

EE / SE 491 Week 4 Status Report

Mar. 4, 2019 - Mar. 8, 2019

Group: sddec19-20

Project: Ultra-thin electronic skin for real-time health Monitoring

Advisor/Client: Liang Dong

Team Members:

Sovann Chak: Software Architect, iOS Developer

Omar El-Sherbiny: Circuit design and analysis of Sweat sensor

Justin Gordon: Software Developer, Communication research

Sungmin Kang: Circuit design and analysis of Mobility sensor

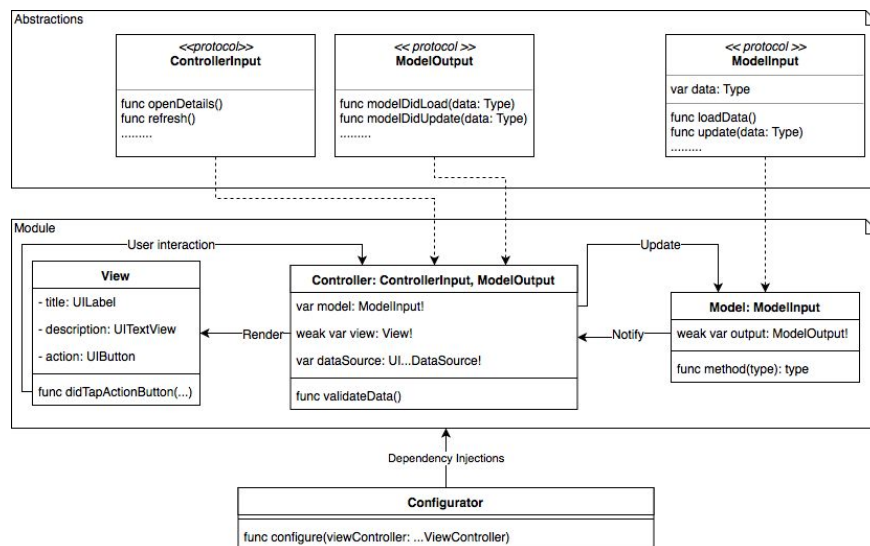
Sangwon Lee: Circuit design and analysis of ECG, DMD 3D printer

Passing Week's Accomplishments

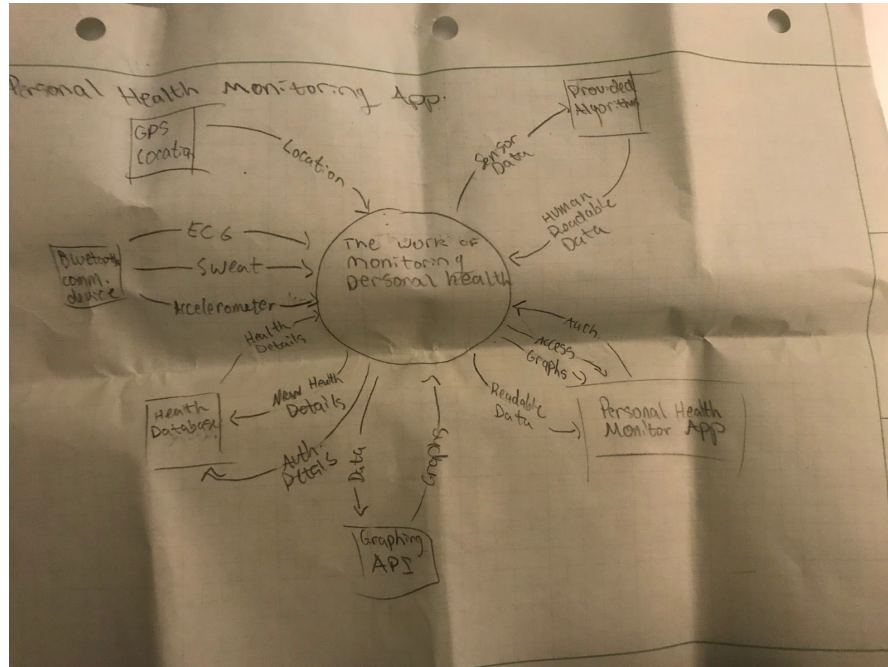
Software Engineers

(Sovann)

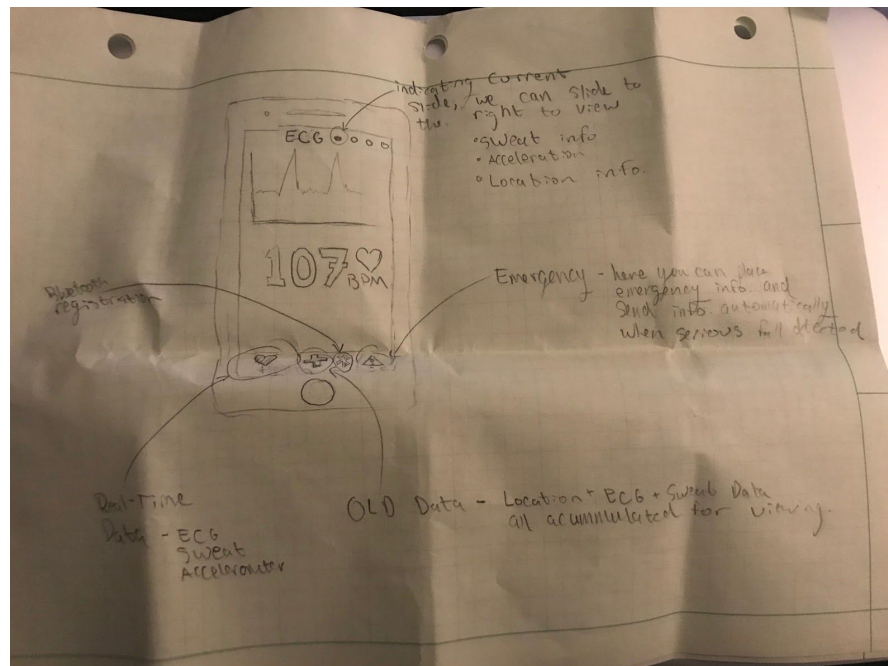
- Created small projects in Swift - which are loosely related to the project. But getting used to the language and how to properly develop on the device
- Refreshing myself on the MVC pattern which is essential to iOS development



- Our stakeholder cancelled our meetings due to his busy schedule, so I've attempted to reach out to him in regards to the parts we need to order, however, no contact has been received
- Designed a rough architecture using some documents and idea I sketched up which will be iterated upon as we come closer to the due date for our design document



(Context Diagram)



(Potential UI)

- Setup Raspberry PI 3 and begun learning how to send data via bluetooth from the device

<https://lifehacker.com/everything-you-need-to-set-up-bluetooth-on-the-raspberri-1768482065>

(Justin)

- Looked into setup Raspberry PI 3 and begun learning how to send data via bluetooth from the device
- Developed an idea for the application requested by the client
- Researched applications with similar architectures

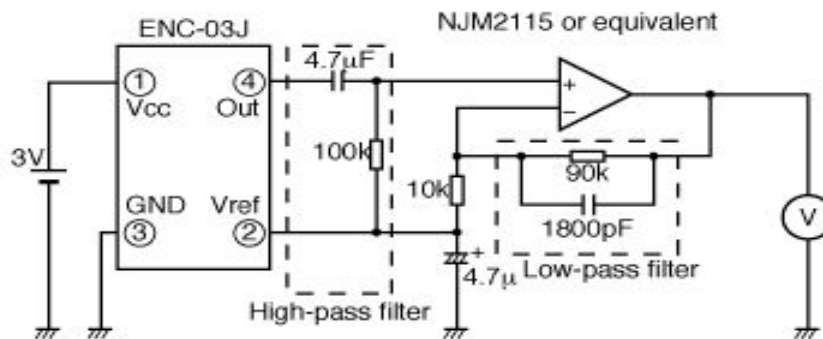


- Continued with learning required software

Electrical Engineers

(Sungmin)

- I could not make sure whether Gyro sensor will work on this project, because we did not have a group meeting with professor on this week due to his busy schedule.
- I checked about basic schematic of one of the Gyro sensor. It seems like programming needed for ENC-03J parts. I also checked other Gyro sensors, and also, in those Gyro sensors, it seems like programming is needed. I thought about the reason why programming is needed. I think it is for the calibration of degrees, and speed of rotation for detecting degrees.



(<https://www.gyroscope.com/d.asp?product=PIEZO>)

- Basic CAD tools will be fine to design circuit. In addition, C+ language skill will be required for programming Gyro sensor.
- Static electric field sensing also can be one of the way to measure body motion. This can be alternative way of Gyro sensor.

(Sangwon)

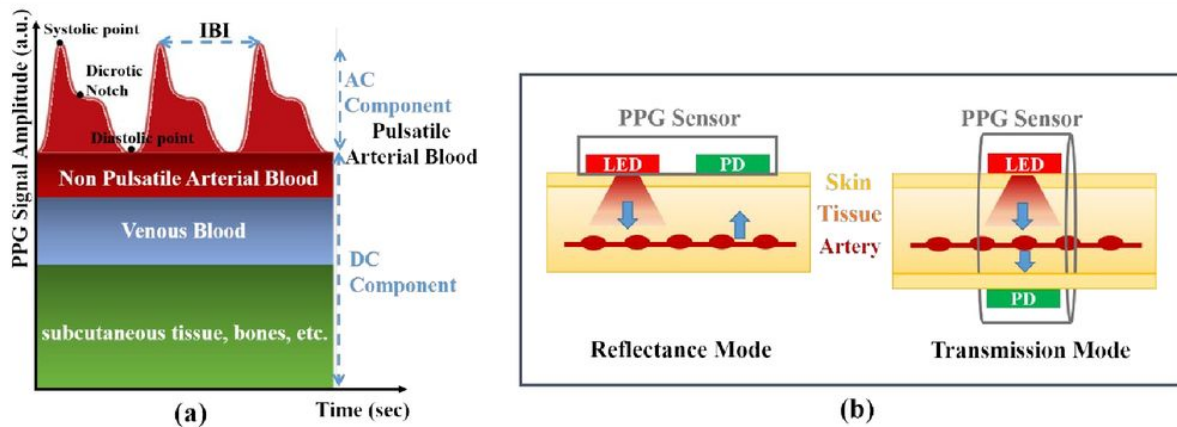
- To be portable, comfortable and limited of power supply, optical ECG is more better than 12-lead ECG sensor.
- 12-lead ECG need at least 5 bluetooth device or connect all sensor in wire. Right arm, left arm, right leg, left leg, and chest.
- Optical ECG(PPG) are widely used for wearable devices.



PPG for apple watch

- Basic principle of PPG is using optical devices emitter and receiver. LED emit light and photodetector detect amount of light and measure blood flow. More blood flows through the arteries when the heart expels blood (systolic phase) and less blood flows when the heart draws blood in (diastolic phase). When the blood volume changes between systolic and diastolic heart beats, it results in a change in the optical absorption coefficient of the arterial layer.

<https://www.sensorsmag.com/components/opto-mechanical-integration-heart-rate-monitors-wearable-wrist-devices>



A. Bilgaiyan, R. Sugawara, F. Elsamnah, C. Shim, Md. Affiq, and R. Hattori "Optimizing performance of reflectance-based organic Photoplethysmogram (PPG) sensor", *Proc. SPIE 10738, Organic and Hybrid Sensors and Bioelectronics XI*, 1073808 (14 September 2018); doi: 10.1117/12.2321060; <https://doi.org/10.1117/12.2321060>

Individual Contributions

Team Member	Contribution	Weekly Hrs	Total Hrs
Sovann	Created initial architecture using design documents that I sketched up (which were approved by the stakeholder) and setup the raspberry pi 3s' bluetooth functionality. Programmed rudimentary Swift apps for practice and learning purposes.	6	32
Justin	Continued looking into android development and front end architecture to make UI portable across multiple platforms. Start working with raspberry pis and projects using bluetooth.	6	31
Omar			24
Sungmin	Searching about basic structure of Gyro sensor circuit, and thought about programming parts in Gyro sensor. Also, searched software for designing mobility sensor. Found out that Static electric field sensing is one of the alternative way of Gyro sensor	6	32
Sangwon	Since ultra thin skin have to light and comfortable. ECG with multiple leads are not suitable to use so optical ECG(PPG) sensor seems more useful. 12-lead ECG need multiple wire or multiple wireless device. However, PPG we can put one place. In other word,	6	32

	more not only more comfortable but also less power.		
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Plans for Next Week

- (Sovann) Order parts for the raspberry pi 3s and take care of the reimbursement process through our stakeholder (this is repeated due to lack of communication on part of the stakeholder)
- (Sovann) Get a solid architecture approved by the stakeholder by next Friday (when we meet)
- (Sovann) Continue to program in Swift and begin creating relevant apps, possibly implementing some medical algorithms such as ECG/EKG signal reader
 - Possible resource:
 - http://www.openclinical.org/prj_medal.html
- (Sungmin) Inspect about Static electric field sensing as alternative way of Gyro sensor (<https://ubicomplab.cs.washington.edu/pdfs/an-ultra-low-power.pdf>)
- (Sungmin) Compare Gyro sensor to Static electric field sensing
- (Sungmin) Make sure which sensor will be proper for mobility sensor.
- (Justin) Get familiar working with raspberry pi and bluetooth
- (Justin) Create dummy applications akin to final app requested by client
- (Sangwon) Research on PPG and small size sensor design.
- (Sangwon) Research on PPG circuit.