

## EE/CprE/SE 491 Weekly Status Report 6

Dates: 2/26/18 – 3/2/18

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

Attempted to measure capacitors of the required values, decided upon new measurement method to achieve ~10fF resolution. Prototype parts arrived and were partially assembled. Members of the team also spent time preparing sections of a design document. This document outlines how our team plans on carrying out a solution for this project and is posted on our team website.

### Past Week Accomplishments

- Kyle: Performed some research trying to figure out how to interface with a capacitive sensor. Assisted in helping measure capacitance with our original circuit idea.
- Nathan: Assembled prototype, attempted capacitance measurement with breadboard model, researched plans for adequate capacitance measurement and ordered samples.
- Jacob: Researched methods for capacitance measurements. Attempted capacitance measurement with breadboard model.
- David: Found multiple ways to cut and test wafer. Set up meeting with Dr. Tuttle to test the actual sensors and maybe cut them on 3/6. Worked on simplifying a capacitance measurement circuit.

- Sok-Yan: Worked on the design document, researched capacitance measurement, and researched techniques for cutting the silicon wafer.

### Pending Issues

Some members of the group attempted to measure capacitors on the breadboard model but were only able to measure down to 1nF and with an accuracy of 14%. A plan has been made to improve accuracy by using a new measurement method. The new measurement method involves using a circuit with active op-amp devices along with some passive components for feedback. We are using a template circuit design from an electronics website but will modify our circuit, so it meets our desired performance requirements.

The sensors need to be tested in order to be cut. We will be testing the sensors next week, and if enough are functional, we will decide to get them laser cut at the University of Minnesota or cut them using a scoring method here at Iowa State.

### Individual Contributions

<b>Name</b>	<b>Contribution</b>	<b>Hours This Week</b>	<b>Hours Cumulative</b>
Kyle	Performed research on circuits that interface with capacitive sensors. Assisted in trying our initial capacitance measurement method.	4	24
Nathan	Assembled prototype, attempted capacitance measurement with breadboard model, researched plans for adequate capacitance measurement, and ordered samples.	6	25
Jacob	Tested capacitance measurement technique and researched new techniques.	5	22
David	Arranged a meeting to get wafer tested before we cut it. Worked on simplifying a capacitance measurement circuit. Worked on Design Document.	4	23
Sok-Yan	Worked on the design document, researched capacitance measurement, and researched techniques for cutting the silicon wafer	5	23

### Plan for Coming Week (3/5/18 – 3/9/18)

We plan on finishing the assembly of our prototype for our DAQ system this week. Also, we will test and try our new capacitance measurement method and technique assuming our sample parts come in.

In addition, we will be testing our provided MEMS sensors to verify proper operation. If enough sensors are operational, i.e., ~50%, we will reach out to the University of Minnesota's Electrical Engineering department to see if they can laser cut our sensors from the wafer or use a scoring cutting method at Iowa State.