

EE/CprE/SE 492 Biweekly Status Report 3

Dates: 9/24/18 – 10/8/18

Group #: 5

Project: Micro-Electro-Mechanical Systems (MEMS) Based Sensing System for Soil Conditions Monitoring

Client: Dr. Halil Ceylan

Advisor(s): Shuo Yang and Dr. Yang Zhang

Team Members:

Nathan Coonrod (Report Manager)

Kyle Kehoe (Communications Manager)

Jacob Verheyen (Meeting Facilitator)

David Severson (Web Master)

Sok Yan Poon (Timeline Manager)

Summary

The past couple of weeks our team has been pushing to complete the design and layout of the DAQ PCB that will interface with our PCB sensors. The design is essentially complete and should be sent for fabrication the week of 10/8/18 pending final team review and discussion. Progress is shown in Figures 1 and 2.

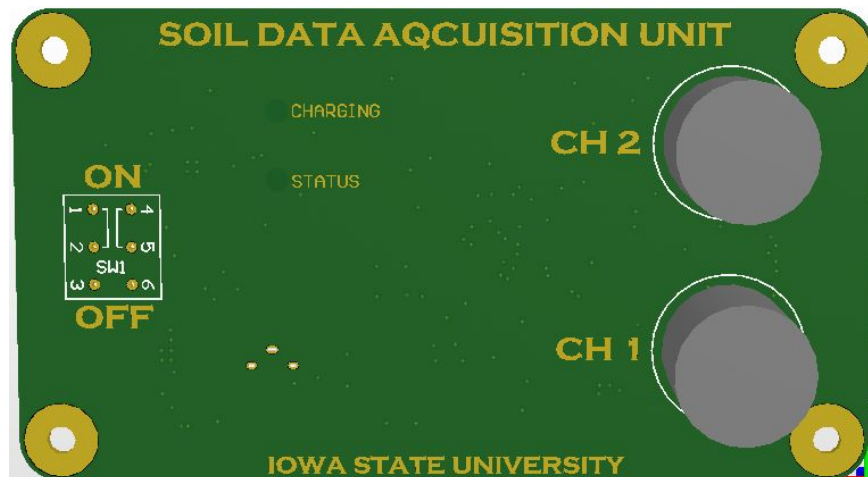


Figure 1: 3-D Rendering (Top View) of DAQ PCB

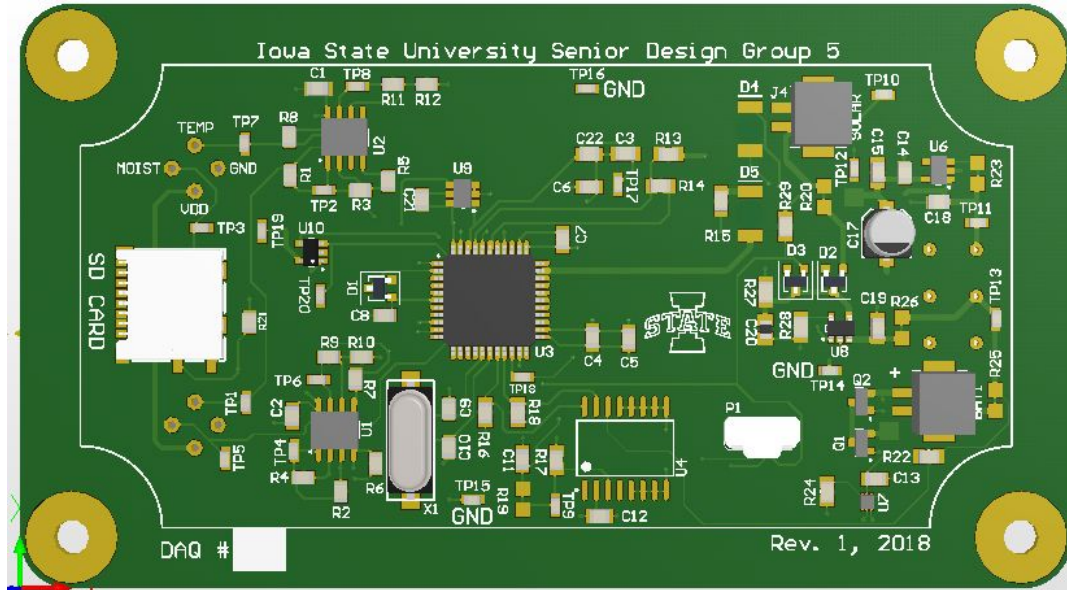


Figure 2: 3-D Rendering (Bottom View) of DAQ PCB

In addition, preliminary temperature characterization of a PCB DAQ sensor was performed in Coover using an electronic temperature chamber and a breadboard to help us interface with the sensor and obtain voltage measurements on the output. The results were promising for preliminary testing. We chose a few set points in 10° C increments starting from ~ -40° C to 40° C and observe the voltage output of a temperature sensor. Results are shown in Figure 3 and Table 1 on page 3.

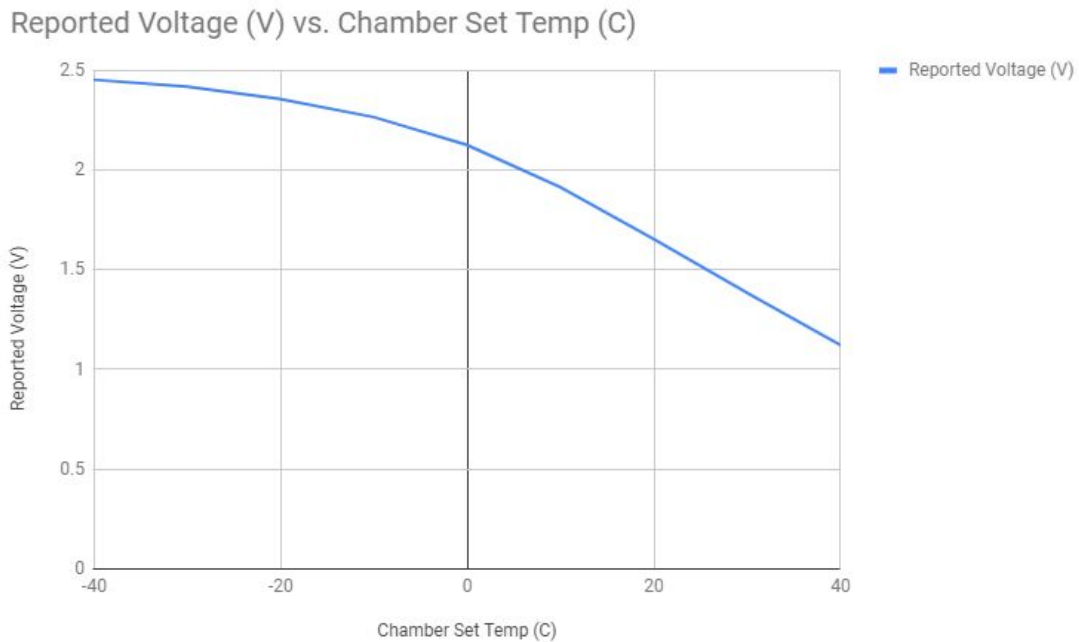


Figure 3: Voltage vs set temperature during temperature sensor characterization

Chamber Set Temp (C)	Reported Voltage (V)	Calculated Voltage (V)	Error (mV)	Error (%)
-40.1	2.4538	2.4687	14.891	0.60
-30.1	2.4202	2.4346	14.412	0.59
-20.2	2.3583	2.3736	15.314	0.65
-10	2.2660	2.2683	2.349	0.10
-0.1	2.1271	2.1125	-14.569	-0.69
9.9	1.9155	1.8970	-18.502	-0.98
20	1.6545	1.6305	-23.962	-1.47
30	1.3848	1.3439	-40.880	-3.04
40	1.121	1.0656	-55.356	-5.19

Table 1: Raw data collected from temperature sensor characterization

Moisture characterization of a sensor is to be performed in a lab in Town Engineering Building on 10/11/18 with setup assistance from our advisor Shuo Yang. The general procedure is to take a completely dry soil sample that we know the volume/mass of in a controlled environment and get a reading from our moisture sensor and iteratively apply

a known amount of moisture and record new voltage readings from our sensor. In this way, we can get enough data points and create a trendline that can be used in future software development to actually output moisture content levels.

Accomplishments

- Kyle: PCB DAQ review and inserted logo on the board for aesthetic appeal. Software development: Put Arduino to sleep and demonstrated that rising level interrupt triggers. Need to finetune and put in a control to make sure microcontroller doesn't go to sleep before it can be reprogrammed if desired.
- Nathan: Made revisions to DAQ PCB and attempted potting process on an assembled PCB sensor. Helped with temperature sensor characterization.
- Jacob: Finished DAQ schematic. Helped characterize temperature measurements of first sensor.
- David: Completed layout for the DAQ PCB.
- Sok Yan: Testing Arduino code for sleep mode and wake-up interrupt.

Pending Issues

- Hardware: Potting compound not adhering properly to sensor PCBs. Air pockets on trial run of potting compound used. Researching to see if an electronics potting company could perform this service possibly. We are also searching for another compound to use for potting. We believe epoxy will be a better route
- Software: One microcontroller "stuck" in sleep mode. Can't reprogram/recompile one of our microcontrollers for test software development since a control statement of some sort wasn't put in. Should be a straightforward fix for future software development using other microcontroller we have available.

Individual Contributions

Name	Contribution	Hours This Week	Hours Cumulative
Kyle	PCB DAQ review and inserted logo on it. Software development.	6	19.5
Nathan	DAQ Schematic and PCB, helped with sensor temperature characterization	8	21
Jacob	Finished DAQ schematic. Helped characterize temperature measurements of first sensor.	6	21
David	Completed layout for DAQ with circuit maker software (Altium)	8	20
Sok Yan	Software development.	6	19.5

Plan for Coming Weeks (10/8/18 – 10/24/18)

- Kyle: Continue software development and integrate with characterization of temperature and moisture sensors.
- Nathan: Continue sensor characterization, order DAQ components, continue software development of DAQ.
- Jacob: Assemble more sensors for characterization. Assemble DAQ for testing when it arrives.
- David: Completed layout for the DAQ to allow our circuit board to be printed.
- Sok Yan: Continue testing sleep-mode and wake-up interrupt.