

## EE/CprE/SE 491 Weekly Status Report 5

Dates: 2/19/18 – 2/23/18

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)

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### Weekly Summary

This week our team ordered parts for our first prototype design. We are now currently waiting for the parts to arrive and will assemble the prototype when the parts come in. In addition, we composed a list of questions regarding how to go about the project. Specifically, we wrote questions about the MEMS sensors and how we could possibly interface them with our DAQ design.

Since we had many questions about the MEMS sensors in general and how to properly use them in our DAQ design, our advisor Shuo helped schedule and coordinate a meeting with the developer of the MEMS sensors we are utilizing on the project. The developer, Yueyi, answered our compiled list of questions at our advisor meeting on 2/22/18. She was very helpful and gave us many good suggestions about how to approach utilizing the sensors on the project.

### Past Week Accomplishments

- Kyle: Met with our advisor and the developer of the sensors. Asked questions regarding how to test the sensors and data collection.
- Nathan: ADC accuracy measurements, battery estimates, prototype part ordering.

- Jacob: Met with advisor and designer of our sensors. Discussed potential new designs.
- David: Spoke with Dr. Tuttle and Lee Harker to figure out the best way to cut out the die on the wafers. Met with the sensor developer and asked questions regarding the sensors.
- Sok-Yan: Met with advisor and developer of sensor. Talked with Dr. Tuttle about how to cut wafer.

### Pending Issues

We are still in the process of figuring out a capacitance measurement circuit. Specifically, a measurement circuit that can interface with an Arduino and read in a precise and accurate enough capacitance value. We expect the capacitance to be in the order of a few picoFarads (pF). Our plan as of now is to use an RC filter circuit with a large precision resistor in the order of MegaOhms (MΩ) in order to make sure a large enough time constant can be found if the circuit were excited by a step input. The capacitance value could then be calculated using software by using the equation  $\tau=RC$  and rearranging to find capacitance  $C=\tau/R$  where  $\tau$  is just the time constant in seconds assuming standard units are used in the calculation for capacitance and resistance.

### Individual Contributions

<b>Name</b>	<b>Contribution</b>	<b>Hours This Week</b>	<b>Hours Cumulative</b>
Kyle	Met with our advisor and the developer of the sensors. Asked questions regarding how to test the sensors and data collection.	3	20
Nathan	Prototype planning and ordering, ADC resolution measurement	3	19
Jacob	Met with advisor and designer of our sensors. Discussed potential new designs.	3	17
David	Talked with Dr. Tuttle and Lee Harker to figure out how to cut the wafer - next step will be contacting the University of Minnesota to get the wafer cut and put on a PCB	2.5	19
Sok-Yan	Met with advisor and developer of sensor. Talked with Dr. Tuttle about how to cut wafer.	2	18

### [Plan for Coming Week \(2/26/18 – 3/2/18\)](#)

We plan on meeting as a team in the evening on 2/27/18 to work on a capacitance measurement circuit that can interface with our Arduino board. If our ordered parts come in sometime this week, we will also start assembling our prototype for the resistance (temperature) measurement circuit. In addition to doing some hardware work, we will also be doing some research into what kinds of test setups we need to characterize our sensors.