

# EE / CprE / SE 492 – sdddec19-19

## Printed Miniature Nutrient Sensors

### Bi-Weekly Report 7

11/23/19 - 12/6/19

**Client** : Dr. Liang Dong

**Faculty Advisor** : Dr. Liang Dong

#### Team Members

Jonathan Hugen - Manufacturing and Testing  
Samuel Keely - Software and App Development  
Jeremy-Min-Yih Chee - Software and App Development  
Clayton Flynn - Manufacturing and Testing  
Ritika Chakravarty - Circuit Design

#### Weekly Summary of Advisor Meeting 11/23/19 and 12/6/19

Dr. Dong went over his final expectations of the system we designed. He asked us the specifics of what will be delivered to him by the projects completion and made final requests for the functionality of the system. Dr. Dong made a request for tweaking our data filtering algorithm so “erroneous” data gets rejected while also carefully watching the rate of change in data to decide whether more or less data needs to be collected. We explained how the variables were utilized for our filtering algorithm and explained how future groups could modify if the changes are deemed necessary. We also gave him some of the final information of our system including the expected battery life which was a vital theme in our design.

#### Weekly Summary of Group Meeting 11/23/19 and 12/6/19

In our group meetings, we did final system testing including power consumption testing which was reported to Dr. Dong. We replicated mock data to imitate an actual sensor so we could test the algorithms in our code that decide how much data to collect/transmit and how often to wake-up from deep sleep mode. The power consumption was unexpectedly high compared to the data sheet for our cell module but we discovered that deep sleep mode must be commanded for both the gsm radio, and the microcontroller in order to get the power consumption in deep sleep mode to be at the 350 microamp level that the data sheet specified. We discussed what needs to be changed to our final report and set up a skype meeting time for when we will make a final edition to the final report. We also set up a final meeting for practicing for the IRP.

#### Past Two Weeks Accomplishments

Jonathan Hugen:

- Soldered components into final package
- Tested power consumption of system while in deep sleep and transmission modes
- Tested wakeup function of the system
- Double-checked calculations for power consumption to ensure 90 day minimum battery life
- Prepared for analyzing the test wafers on the Atomic Force Microscope
- Worked on Poster
- Started revising final report
- Attended weekly meetings

Samuel Keely:

- Optimize and develop the app based on requirements
- Work on server workflow
- Verification of code used for Arduino system

Jeremy-Min-Yih Chee:

- Integrate all of the components into a single system.
- Ran tests on the software algorithm to ensure that it is working accordingly.

These tests are as follows:

1. Test the location algorithm where it will retrieve the approximate location of the cellular module based on the cell tower.
2. Test the reading algorithm where it will retrieve the correct readings from the sensor and perform the correct calculation so that users will receive the proper nitrate readings.
3. Test the algorithm for calculating the number of times where the system will boot up and retrieve the sensor readings per day.

MAC	readings	battery_level	sensor	latitude	longitude	altitude	security	updates	created
5d9f9394e050277094	201	100	1	42.025537	-93.620233	0	1485	0	Dec 2, 2019 23:24
5d9f9394e050277094	168	100	1	42.025537	-93.620233	0	1485	0	Dec 2, 2019 23:24
5d9f9394e050277094	233	100	1	42.048476	-93.640307	0	1500	0	Dec 2, 2019 23:32
5d9f9394e050277094	233	100	1	42.048476	-93.640307	0	1500	0	Dec 2, 2019 23:31
5d9f9394e050277094	203	100	1	42.048476	-93.640307	0	1500	0	Dec 2, 2019 23:48
5d9f9394e050277094	164	100	1	42.048476	-93.640307	0	1500	0	Dec 2, 2019 23:48
5d9f9394e050277094	142	100	1	42.048476	-93.640307	0	1500	0	Dec 2, 2019 23:47
5d9f9394e050277094	259	100	1	42.048476	-93.640307	0	1500	0	Dec 2, 2019 23:46
5d9f9394e050277094	276	100	1	42.047941	-93.620582	0	2089	0	Dec 2, 2019 23:45
5d9f9394e050277094	253	100	1	42.047941	-93.620582	0	2089	0	Dec 2, 2019 23:44
5d9f9394e050277094	255	100	1	42.047941	-93.620582	0	899	0	Dec 2, 2019 23:42
5d9f9394e050277094	265	100	1	42.025538	-93.640707	0	133	0	Dec 2, 2019 23:42
5d9f9394e050277094	111	100	1	42.025538	-93.640707	0	420	0	Dec 2, 2019 23:39
5d9f9394e050277094	195	100	1	42.025538	-93.640707	0	1963	0	Dec 2, 2019 23:37
5d9f9394e050277094	0	100	1	42.024992	-93.698973	0	797	0	Dec 2, 2019 23:35
5d9f9394e050277094	290	100	1	42.024992	-93.698973	0	747	0	Dec 2, 2019 23:33
5d9f9394e050277094	290	100	1	42.025536	-93.642207	0	420	0	Dec 2, 2019 23:31

**Layout of the Database that the cellular module will interact with**

- Work on the poster design and create relevant flowcharts to include in the poster.
- Tidied up and comment the code to improve readability and understanding of the cellular module code.

Clayton Flynn:

- Attended weekly meetings
- Deposited material on the dot array and identified pattern variables
- Analysed the profiles of the dots
- Looked at which pattern performed best
- Worked on poster got the poster printed
- Helped with testing the system

Ritika Chakravarty:

- Met with group for weekly meeting.
- Attended testing sessions of cellular module.

## Pending Issues

We have yet to get the final ISM and epoxy variables report to Dr. Dong. This is the progress tracking spreadsheet that was used to make changes to the fluid dispensing robot parameters for accurate dispensing of fluids onto the sensors. The spreadsheet is done but it needs to be summarized so Dr. Dong has the parameters for higher volume production of the sensor. The app has a few changes to be made including a link to a USGS soil map that helps the system user identify the expected nitrate levels for soil in the area where the sensor is located. The variables for the wakeup timer and data filtering still need to be tweaked for more accurate filtering but as long as Dr. Dong knows how the filtering works, this wasn't a major issue for him. The ISM has had profilometry data that was obtained off campus on a machine located at the MRC. The data needs to be analyzed so AFM can be performed but scheduling conflicts make this difficult and this is largely out of our control. We hope to have results soon but this is unlikely given the time allotted to us for this portion of the project.

## Individual Contributions

Member	Projects	Hours	Total Hours
Jonathan Hugen	<ul style="list-style-type: none"><li>- Helped with testing wakeup function</li><li>- Helped with mock data acquisition of system</li><li>- Obtained power consumption of device during data transmission and deep sleep mode</li><li>- Helped develop logic for wakeup function and data collection rate algorithm</li></ul>	8	73
Samuel Keely	<ul style="list-style-type: none"><li>- Develop app based on requirements</li><li>- Implement Database workflow</li><li>- Discussed questions to ask Dr. Dong</li></ul>	15	30
Jeremy-Min-Yih Chee	<ul style="list-style-type: none"><li>- Ran several tests on different features of the software.<ol style="list-style-type: none"><li>1. Location Reading</li><li>2. Sensor Reading</li><li>3. Number of transmission</li></ol></li><li>- Work on poster.</li><li>- Meet up with group members to integrate all of the components into an entire system.</li><li>- Improve the readability of the code.</li></ul>	25	110
Clayton Flynn	<ul style="list-style-type: none"><li>- Attended weekly meetings</li><li>- Deposited material on the dot array and identified pattern variables</li><li>- Analysed the profiles of the dots</li><li>- Looked at which pattern performed best</li><li>- Worked on poster got the poster printed</li><li>- Helped with testing the system</li></ul>	8	66
Ritika Chakravarty	<ul style="list-style-type: none"><li>- Met with group for weekly meeting.</li><li>- Attended testing sessions of cellular module.</li></ul>	6	40

The total hours in the above table includes the hour from CprE/EE/SE 491.

### Plans For Upcoming Week

#### Jonathan Huguen

- Practice for final presentation
- Skype meeting for final report/IRP
- Write outline and talking points for final presentation

#### Samuel Keely

- Further testing on the app
- Continue optimizing the app
- Worked on final report and presentation

#### Jeremy-Min-Yih Chee

- Work on Final Report.
- Work and rehearse on presentation for IRP.
- Perform final testing for the cellular module software and database.

#### Clayton Flynn

- Work on design document
- Finish analyzing the data
- Work on final report
- Work on industry presentation

#### Ritika Chakravarty

- Edit final report for submission.
- Attend final testing for cellular module.
- Prepare for Senior Design Poster Presentation.

### Future Plans

For future plans, we will be doing some final testing on the system to ensure that it is working accordingly. At the same time, we are also planning to compile all of our design and testing results into our final report and presentation. We also planned a few practice sessions for the final IRP. We are still waiting on results from the profilometry measurements taken by a machine located at the MRC. These results need to be analyzed and some exceptional gold dots will be requested to have AFM performed on them for more accurate surface measurements. This may or may not get done by the projects end as this is out of our control and is a lengthy process.