

EE/CprE/SE 491 Weekly Status Report 4

Dates: 2/12/18 – 2/16/18

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)

Weekly Summary

We obtained a backup batch of MEMS sensors for our project after the prototype batch were not functional. Our team met on 2/15/18 in lieu of our usual bi-weekly client meeting (cancelled) to work on implementing a resistance measurement circuit with an Adafruit Feather Adalogger board. This circuit utilizes a precision voltage reference of 2.5V that will allow us to better measure resistance values with more precision and accuracy. Also, we used a handheld multimeter to verify the functionality of sensors and observed output voltage and resistance readings for the MEMS sensors.

Also successfully logged readings to .csv file on SD card and exported to excel. Parts for prototype chosen to create deliverable prototype and to give a platform for software development.

Past Week Accomplishments

- Kyle: Assisted with writing Arduino code for measuring resistance using the data logger circuit. Did some research on precision capacitance measurement and calibration of sensor. Performed self-study to better familiarize myself with best practices of assembling components on a PCB.

- Nathan: Got voltage reference to give < 0.1% error which greatly improved ADC performance and ability to measure resistance. Successfully datalogged to SD card and chose prototype parts.
- Jacob: Researched methods to accurately measure small capacitances using an Arduino. Assisted with initial prototyping of resistance measurements using Arduino.
- David: Researched different methods to put a CSV plot into a readable format in excel. Also explored old macros I've written to get familiar with how excel's "coding" format works in order to make pretty plots of the data from the CSV files. Assisted with the arduino resistance measurement.
- Sok-Yan: Researched the measurement of capacitance sensor on temperature.

Pending Issues

We are still working on implementing moisture measurement capabilities with our data acquisition system. We have sensors that are capable of measuring moisture by providing a varying capacitance between its leads. However, we would like to meet with the developer of the sensors to make sure we are understanding the appropriate relationships among variables of concern and whether additional calibration needs to be done by us or if there is some form of existing raw data we could utilize in order to write our software.

Individual Contributions

Name	Contribution	Hours This Week	Hours Cumulative
Kyle	Capacitance measurement and sensor calibration research. Assisted with writing code for resistance measurement data logger circuit.	5	17
Nathan	Resistance measurement with Adalogger and LM4040 reference. Successfully logging resistance at resolution under 1 ohm	5	16
Jacob	Researched capacitance measurement techniques. Assisted with prototyping of resistance measurements.	4	14
David	Explored Excel data analysis methods. Reviewed old scripts I've written in Excel Macros. Helped with resistance measurement prototype	4.5	21
Sok-Yan	Researched capacitance measurement on temperature	4	16

[Plan for Coming Week \(2/19/18 – 2/23/18\)](#)

We are working on scheduling a time to meet with the developer of the MEMS sensors to see if there is any raw data that could be useful in helping us calibrate moisture measurements from the MEMS sensors. This could save us time if we do not need to perform our own tests to calibrate the sensors. Moisture content measurement by precisely measuring capacitance will be very challenging and as such reliable data from calibrating the sensors is needed to write the necessary Arduino software to yield accurate moisture measurements. Our goal is to test and prototype a circuit that can measure capacitance values accurately in the pF range this week.