

EE/CprE/SE 491 Weekly Status Report 3

Dates: 2/5/18 – 2/9/18

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

Our project team worked on compiling a project plan document. The project plan is meant to articulate our approach and plan to carry out the MEMS data acquisition system project to completion. Elements of this document include a problem statement, constraints, background information, a timeline, approach, and conclusion.

In addition, initial resistance measurement testing using an Arduino Uno was performed. A voltage divider circuit was used to measure an “unknown” resistor value by measuring a known resistor value as shown in Figure 1 on page 2. The nominal values of the unknown and known resistor values were 4.7 kOhm and 1 kOhm respectively. We measured the actual resistances of these resistors using a multimeter. We then compared the output value of the unknown resistor value the Arduino Uno was obtaining for an output versus what the multimeter was displaying for resistance. Figure 2 shows the output for the unknown resistor (R2) in Ohms and Table 1 summarizes the difference in measurements.

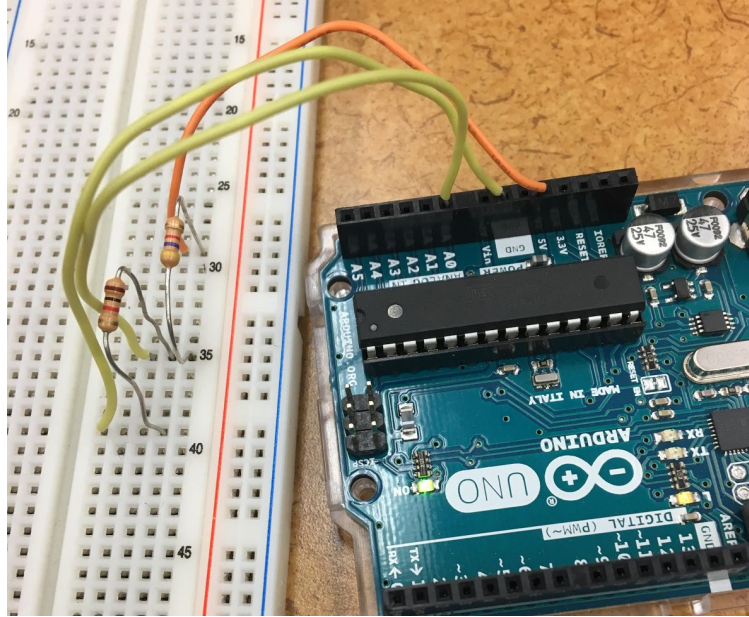


Figure 1: Voltage divider circuit used to perform initial resistance measurement testing.

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R2: 4664.02
Vout: 0.70
R2: 4695.78
Vout: 0.70
R2: 4664.02
Vout: 0.70
R2: 4695.78
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Vout: 0.70
R2: 4695.78
Vout: 0.70
R2: 4664.02
Vout: 0.70

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Figure 2: Arduino resistance measurement readings. R2 is the unknown resistor.

Average Arduino Resistor Value (Ohms)	Multimeter Measured Value (Ohms)	Discrepancy in Measured Value (Ohms)
4685.19	4630	~55

Table 1: Summary of Multimeter vs Arduino Resistance Measurements

This simple resistor measurement circuit with an Arduino shows that it is by no means a perfect measurement of the unknown resistor value. It could be off by as much as 30 to 60 ohms for each measurement reading the Arduino took. This is not going to fit our measurement accuracy standards for this project as we would like this tolerance to be within 1 Ohm of the expected value. We believe some research into precision measurement circuits (resistance and capacitance measurements) would be of great use in our project and could be assembled on a printed circuit board (PCB) or find another method to improve accuracy and precision.

Past Week Accomplishments

- Kyle: Wrote background, feasibility, and conclusion sections of project plan. Performed initial accuracy testing of voltage divider circuit used to measure a resistor value.
- Nathan: Datalogging to SD card complete, also acquired a 2.5V reference which should improve the measurements described above and allow us to achieve much better resolutions.
- Jacob: Completed more background research on project. Brainstormed potential ideas for accurately and precisely measuring resistance (wheatstone bridge or voltage divider) and capacitance (RC circuit). Wrote design section of project plan.
- David: Completed the introduction components (section 1) of the project plan. Took every group members work and put it on one project plan document to upload to the website. Put all of the group member information on the website. Assisted with arduino resistance measurement. Initial testing of sensors to see if they were functional.
- Sok-Yan: Testing and measure resistor value with arduino. Working on project timeline, and research more on the project about the capacitive sensor.

Pending Issues

The provided MEMS sensors were not functional due to excessive scratching of the sensors. New sensors would need to be fabricated if the project were to utilize the required MEMS sensors. In addition, the project team should speak with Dr. Liang Dong to understand any special considerations/precautions that need to be taken in order to properly test and utilize the MEMS sensors.

Individual Contributions

Name	Contribution	Hours This Week	Hours Cumulative
Kyle	DAQ system research, project plan documentation, and resistance measurement testing with Arduino Uno	5	12
Nathan	SD card logging and analog measurements on Arduino Feather with volt reference	5	11
Jacob	Research, design brainstorming, project plan	5	10
David	Project plan, updated website, tested sensors, assisted with resistance measurements	6	12
Sok-Yan	Resistance and measurement test with Arduino, project plan timeline, research	5	12

Plan for Coming Week (2/12/18 – 2/16/18)

Setup hardware and write Arduino code to more accurately and precisely measure resistance. This will be done using the Adafruit Feather M0 Adalogger board along with a voltage reference. We also plan on discussing the issue of the scratched MEMS sensors at our client/advisor meeting and how it will affect the timeline of the project.