EE/CprE/SE 492 WEEKLY REPORT 1

Feb 4th 2019 - Feb 10th 2019

Group number: 45
Project title: IoT environmental monitor
Client &/Advisor: Dr. Geiger

Team Members/Role:
Tyler Fritz – Software Developer,
Dong Xing – Hardware developer,
Ahmed Abuhjar – Hardware Developer,
Haoyue Ma – Hardware developer,
Yuanzhe Wang – Hardware Developer

- **Weekly Summary**

This week, we have met with our advisor to discuss further about the expectations and deliverables for our project this term. We scheduled a weekly one hour meeting with our advisor to discuss about the progress in our project.

- **Past week accomplishments**

Tyler Fritz: worked on setting up web server. Installed database software and laravel on our VM. Working on configuring the the previous senior design groups code to use the database.

Ahmed Abuhjar: Last week, I have created more substrates (10) that will form the base of our humidity sensors, and so we will be able to test our implemented protocol and functionality of the network communication between the sensor-nodes.

Dong Xing: Reworked on data transmitting part by checking and improving some codes on both web server and homenodes.

Haoyue Ma: Worked on the code for data transmitting to the web server. Tried to solve the issues we left last semester (APN and SIM) for the code testing.

Yuanzhe Wang: Reviewed what we did before the winter break.

- **Pending issues**

- We still need to work on the website or the web server, which is still not functioning properly.
- More humidity sensors needed to be made for testing purposes.
- We still need to solve some issues on data transmitting to the web server.

- **Individual contributions**

NAME	Individual Contributions	Hours this week	HOURS cumulative
Tyler Fritz	Started setting up our webserver and database. Installed required software on our VM.	3	3
Ahmed Abuhjar	● Created substrates for humidity sensors. ● Contacted the advisor and planned for a weekly meeting schedule.	3	3
Haoyue Ma	Debugged the code for transmitting data to the web server. Worked on issues we left last semester.	3	3
Dong Xing	Reworked some codes transmitting things, get some improvements compare with what we left the last semester.	3	3
Yuanzhe Wang	Reviewed what we did before and listed the unsolved problem.	2	2

- **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

  - **Tyler Fritz:** have web server set up and ready to recieved packets.
  - **Ahmed Abuhjar:** Will complete making humidity sensors and will test them individually to make sure they're working as expected.
  - **Haoyue Ma:** solve the connection issues between the homenode and the webserver.
  - **Dong Xing:** Reworked on web server receiver codes in order to get better connections between itself and homenodes.
  - **Yuanzhe:** Work on the code of data transmition.

- **Summary of weekly advisor meeting**

Since this is actually our first time meeting the advisor this semester, (last week's meeting was canceled because of the bad weather issue) our group reworked on some issues what we left from the last semester based on our understandings and advisor's recommendations.

EE/CprE/SE 492 WEEKLY REPORT 2

Feb 11th 2019 - Feb 17th 2019

Group number: 45
Project title: IoT environmental monitor
Client &/Advisor: Dr. Geiger

Team Members/Role:
Tyler Fritz – Software Developer,
Dong Xing – Hardware developer,
Ahmed Abuhjar – Hardware Developer,
Haoyue Ma – Hardware developer,
Yuanzhe Wang – Hardware Developer

- **Weekly Summary**

Last week, we have met with the advisor and discussed further the project status and what we are going to do during the next week. We have listed the parts needed for our project for them to be ordered. We have starting on soldering the new substrates we made before for more humidity sensors. Next week, we will add the gypsum layer to finish the sensors and make them ready for testing experiment.

- **Past week accomplishments**

Tyler Fritz: Worked with Hayue to get the home node's internet connection working. We fixed quite a few issues such as the sim card not being provisioned and errors in our sample code, but do not yet have the connection working.

Ahmed Abuhjar: Soldering substrates and connecting them with resistors to make the circuit needed for the sensors to operate as required.

Dong Xing: Figuring out some necessary parts to order by recalculating the values of each part.

Haoyue Ma: active the SIM card and work on the connection issue between the homenode and the web server.

Yuanzhe Wang: looked for gypsum we need in every supermarket in Ames. Finally, I found a kind of gypsum in a garden store. We will check does it work for us, otherwise we will order what we need online.

- **Pending issues**

- Still missing some parts ordered, and we're still waiting for them to be delivered. These parts include the ones to make new leaf node PCBs.
- Still some connection issues between homenode and web server need to solve.

- **Individual contributions**

NAME	Individual Contributions	Hours this week	HOURS cumulative
Tyler Fritz	Worked on getting the home node connected to the cellular network. I see no reason why it is not currently working, so hopefully, that means we're close.	3.5	6.5
Ahmed Abuhjar	Soldered substrates for new sensors. Identified the type of soil we need to use for testing the soil moisture sensors.	3	6
Haoyue Ma	Active the sim card and work on the connection issues between the homenode and web server.	4	7
Dong Xing	Recalculating the values of each parts(resistors, inductors,etc.) and ordering them.	3	6
Yuanzhe Wang	Drived to many places to look for gypsum.	3	5

- **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

  - **Tyler Fritz:** get the home node connected to the internet, and test comminations between leaf nodes using 1km range radios.
  - **Ahmed Abuhjar:** Will add the gypsum layer to the substrates and start the testing procedure.
  - **Haoyue Ma:** Solve the connection issues between homenode and web server, and help Tyler test communications between leaf nodes.
  - **Dong Xing:** Order some necessary parts for radio from calculations in order to get longer range than the last group's work.
  - **Yuanzhe:** Get the gypsum done and ready to do the tests.

- **Summary of weekly advisor meeting**

Last week, we have met with the advisor and discussed further the project status and what we are going to do during the next week. We have discussed the soil types that could be used for testing.

EE/CprE/SE 492 WEEKLY REPORT 3

Feb 20th 2019 - Mar 3rd 2019

Group number: 45
Project title: IoT environmental monitor
Client &/Advisor: Dr. Geiger

Team Members/Role:
Tyler Fritz – Software Developer,
Dong Xing – Hardware developer,
Ahmed Abuhjar – Hardware Developer,
Haoyue Ma – Hardware developer,
Yuanzhe Wang – Hardware Developer

- **Weekly Summary**

This week, we did some specific soil moisture tests by using samples according to our advisors suggestions. We also ordered some new tools which have better performances compare with the ones we used before. We built the connection between the homenode and the testing web server successfully.

- **Past week accomplishments**

Tyler Fritz: Successfully connected our MKR GSM 1400 to the cellular network using the new sim card and provider. Then started setting up our webserver. I got the application running, I just need to get the database running and configured now.

Ahmed Abuhjar: Calibrate the sensors to characterize the soil moisture level with the corresponding resistance of the gypsum used in the sensor

Dong Xing: Reorganized and rechecked some parts of tools in order to select some better performance resources.

Haoyue Ma: Worked with Tyler to build the connection between the homenode and the testing web server successfully. We also started work on our webserver.

Yuanzhe Wang: Worked on the moisture sensors. Made soil sample and did the tests.

- **Pending issues**

- **Individual contributions**

NAME	Individual Contributions	Hours this week	HOURS cumulative
Tyler Fritz	Successfully connected our MKR GSM 1400 to the cellular network using the new sim card and provider. Then started setting up our webserver on our vm. I got the application running, I just need to get the database running and configured now.	4	10.5
Ahmed Abuhjar	Calibration experiments for the soil moisture sensor.	4	10
Haoyue Ma	Built the connection the between the homenode and the testing web server successfully. Started work on our web server.	3	10
Dong Xing	Keep working on some new resources check and order work. Reorganized some parts of size and type of tool performances.	4	10
Yuanzhe Wang	Made the soil sample to extreme dry, 20% moisture and 40% moisture and measure the voltages crossed the sensors.	7	12

o **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

- **Tyler Fritz:** Get the web server running and do a complete integration test.
- **Ahmed Abuhjar:** Continue doing the testing and making PCB layout
- **Haoyue Ma:** Coninue work on our webserver with Tyler. Try to send data to our webserver if possible.
- **Dong Xing:** Ordered some new parts of tool and checked their performances according to online resources and descriptions.
- **Yuanzhe:** Made more samples from 10% to 40% moisture then test them.

o **Summary of weekly advisor meeting**

EE/CprE/SE 492 WEEKLY REPORT 4

Mar 4 th 2019 - Mar 10 th 2019

Group number: 45
Project title: IoT environmental monitor
Client &/Advisor: Dr. Geiger

Team Members/Role:
Tyler Fritz – Software Developer,
Dong Xing – Hardware developer,
Ahmed Abuhjar – Hardware Developer,
Haoyue Ma – Hardware developer,
Yuanzhe Wang – Hardware Developer

- **Weekly Summary**

- **Past week accomplishments**

  Tyler Fritz: Worked on setting up the backend of the web server. I got it built and running but the front-end crashes every time it tries to connect to it. Crazily, the front-end is running SQL on the database and it expects a different schema to what the back-end uses. I'm very confused.

  Ahmed Abuhjar: Finished modifying and designing the PCB layout for the leaf nodes. Request to order the radio transceivers we're using for our leaf nodes.

  Dong Xing: contacted employees to order necessary items and connected some circuit works.

  Haoyue Ma: Checked the connection between the home node and temporary web server. Started working on the code for homenode receiving the data from leaf nodes.

  Yuanzhe Wang: Tested the moisture sensor resistance vs moisture level.

- **Pending issues**

- Sometimes members may misunderstand with each other's needs by just typing words, we will need some necessary meetings more frequently.

- **Individual contributions**

NAME	**Individual Contributions**	**Hours this week**	**HOURS cumulative**
Tyler Fritz	Setting up web server backend.	8	18.5
Ahmed Abuhjar	PCB design for leaf nodes.	12	22
Haoyue Ma	Work on the code for homenode receiving the data from leaf nodes.	4	14
Dong Xing	Items check and order	3	13
Yuanzhe Wang	Tested the moisture sensor resistance vs moisture level.	6	18

o **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

- **Tyler Fritz:** Fix all the errors in the webserver.
- **Ahmed Abuhjar:** Assemble and test the radio transceivers and send the PCB layout for fabrication.
- **Haoyue Ma:** Build the connection between the homenode and our own web server if possible. Continue working on the code for homenode receiving data from leaf nodes.
- **Dong Xing:** check with teammates and keep contacting with employees to order necessary new items, if needed, will help the others with design work.
- **Yuanzhe:** Make sure all sensors have same sensitivity with water.

Summary of weekly advisor meeting

This week, Geiger improved some PCB circuit board design according to our work, listed some helpful ideas about the items which might be useful for our design.

EE/CprE/SE 492 WEEKLY REPORT 5

Mar 11th 2019 - Mar 17th 2019

Group number: 45
Project title: IoT environmental monitor
Client &/Advisor: Dr. Geiger

Team Members/Role:
Tyler Fritz – Software Developer,
Dong Xing – Hardware developer,
Ahmed Abuhjar – Hardware Developer,
Haoyue Ma – Hardware developer,
Yuanzhe Wang – Hardware Developer

- **Weekly Summary**

This week, we have done the almost work except the API transaction for creating the final reable graph for users on the website by collecting and analyzing the data from nodes. But this does not influence the whole project and we are going to start testing the projects next week during spring break time. We also tested the communication between leaf nodes and worked on the communication between home node and leaf node. There are still some issues in communication between leaf node and home node. We will continue work on that to figure it out.

- **Past week accomplishments**

Tyler Fritz: Worked on system integration. Specifically, Haoyue and I tried to get the home node to receive data from the leaf nodes. This is more challenging than expected because the home node is on a different board with different IO than the leaf nodes.

Ahmed Abuhjar: Started testing the radio transceivers using arduinos.

Dong Xing: Continue working on new items ordering and resources researching jobs.

Haoyue Ma: Tested the communication between leaf nodes. Worked on the on the communication between the leaf node and home node.

Yuanzhe Wang: Retested the ratio between sensor resistance vs moisture level.

- **Pending issues**

- We tested the communication between the leaf nodes successfully. However, we found that there are some issues when homenode communicate with leaf node by using NRF24L01 transceiver.

- **Individual contributions**

NAME	**Individual Contributions**	**Hours this week**	**HOURS cumulative**
Tyler Fritz	System Integration	6	24.5
Ahmed Abuhjar	Testing the transceivers using arduinos	4	26
Haoyue Ma	Tested the communication between leaf nodes. Worked on the communication between the leaf node and home node.	6	20
Dong Xing	Get needs from other group members, research items' unit prices online and get contact with Dubert to order.	3	16
Yuanzhe Wang	Retested the ratio between sensor resistance vs moisture level.	3	21

o **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

- **Tyler Fritz:** Get the back-end fully up and running and make a simple POC front-end.
- **Ahmed Abuhjar:** Will continue testing radio transceivers and confirm that they are working properly before sending PCB for fabrication
- **Haoyue Ma:** I and Tyler will work on the data transmission from leaf nodes and home node. Test the data transmission from leaf nodes to home node and upload to web server if possible.
- **Dong Xing:** Since it needs 4 to 5 working days shopping items here which start counting on 3/15/2019, I am assuming that if we can receive these items on next Thursday or Friday, it's time to do off campus tests.
- **Yuanzhe:** After new sensors get ready. I will test the new sensors and make a final plot.

Summary of weekly advisor meeting

This week, Gerger mentioned some potential risks for copper layers which might cause the circuits short, and we are planning to buy some golden thin layer for safety.

EE/CprE/SE 492 WEEKLY REPORT 6

Mar 25th 2019 - Mar 31th 2019

Group number: 45
Project title: IoT environmental monitor
Client &/Advisor: Dr. Geiger

Team Members/Role:
Tyler Fritz – Software Developer,
Dong Xing – Hardware developer,
Ahmed Abuhjar – Hardware Developer,
Haoyue Ma – Hardware developer,
Yuanzhe Wang – Hardware Developer

- **Weekly Summary**

This week we setted up a complete web server and tested the data communication between homenode and leafnode by using our new ratio.

- **Past week accomplishments**

Tyler Fritz: Worked on overcoming issues being had with the HC-12 radios. Eventually found the correct libraries and pins required to get them working.

Ahmed Abuhjar: Tested the radio transceiver for 1km distance range between two leaf nodes.

Dong Xing: contact with teammates to get needs and put them on items requests, help with the others' work.

Haoyue Ma: Test data communication between homenode and leafnode by using new radio H12.

Yuanzhe Wang: Tested new sensors.

Pending issues

Still have some issues in testing data transmitting from leafnode to homenode when we try to use our new ratio H12.

- **Individual contributions**

NAME	Individual Contributions	Hours this week	HOURS cumulative

Tyler Fritz	Set up a complete web server.	3	35.5
Ahmed Abuhjar	Tested the radio transceiver for 1km distance range between two leaf nodes.	7	33
Haoyue Ma	Test data communication between homenode and leafnode by using new ratio H12.	4	24
Dong Xing	Work with the others to get necessary items and circuits connections check.	3	19
Yuanzhe Wang	Tested new sensors	2	23

o **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

- **Tyler Fritz:** Adjusted message protocol to conform to the new libraries for the HC-12 radio. Update home node program to use new protocol and ensure that it can consistently communicate with leaf nodes.
- **Ahmed Abuhjar:** Will continue testing the radio transceiver in an open field and see how fat it can receive and transmit signals.
- **Haoyue Ma:** Solve all issues left in data transmitting part.
- **Dong Xing:** Since the integration will be done soon, everyone will go outside to take some experiments for checking errors.
- **Yuanzhe:** Keep working on the new sensors and solve the remaining problem.

Summary of weekly advisor meeting

We don't a meeting with Dr. Geiger this week since he was out of the town.

EE/CprE/SE 492 WEEKLY REPORT 7

April 1st 2019 - April 7th 2019

Group number: 45
Project title: IoT environmental monitor
Client &/Advisor: Dr. Geiger

Team Members/Role:
Tyler Fritz – Software Developer,
Dong Xing – Hardware developer,
Ahmed Abuhjar – Hardware Developer,
Haoyue Ma – Hardware developer,
Yuanzhe Wang – Hardware Developer

- **Weekly Summary**

This week our team figured the left issues in data communication out. We tested the range of our new ratio H12 in an open field.

- **Past week accomplishments**

Tyler Fritz: Worked with teammates to do open field test range of HC-12 radio. We did not get the advertised range of the radio sadly. In our test configuration, we were only able to get around 200m compared to the advertised 1km. We think this could be because we were powering the microcontrollers with USB ports on laptops. These ports can only support .5 A of current, and our radio might require more than that.

Ahmed Abuhjar: Testing the transceivers in an open field and finalized the leaf node PCB layout to be sent for fabrication.

Dong Xing: Getting work done for both transceivers and leaf nodes, also testing the integration work's range with teammates.

Haoyue Ma: Finish the data transmission from leafnode to homenode by using H12 ratio. Test the range of the ratio in an open field.

Yuanzhe Wang: Cooperated with teammates to finish test and tested the sensors.

Pending issues

- **Individual contributions**

NAME	**Individual Contributions**	**Hours this week**	**HOURS cumulative**
Tyler Fritz	Writing code for tests, and performing tests on radios in open field.	5	40.5
Ahmed Abuhjar	Testing the transceivers in an open field and finalized the leaf node PCB layout to be sent for fabrication.	5	38
Haoyue Ma	Finish the data transmission from leafnode to homenode by using H12 ratio. Test the range of the ratio in an open field.	5	29
Dong Xing	Finished all items integration and tested the transceivers' range outside.	5	24
Yuanzhe Wang	Cooperated with teammates to finish test and tested the sensors.	3	26

o **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

- **Tyler Fritz:** Test radios with more substantial power supplies to see if that improves our range. Also I need to get the webserver's API to communicate with the front-end. It doesn't seem like the previous group ever integrated the two. The front-end I received was directly running SQL on the database.
- **Ahmed Abuhjar:** Will start doing an actual soil moisture testing using sensors ,radio transceivers, and arduinos.
- **Haoyue Ma:**. Test the whole data communication from one leaf nodes to another then to homenode then upload data to our own web server. Test the whole system if possible.
- **Dong Xing:** Try to figure out another way to get longer range for transceivers.
- **Yuanzhe:** Assemble everything together and do the field test.

Summary of weekly advisor meeting

EE/CprE/SE 492 WEEKLY REPORT 8

April 8th 2019 - April 14th 2019

Group number: 45
Project title: IoT environmental monitor
Client &/Advisor: Dr. Geiger

Team Members/Role:
Tyler Fritz – Software Developer,
Dong Xing – Hardware developer,
Ahmed Abuhjar – Hardware Developer,
Haoyue Ma – Hardware developer,
Yuanzhe Wang – Hardware Developer

- **Weekly Summary**

- **Past week accomplishments**

  Tyler Fritz: Worked on new simple front-end that will be mostly a proof-of-concept for our project. I got the leaf-node GPS locations to appear as pins on google maps. Next I need to make it so that when the user clicks on a pin, the data for that node is displayed in a graph below.

  Ahmed Abuhjar: Finalized the process for PCB fabrication order, and continued testing the Gypsum-sensors with different level of soil moisture

  Dong Xing: Worked with teammates for checking the influences of power supplies to the signal transmission lengths. Reworked few parts of codes to make sure the transceivers performances.

  Haoyue Ma: We used the two power banks as power supply to test the range of the ratio again. We found that the range of the ratio increased from 300 meters to 600 meters. Tested the data transmission system.

  Yuanzhe Wang: Tested the sensors and tried to figure out what other factors affect the sensors besides moisture level.

  Pending issues

- **Individual contributions**

NAME	**Individual Contributions**	**Hours this week**	**HOURS cumulative**
Tyler Fritz	Worked on new simple front-end that will be mostly a proof-of-concept for our project. I got the leaf-node GPS locations to appear as pins on google maps. Next I need to make it so that when the user clicks on a pin, the data for that node is displayed in a graph below.	8	48.5
Ahmed Abuhjar	Finalized the process for PCB fabrication order, and continued testing the Gypsum-sensors with different level of soil moisture	4	42
Haoyue Ma	We used the two power banks as power supply to test the range of the ratio again. Tested the data transmission system.	5	34
Dong Xing	Reworked and checked the signal transmission lengths by increasing the power supplies in order to increase the items' performances.	5	29
Yuanzhe Wang	Tested the sensors and found that our sensors seems affected by other factors besides moisture level.	3	29

o **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

- **Tyler Fritz:** Fully finish system integration.

- **Ahmed Abuhjar:** Continue testing the Gypsum sensors and make a plot with all the data to find the relation between moisture level and the output gypsum resistance.
- **Haoyue Ma:** Work on our poster. Test the whole system when our sensors are ready.
- **Dong Xing:** Start preparing on the poster and final presentation work.
- **Yuanzhe:** Try to figure out what other factors will affect our sensors.

Summary of weekly advisor meeting

EE/CprE/SE 492 WEEKLY REPORT 9

April 15th 2019 - April 21th 2019

Group number: 45
Project title: IoT environmental monitor
Client &/Advisor: Dr. Geiger

Team Members/Role:
Tyler Fritz – Software Developer,
Dong Xing – Hardware developer,
Ahmed Abuhjar – Hardware Developer,
Haoyue Ma – Hardware developer,
Yuanzhe Wang – Hardware Developer

- **Weekly Summary**

- **Past week accomplishments**

  Tyler Fritz: The home node seems to be broken. I was unable to upload code to it any longer. But because it didn't give a stack trace when it crashed, I was not sad to see it go. I switched over to using a raspberry pi and rewrote all the home node's code in Python. After I finished that, I was able to successfully run an integration test! Data originating from a leaf node made it to the webserver's database.

  Ahmed Abuhjar: Finished testing the gypsum sensors, and finalized the data collected in a plot for illustration and analysis purposes. Also, the final gerber files for the PCB layout was sent to the manufacturer to fabricate the PCB.

  Dong Xing: Finished the final integration of necessary number of items, all data have been edited and improved by reworking on designs.

  Haoyue Ma: Finished all tests. Waited for PCBs. Worked on the design of the poster.

  Yuanzhe Wang: Found that our sensors also affected by pressure. We can put sensors in the shell to reduce the effect by pressure.

  Pending issues

- **Individual contributions**

NAME	**Individual Contributions**	**Hours this week**	**HOURS cumulative**
Tyler Fritz	Switched over to using raspberry pi for home node, and rewrote its program in Python. Successfully ran integration test! Also did some small-scale field tests.	28	76.5
Ahmed Abuhjar	Finished testing the gypsum sensors, and finalized the data collected in a plot for illustration and analysis purposes. Also, the final gerber files for the PCB layout was sent to the manufacturer to fabricate the PCB.	6	48
Haoyue Ma	Finished all tests. Waited for PCBs. Worked on the design of the poster.	6	40
Dong Xing	Finished all process integration and final detections	7	36
Yuanzhe Wang	Tested the other factors may affect our sensors and tried to find a way to reduce the effect.	4	33

o **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

- **Tyler Fritz:** prepare for final presentation and write final report.
- **Ahmed Abuhjar:** Will plan on preparing for the final presentation, and writing the final report.
- **Haoyue Ma:** I will prepare on the final report and presentation next week.

- **Dong Xing:** Will start working on the final presentation preparation and Powerpoint slides creation with other teammates.
- **Yuanzhe:** Will work on the final report and presentation.

Summary of weekly advisor meeting