

[EE/CprE/SE 492 Biweekly Status Report 5](#)

Dates: 10/22/18 – 11/5/18

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](#)

Our DAQ PCB boards arrived along with components to populate the boards. The team spent a Friday afternoon using a stencil setup, solder paste, and a hot air heat gun to solder most of the active and passive components on the board. Other components and connectors were hand-soldered. A mostly assembled board is shown below in Figure 1 without moisture and temperature connectors. Hardware debugging and integration with software is currently in progress.



Figure 1: Assembled DAQ PCB

Since we discovered that the resistance of soil drifts over time, we decided to measure the capacitance of the soil in order to determine the moisture content. We had tried to implement this type of circuit on our original DAQ that we designed last semester. However, we found different type of capacitance measurement circuit based around a 555 timer (shown [here](#)) and schematic shown in Figure 2. We plan to use this type of circuit to measure capacitance for the next revision of our sensor. We purchased the sensor shown on that website, and are tinkering around with it to verify that the technique works before we implement it.

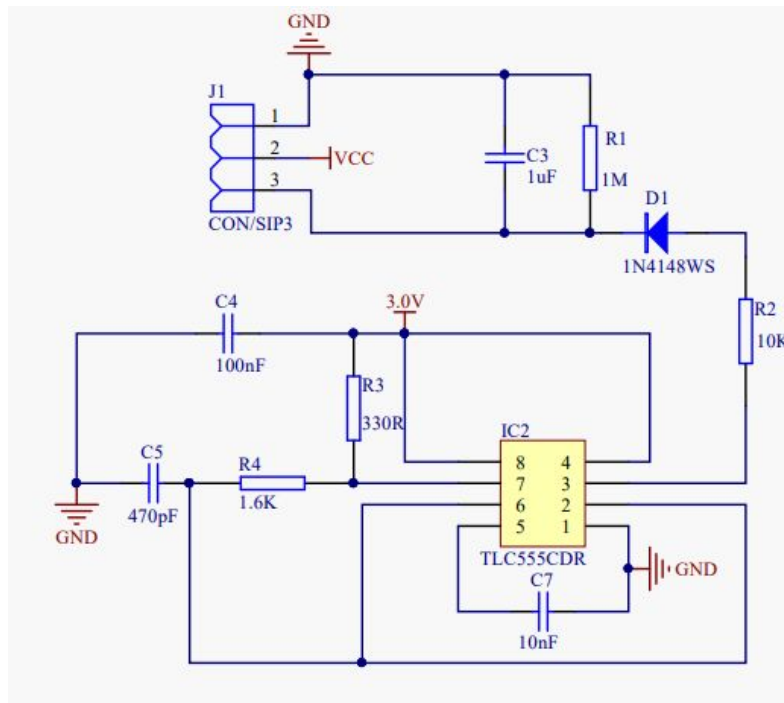


Figure 2: Reference circuit for capacitive moisture sensor.

Accomplishments

- Kyle: Assisted with DAQ PCB assembly using solder paste and stencils. Programmed RTC to keep track of time and timestamp measurements. Also wrote code to implement checking the battery level and SD cards being present on the DAQ. Drafted AutoCad drawing file for custom box enclosure design.
- Nathan: Helped assemble and solder DAQ as well as some moisture sensor redesign/testing. Debugged DAQ issues, loaded Arduino bootloader, and began testing of DAQ hardware to prepare for software testing.
- Jacob: Characterized old moisture sensor at different frequencies. Simulated capacitance measurement circuitry that we originally used on old DAQ. No longer using old measurement circuit, using a new circuit based on a 555 timer. Created Altium schematic for new capacitance measurement circuit.
- David: Characterizing and testing old moisture sensors. Found new capacitance measurement circuit which will allow us to move forward with soil moisture sensing. Began creating new soil moisture PCB.
- Sok Yan: Assisted with soldering DAQ PCB using solder paste and stencils. Overview arduino code.

Pending Issues and Tasks In Progress

- Connectors and cable not compatible
 - Minor issue: Solution is to buy a connector and cable with appropriate keyed slots
- Redesign of capacitive moisture sensor
 - In progress and hope to have ordered by end of week 11/5/18
- Custom enclosure design
 - Spoke with ETG to have custom box fabricated
 - Currently in progress
- Missing trace on DAQ PCB
 - Put small jumper wire in its place for now
 - Will be corrected if future orders of DAQ PCB are placed

Individual Contributions

Name	Contribution	Hours This Week	Hours Cumulative
Kyle	Software coding, DAQ assembly, and AutoCad drawing for enclosure.	8	35.5
Nathan	DAQ assembly, debugging hardware issues, and software development.	10	38
Jacob	Moisture sensor characterization, simulation, schematic layout.	8	36
David	Moisture sensor characterization, testing. Working with new sensor circuit.	7	34
Sok Yan	Solder DAQ PCB, and overview software code.	8	35.5

Plan for Coming Weeks (11/5/18 – 11/19/18)

- Kyle: Software testing and debugging on the actual DAQ PCB hardware. Assist with capacitive moisture redesign and characterization.
- Nathan: Finish testing of hardware, start documentation, help develop DAQ software, fix any DAQ design issues.
- Jacob: Finish sensor design and order new sensors. Test sensors when they arrive.
- David: Ordered new sensors, continued testing of new sensors for our sensor fabrication.
- Sok Yan: Assisted with software testing and moisture sensor characterization.