

# EE / CprE / SE 491 – sdmay18-12

## Pilot Biometrics - ECG Waveform Captures Week 1 Report

*12/9/2017 – 1/26/2018*

*Client: Rockwell Collins*

*Point of Contact: JR Spidell*

*Faculty Advisor: Dr. Tyagi*

### Team Members:

Ryan Gallus - Team Lead

Justin Bader - Filter Design Lead

Zachary Glanz - Filter Design Lead

Kory Gray - Operating Systems Lead

Andrew Jones - Algorithm Design Lead

David Kirpes - Circuit Design Lead

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### Weekly Summary

Over break and for the first few weeks of the semester, our team focused on updating the microcontroller and developing the main algorithm. Our team succeeded in booting from a linux image and settled on a neural net algorithm design. In addition, we made advancements on the hardware and software filter and completed calculations for the power supply and memory requirements.

### Past Week Accomplishments

- Build OS and setup communication/dev environment on our board
  - Ordered/received Waveshare dongle and set up serial communication
  - Load U-boot and linux image and booted linux onto the board
- Started Neural Net Algorithm
  - Completed hidden layer class
  - Chose sigmoid function as the “activation function”
- Continued development of the hardware bandpass filter
  - Initial design ready to be built on breadboard for testing
- Continued development of the software filter
  - New filter algorithm started to use k-means clustering to exclude machine interference and other noise from final ECG waveform
  - Testing begun with synthesized noisy ECG data
  - Performance testing started on algorithm speed compared to ADC polling rate

- Calculated onboard storage requirements for 5 hours of operational data
  - Based on ADC polling rate and serial connection transfer rate between ADC and board
- Calculated power requirements for 5 hour operation of ADC and board
  - Ordered sufficient sized battery
    - 2,000 mAh
  - Initial design of power supply for consistent voltage
- Ordered ECG sensors for testing
  - 50 disposable ECG sensor pads
  - 3 leads

## Pending Issues

- Board resets when turned off, requiring a reboot from USB. Should be able to boot from memory.
- ADC power supply needs to be replaced.
- Waiting on a USB Dongle to arrive.

## Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Ryan Gallus	Worked on design of the hardware and software filter components. Calculated memory and battery requirements and ordered hardware.	25	65
Justin Bader	Talked with Ryan a little to discover how we will be reading the signal. Begun a simulation of our bandpass filter	4	39
Zachary Glanz	Worked with Kory getting OS set up. Began looking through ADC datasheet to figure out how to send data and get it to the board.	30	66
Kory Gray	Worked with Zach to install the OS onto the board. Ordered USB dongle in order to have a serial connection to the board. After booting the linux to the board, I found that the OS is not booting automatically after a reset. It still requires the serial connection.	25	58
Andrew Jones	Started neural net algorithm. This included starting hidden layer class, making each layer customizable (as in size), and choosing function that will be used for calculations. (sigmoid function)	20	52
David Kirpes	Began research for power supply. Collected requirements for battery, and the supplies to each of the boards. Started an initial power supply design to be modified as the project continues and additional requirements/constraints are discovered.	22	59

## Comments and Extended Discussion

- Although 3 leads were ordered with disposable pads, the final design will utilize 4 leads and reusable pads built into a harness design.

## Plans for Coming Week

- Interface ADC with microcontroller board
  - Use USB connection and board support software
- Test ADC with arbitrary waveform generator
  - Save output data on microcontroller
  - Test for 5 hour of operational data
- Order missing USB dongle
  - Interact with the OS