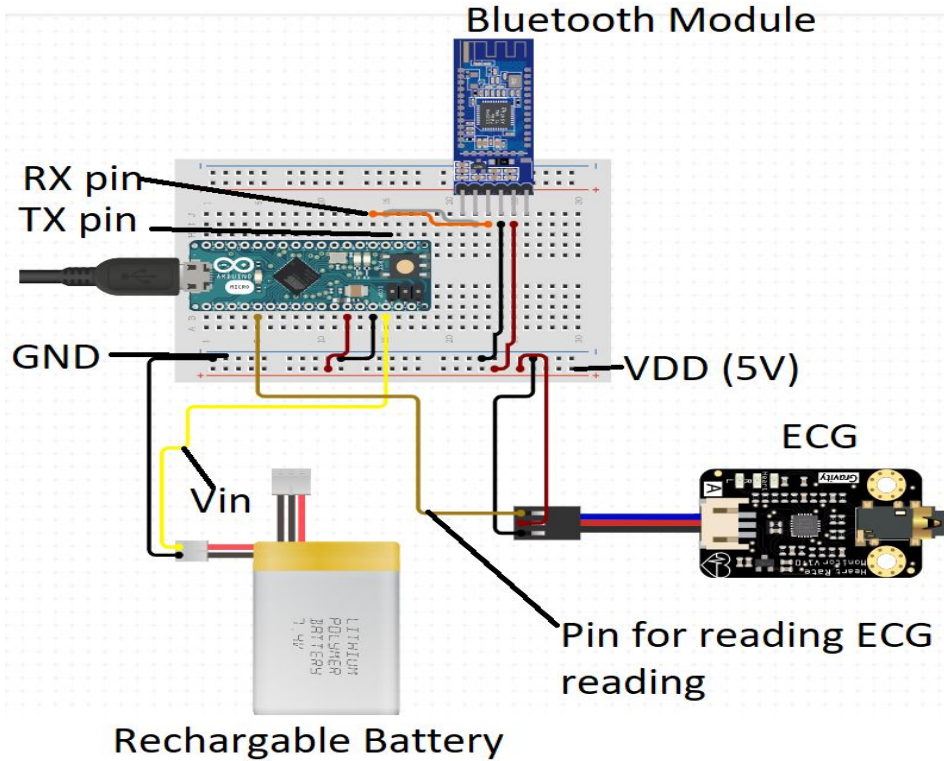
- Android Application which allows for tracking and storing Cardiac Information
- Google FireBase Login
- Similar to existing applications/user familiar
- Allow user to export data
- Maintain Bluetooth connection in background



Screenshots from our application



# Prototype of Final Product



# Final Product Design



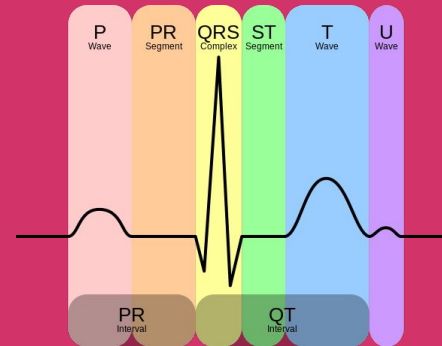
## Key Components

- Functionality vs. Power
- Small Form Factor (deck of cards)
- Eliminate Noise
- Style and Comfort
- Remove wires and try flexible circuit board to remove noise (unable to implement)

Model of the adjustable strapping we planned to use to hold the device

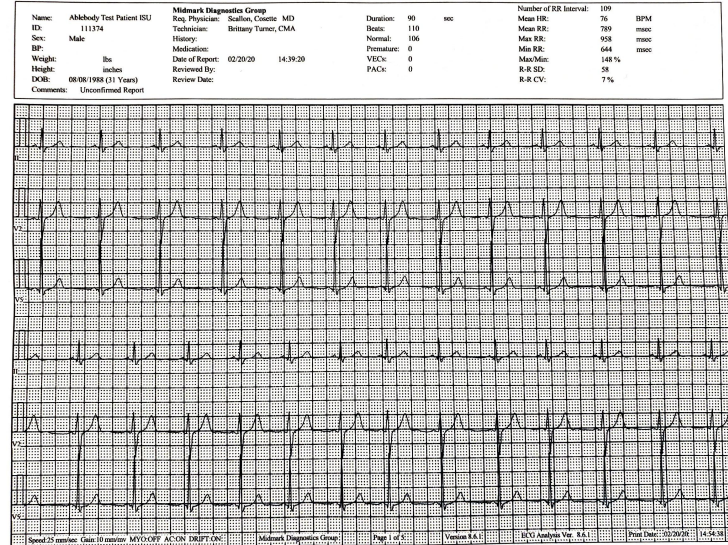
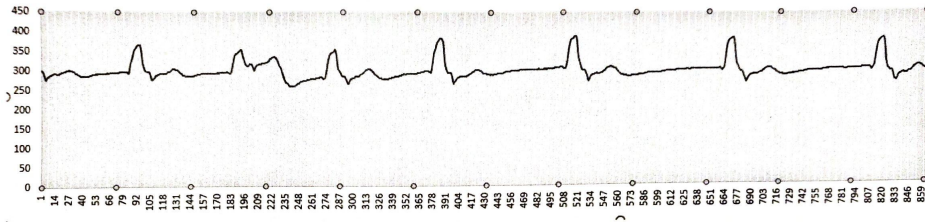
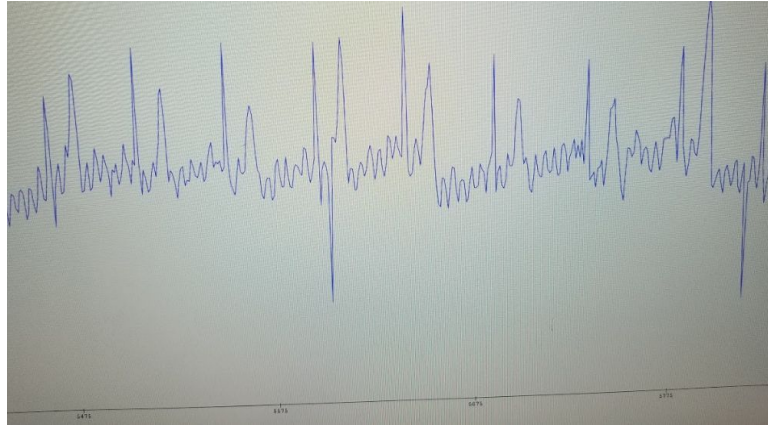
# Using a Reference Heart Rate Monitor

- BioPac
  - Old fashioned heart rate monitor
  - Weren't able to run tests
- Student Health Center
  - Cosette Scallon, MD
  - Helped us understand the important parts of a heartbeat wave
  - Gave us a readout of Vincent's heartbeat





# Our Results



# Engineering Standards and Design Practices

- IEEE Standards
- Circuit and Block Diagrams
- Agile practice & values
- Commenting on Code



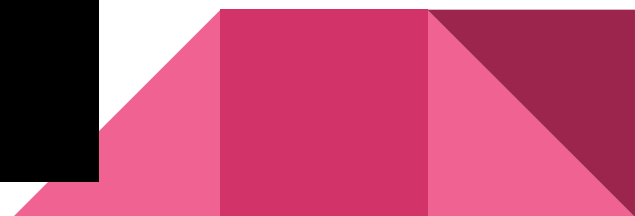
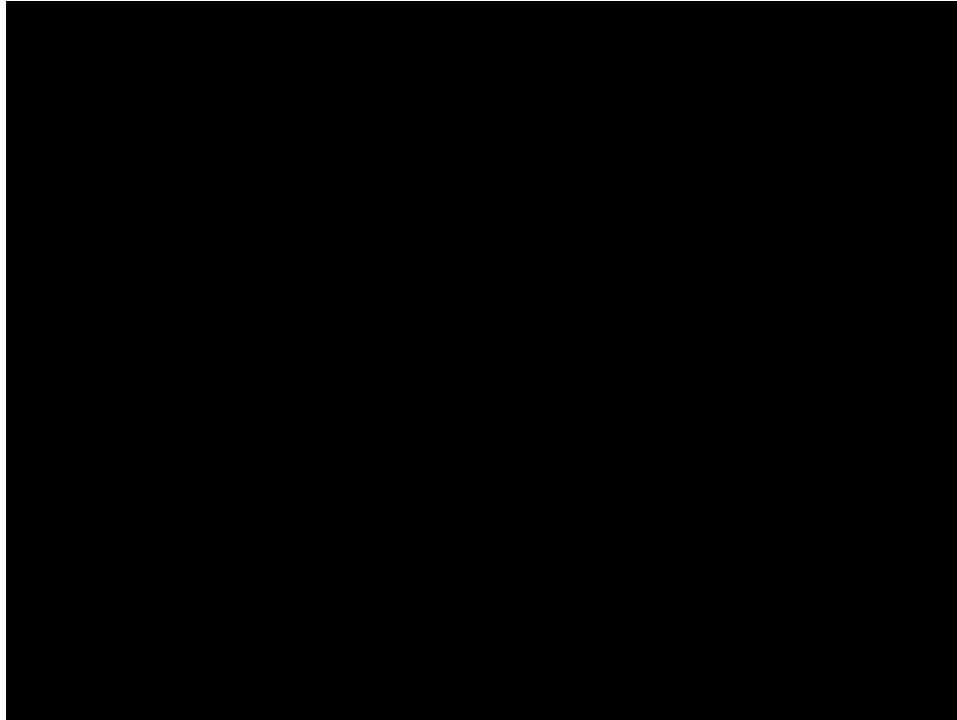
# How Switch Online Impacted Project

- Unable to package the final prototype its final product form
- In person team meetings couldn't happen
- Unable to do as much physical testing due to loss of lab access and equipment
- We were unable to order/install some of the features we wanted





# Demo Video



# Contributions

## Software

- Andrew O'Brien
- Peyton Sher

## Client/Adviser

- Dr. Cheng Huang

## Hardware

- Ruiyu Sun
- Scott Beard

## Communications

- Sam Kimball
- Vincent Lazzaro

# Questions?