

EE / SE 491 Week 7 Status Report

Apr. 8, 2019 - Apr. 12, 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)

(Sovann) Learn how to solder

- Watched various instructional videos to begin soldering the hardware together for our prototype
- Retrieved and prepared the breadboards and arduinos to begin to piece together the parts for the prototype
- Watched 2 hours of the iOS development course (<http://CS193p.stanford.edu>) and studied the intricacies of the language
 - Value Types
 - Lazy Properties
 - Tuples
 - Computed Properties
 - Extensions
 - Optionals
 - And other various design paradigms of the language
- Wrote and emailed our proposed parts list along with justifications for each part, and included a link to the itemized cart (<https://www.digikey.com/short/pj14qf>)

(Justin)

- Learned how to create an android emulator
- Downloaded full android studio
- Downloaded software for emulation of several phones
- Constructed a project using android studio to get a feel for it

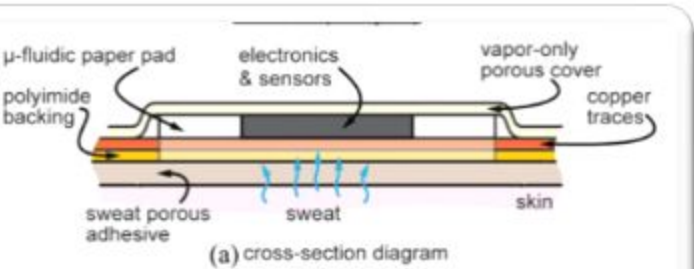
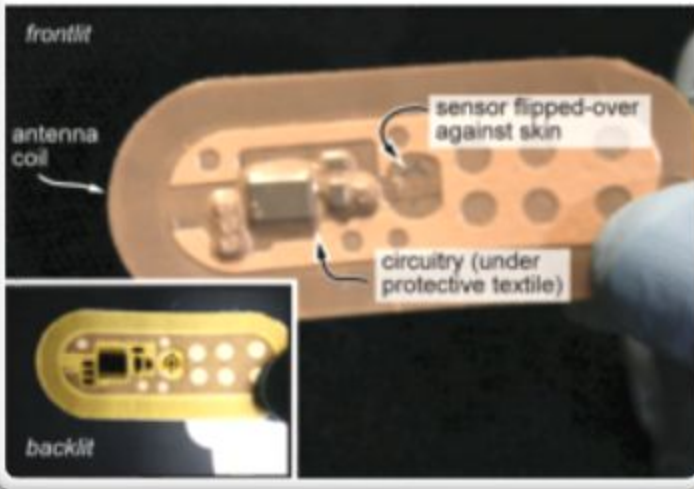
Electrical Engineers

(Omar)

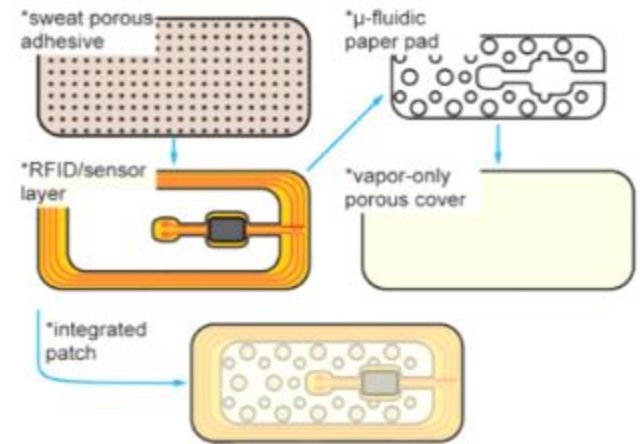
- Completed review of literature for 12 peer-reviewed papers for different sweat sensors designs.
 - Main goal was to explore the different platforms, different testing techniques, and different analytes.
- Device powering and communication might pose a challenge as none of our team members has worked with anything similar to this before.
 - To make the device reliable as possible, we need the sensor to operate without having to be recharged at any point.
 - After presenting literature review to client, we decided to do more research on RFID and NFC.
 - These methods of communication will mitigate the need for a power source since the receiver will power the device.
- Adhesion of the sensor to skin will be made using commercially available products either from Mepore or 3M.
 - A feasibility study will be performed.
- Since there is a plethora of elements that could be tested from sweat, we need to perform a feasibility study to see what recognitions element will be best to test for. Our goal is to find what is realistically achievable for a senior design project.
 - Different ions: Na⁺ , K⁺, Cl⁻
 - Different compounds: acetate, glucose, and ammonia
- A design similar to what is published in this paper looks the most promising.
 - D. P. Rose, M. E. Ratterman, D. K. Griffin, L. Hou, N. Kelley-Loughnane, R. R. Naik, J. A. Hagen, I. Papautsky, and J. C. Heikenfeld, “Adhesive RFID Sensor Patch for Monitoring of Sweat Electrolytes,” IEEE Transactions on Biomedical Engineering, vol. 62, no. 6, pp. 1457–1465, 2015.
 - It’s the size of a band aid
 - Interfaces with user through RFID communication
 - NFC is still a viable option



(a) phone and smallest communicating patch



(a) cross-section diagram

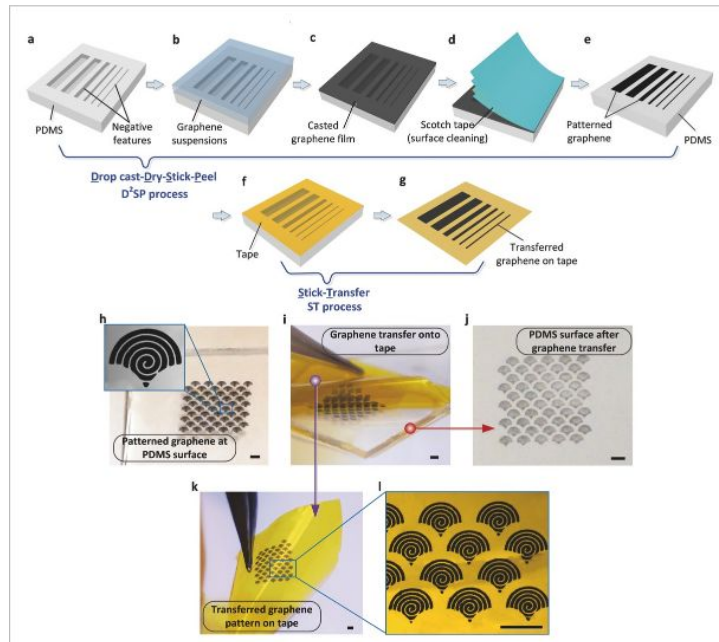


(Sungmin)

(Sungmin) Re-make pattern on the wafer using SU8-25 and photomask

(Sungmin) Finish the PDMS part, and got some mold based on our pattern

(Sungmin) Tried to get mobility sensor using the graphene, but there was some problem like every graphene stick on the tape.



<https://onlinelibrary.wiley.com/doi/full/10.1002/admt.201700223>

(Sangwon)

(Sangwon) research about carbon tape that can use for ecg sensor.

(Sangwon) read paper about to make more conductive and stable carbon sensor.

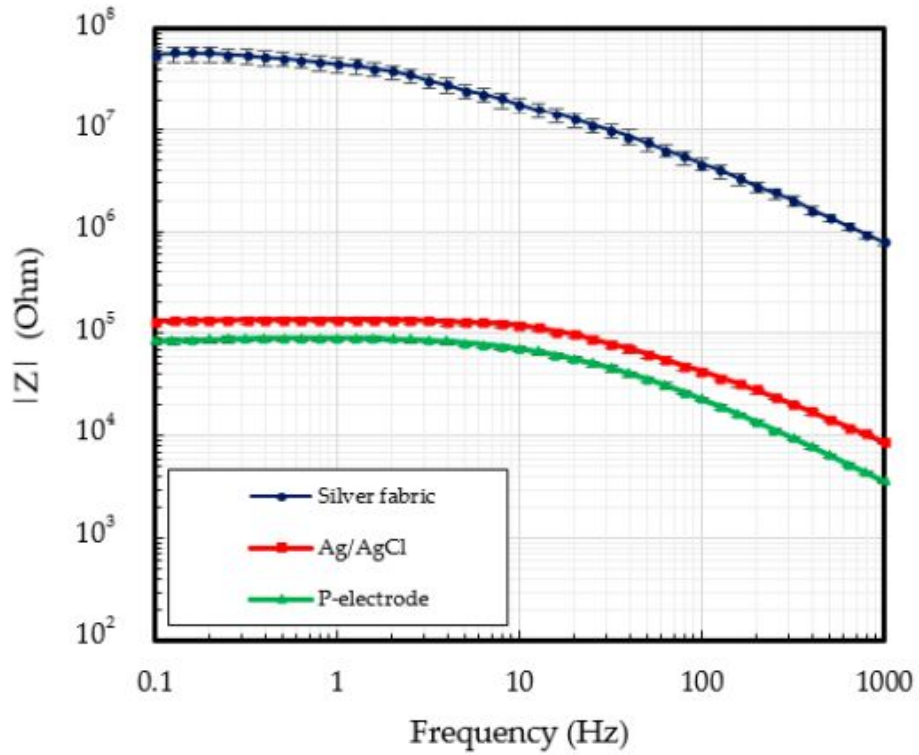
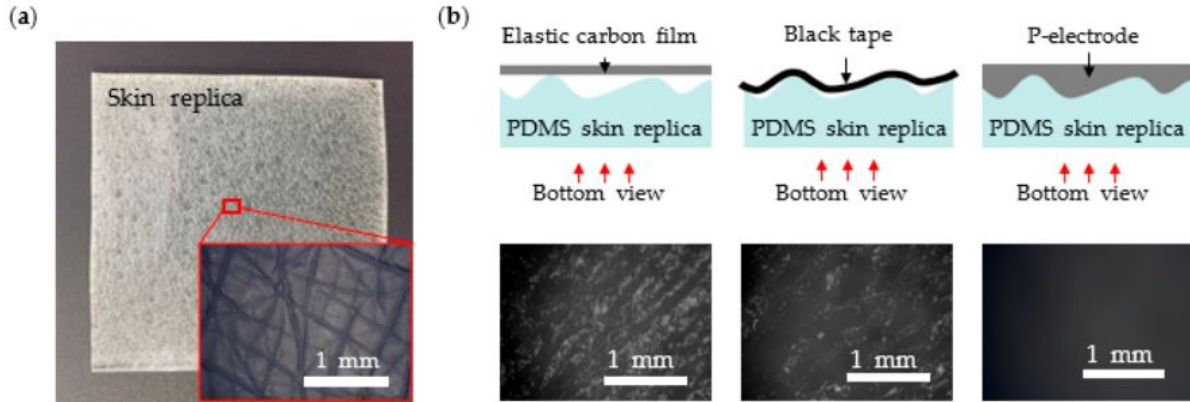


Figure 7. Contact impedance of the silver fabric, Ag/AgCl, and P-electrode.

Individual Contributions

| Team Member | Contribution | Weekly Hrs | Total Hrs |
|-------------|---|------------|-----------|
| Sovann | Prepared hardware and continued iOS development studies, as well as sent an email to our client to get our parts list approved. | 6 | 51 |
| Justin | Worked with android studio to learn how to develop and run android applications. | 6 | 49 |
| Omar | Finished review of literature and moved on to the initial stages of the design. | 6 | 43 |
| Sungmin | Made new pattern, and got PDMS mold based on our pattern at the wafer. Tried graphene part, but failed. | 7 | 45 |
| Sangwon | Research about carbon based sensor. | 6 | 51 |

Plans for Next Week

(Sungmin) Re-try graphene part, and after getting graphene pattern, apply on the stretchable tape (substrate).

(Sungmin) After getting graphene sensor with substrate, try to measure the resistivity using Neulog.



<https://www.fishersci.com/us/en/brands/JGMKROQG/neulog.html>

(Sovann) Order parts from ETG

(Sovann) Retrieve ordered parts from the ETG

(Sovann) Continue iOS development course (<http://CS193p.stanford.edu>)

(Sovann) Solder together the necessary parts for the prototype

(Justin) Continue using android studio

(Justin) Acquire parts needed for testing

(Sangwon) research more about signal processing about ECG

(Sangwon) try to measure voltage and test.

(Omar) Have a preliminary design ready

(Omar) Start manufacturing process