ENSC 305W/440W Grading Rubric for Post-Mortem

Criteria	Details	Marks
Introduction/Background	Introduces basic purpose of the project. Includes clear background and motivation for the project.	5 **/05%**
Body of the Document	Provides a high-level description of main functions and project modules. Outlines materials, costs, and schedule (both estimated and actual).	15 **/15%**
Problems/Challenges	Outlines major technical challenges encountered. Explains how these were resolved. Details any major changes in scope and design.	5 **/05%**
Group Dynamics	Includes a discussion of how the team was organized, any problems that arose, and how they were resolved	5 **/05%**
Individual Learning/Work-load Distribution Chart	Includes a one-page, individually written reflection upon what was learned from the project, both technically and interpersonally (each team member writes a page about their learning experience). **The workload distribution chart outlines major technical, administrative, and support tasks and indicates who participated significantly in those tasks.**	25 **/25%**
Conclusion/References	Summarizes outcome and evaluates the project. Includes discussion of future plans, if any (or explains why project will be abandoned).	7 **/10%**
Meeting Agendas/Minutes	Includes an appendix that provides all the meeting agendas and minutes produced by the team over the course of the semester. (NB. Neatness does not count here.)	20 **/20%**
Presentation/Organization	Document looks like the work of a professional. Ideas follow in a logical manner. Layout and design is attractive.	5 **/05%**
Format Issues	Includes title page, table of contents, list of figures and tables, and references. Pages are numbered, figures and tables are introduced, headings are numbered, etc. References and citations are properly formatted.	5 **/05%**
Correctness/Style	Correct spelling, grammar, and punctuation. Style is clear, concise, and coherent.	4 **/05%**
Comments		96

SIGNATUS INC.

School of Engineering Science
Simon Fraser University
8888 University Dr
Burnaby, BC Canada

December 6th, 2013

Professor Lakshman One
School of Engineering Science
Simon Fraser University
Burnaby, BC V5A 1S6

Re: ENSC 440 Post Mortem for a Wireless Leak Detector and Inhibitor System

Dear Professor Lakshman One,

The attached document describes the post mortem for Signatus Inc.'s Wireless Leak Detector and Inhibitor System. The Wireless Leak Detector and Inhibitor System is a device that detects a water leak inside a property, inhibits further damage, and notifies the owner in order to avoid causing damage. Once the leak is detected, an alarm will sound, and the user can shut it off by means of a button. This document briefly explains the project, financial parts, timeline, problems encountered and each individual's opinion about the work put into this project during the last four months. Signatus Inc. consists of four motivated and talented senior engineering students: Petar Arnaut, Olivier Thomas J, Chris Fontaine, and Barry Zou. If you have any questions or concerns about our post mortem, please contact me by phone at (604) 328-4996 or by email at paa9@sfu.ca.

Sincerely,

Petar Arnaut

Petar Arnaut
Chief Executive Officer
Signatus Inc.

Enclosure: Post Mortem for a Wireless Leak Detector and Inhibitor

Post Mortem

Wireless Leak Detector and Inhibitor

SIGNATUS INC.

Petar Arnaut
Chief Executive Officer

Olivier Thomas
Chief Operating Officer

Chris Fontaine
Chief Technical Officer

Barry Zou
Chief Financial Officer

Contact Person: Petar Arnaut
paa9@sfu.ca

Submitted to: Lakshman One (ENSC 440)
Mike Sjoerdsma (ENSC 305)

Issue date: December 6th, 2013

Table of Contents

List of Figures

1. Introduction

The idea of a leak detecting and inhibiting system was brought to our attention when we realized that a rising problem in most owners of condominiums or houses experienced property water damages due to faulty pipes, accidents, or carelessness. Purchasing property insurance can be expensive and overwhelming as insurance plans can vary greatly between the degrees of coverage each company provides. Therefore, homeowners decide to purchase policies based on recommendations, or perhaps none at all. When it comes to property water damage, this can result in the loss of items that cannot be replaced, extensive restoration to the home and in extreme cases, relocation of tenants during the renovation. It is common for most home owners to notice a leak when it is already too late, as water can cause excessive damage in a short period of time. If homeowners do have insurance, the claim often be tricky and take a lengthy duration before homeowners can collect their funds. Mos plans do not provide coverage for all water damage accidents, resulting in a more expensive plan. For large scale water leaks, the damage amount can exceed the homeowner's coverage and result in incurring costs even with an insurance plan.

Any references for these

Signatus Inc. has successfully developed a system that automatically detects water leakages from various plumbing systems and inhibits further water damages to the property. Water sensing units, in the form of mats are easily positioned to possible leak areas by any user. When a leak is detected, a signal is sent to shut off the water source. This is achieved through an electronic valve placed at the main water pipe for the property. The system's management software will alert the home owner remotely that a leak has been detected and its location through SMS and email. The management software will also provide information on detector battery status and allow customization of the system. This system will be targeted toward homeowners with or without water damage insurance coverage, and possibly further improvements would allow targeting large scale business markets.

This post mortem will provide a high level overview of our system along with finances, deviations and challenges that may have taken place in the past 4 months. Finally, we will conclude this document with personal reflections of our individual accomplishments and what was learned throughout the course of this project.

2. System Overview

The basic conceptual model of our leak detector and inhibitor system is shown in Figure 1 below.

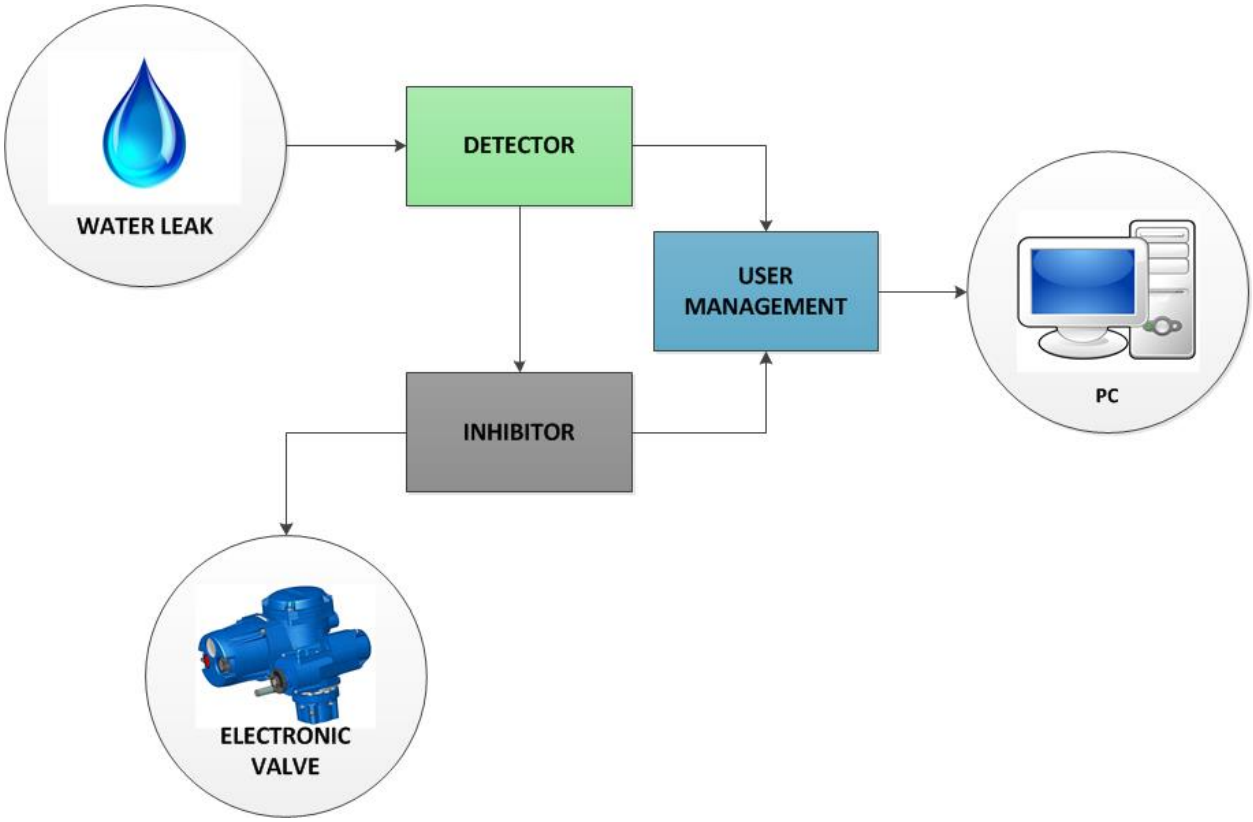

Figure 1: System Overview Diagram

A water leak is detected in proximity of the situated detector when 3 out of the 4 sides of the mat detect water. When a leak is determined a wireless signal is sent using a 2.4GHz RF transceiver to activate the electronic valve installed on the water main. In unison, the system transmits wireless data to the user's personal computer through the USB attached manager transceiver module. The manager will provide remote alerts in a timely fashion through SMS and email in order for inspection to be taken. Furthermore, the management software will provide status of leak location and battery levels of detector devices in the vicinity.

2.1 Detector Overview

Figure 2 below shows the Detector Module and Figure 3 below shows the inside of the Detector module. The water sensor circuit enclosed in the mat was revised several times throughout the design process. In the beginning, an NMOS circuit was used as a switch. However, due to threshold problems that affected operating regions of the NMOS changes had to implement. The next idea was implementing a simple comparator circuit that would compare one fixed voltage with another voltage that would depend on water resistance. The circuit was not useful since adding a water resistance that fluctuated significantly would cause the voltage to diverge dramatically, and therefore the output was not as expected. A third solution was to use a Wheatstone bridge with an instrumentation amplifier. The idea was productive, but we did not want to measure the water resistance and achieve an analog voltage output that was to be sent to the Arduino. We needed a Wheatstone bridge with a comparator in order to receive a digital '1' or '0' as the output. In the end, we were pleased with the solution for the water sensor combined with a buzzer circuit to notify the user of a leak.

2: Enclosed Detector Module

define such terms.

The rubber mat took a long time to design the way we initially agreed to. In the beginning, our idea was to add three layers of rubber in between the water sensor and buzzer circuits. However, we decided to use a single thick piece of rubber, create cutouts for the various parts and wiring and then use a second piece of rubber to be placed on top of the mat. The bottom of the mat was then sealed with a plastic enclosure to keep water out of the mat.

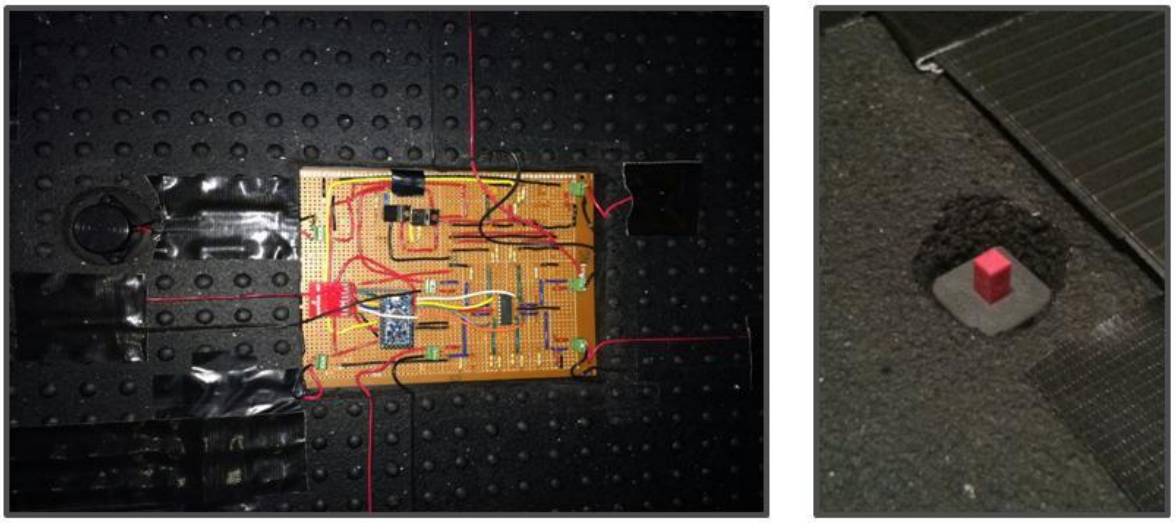

Figure 3: Detector Circuit and Buzzer Switch

2.2 Inhibitor Overview

The inhibitor contained a digital switch circuit which was controlled by the included arduino and transciever module inside the enclosed box. The switch was primarily designed to allow a full 9V to power the attacheable electronic valve. This was done by providing the the gate of the NMOS with a control voltage of 5V from the arduino. The arduino was attached to a transciever module through the SPI lines to allow receiving and sending of packets from the detector. An IP66 rated box was used in the mechanical design to protect the circuit from dust and water that may present when installed outdoors, as can be seen in figure X below.

Figure 4: Enclosed Inhibitor Module

2.3 Manager Overview

Figure 5 below shows the GUI of the User Management Module. The GUI Application's main purpose is to provide information to the user regarding the status of all currently mapped devices. The information includes the leak and battery status of Detectors. The GUI application is built for ease of use, simplicity and reliability. Ideally as a user, they would prefer to have the GUI application minimized to the system tray running in the background, since this would suggest everything is working as expected and there are no leaks. When a leak is detected the GUI application would prompt a warning window, an email and text message alert sent to the address set by the user.

The GUI application is implemented using the Qt creator and Qt 5.1 framework. Qt was chosen for the C++ programming language and multiple operating system support. The GUI information is updated periodically. The information is gathered using USB communication to the MCU's USB controller which receives its data from the wireless transceiver.

Almost all the requirements specified originally during functional specification are met. However there were some technical challenges met during the development process. First due to the time constraint and driver issues dealing with the transceiver hardware, the feature to manually control the Inhibitor through the GUI has been dropped for the prototype. This is a key feature Signatus believes would be implemented in the future production model.

Successful unit testing was done on the GUI using generated RF data packets. Unit testing was done on a console application to asynchronously receive the RF data through the Transceiver as well. Another challenge was discovered during the system integration process between the two. To continuously receive the RF data, most of the system resources was spent. This resulted in the GUI being unresponsive as the application does not have resource to process updates to the GUI. A workaround to manually update the GUI in the application was used, but the GUI was delayed by 1 second. For future considerations, multithreading the application to receive the data would be the correct proper solution to this challenge. Multithreading the application allows one thread to continuous receive RF data while the main thread is able to update the GUI in a timely fashion.

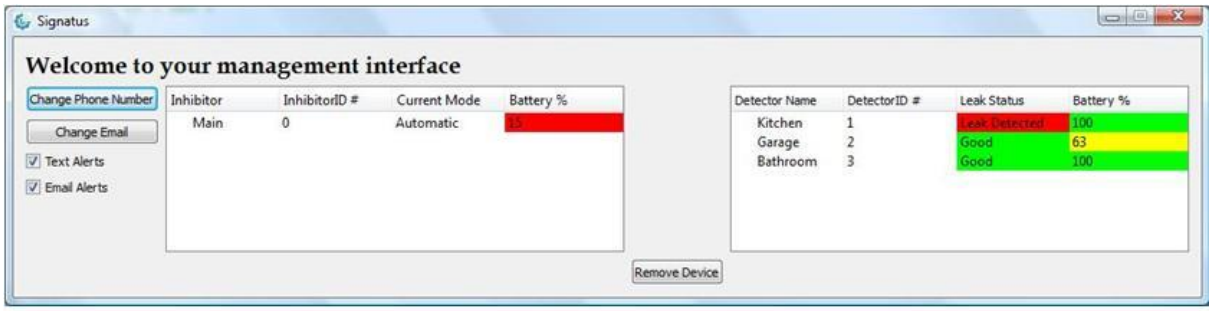

Figure 5: GUI Main Window

3. Finances

Table 1 below shows the budget estimation presented by Signatus Inc. to the ESSEF in September versus the actual total cost. Overall the actual cost ended up being very similar to the estimated costs. Some discrepancies in the cost were due to shipping fees which were due to the prototyping nature of the project in the time constraint. A few equipment items were not ordered, and other parts were ordered but ended up not being used due to design changes. Miscellaneous equipment cost more than our initial estimates. This accounts for extra electronic parts, wood, screws, as well as malfunctioning parts that had to be repurchased.

Table 1: Budget Deviation Comparison

Equipment List	Estimated Cost	Actual Cost
Arduino Microcontrollers	$100	$94.56
Transceiver Modules	$80	$75.85
Moisture Sensors	$40	$0
Electronic Valve	$50	$24
Enclosure for Inhibitor/User management	$50	$16.26
Rubber Mat	$30	$30
Water proofing material (Seals, Covers, etc)	$20	$24.06
Miscellaneous Electronic Parts, Construction Equipment (Wires, Switches, Resistors, Screws, Wood, etc)	$80	$150.82
Internally Driven Buzzer	$ -	$11.04
RP-SMA Antenna	$ -	$31.12
Miscellaneous Tax/Shipping Costs	$ -	$91.93
Contingency	$70	
Total Cost	**$520**	**$549.64**

4. Timeline

Figure 6 below shows the proposed project development schedule in blue, whereas red highlights any deviations.

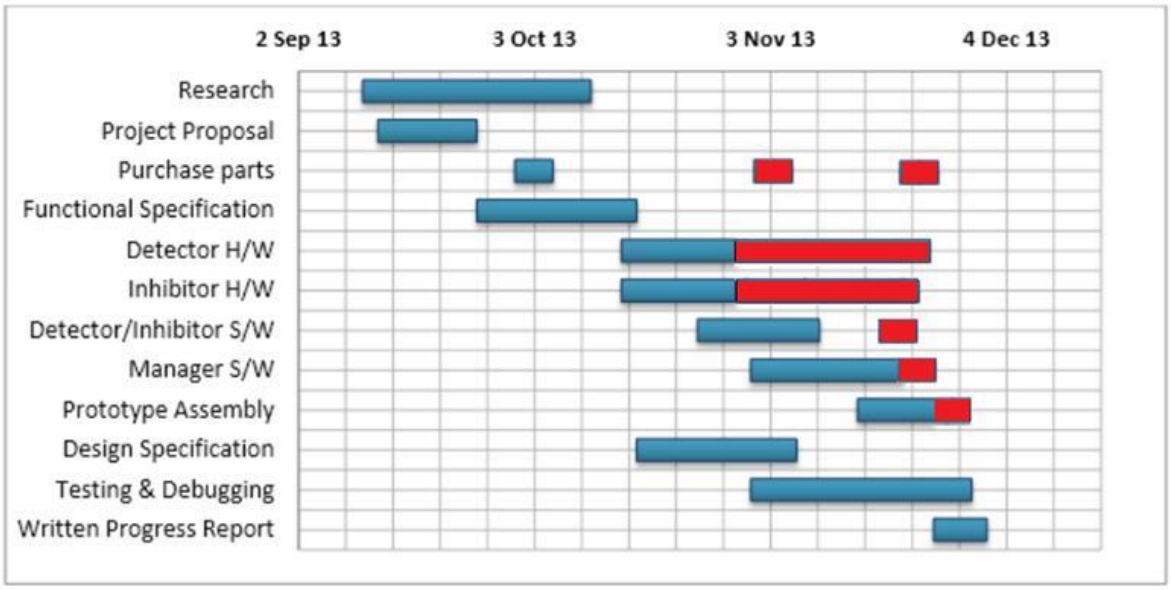

Figure 6: Timeline Deviation Comparison

As shown in Figure 6, documentation deadlines for project proposal, functional specification were met. However a 3 day extension period was used for the design specification causing some delay which has propagated slightly into project development. The time spent in developing each individual module continued well after the initial estimates, which had an effect on prototype assembly. Some of these issues occurred due to some communication issues about individual tasks as well as differences in understanding of specific features. Other reasons are due to general hardware debugging issues and transceiver software interfacing that has taken longer than anticipated. Equipment purchasing continued into project development due to changes in design choices.

5. Group Dynamics & Work Distribution

The group was primarily organized based on expertise. Olivier Thomas and Barry Zou were in charge of the software areas of the project; Olivier Thomas for the embedded software and Barry Zou for the application software. Whereas Petar Arnaut and Chris Fontaine were in charge of the hardware areas of the project, Petar mostly for the electronic circuit design involving the detector and Chris for the Inhibitor. There were some disagreement in preferences during the project proposal phase; however after reaching a final agreement all team members were fully committed. All decisions were discussed by the entire group in a democratic process, with only minor disagreements occurring. Any minor disagreements were discussed rationally as engineering professionals and the result was found by logically determining the best course of action, regardless of personal feelings. Meetings were generally held once a week either in person or via online conferences.

A workload distribution chart can be seen below:

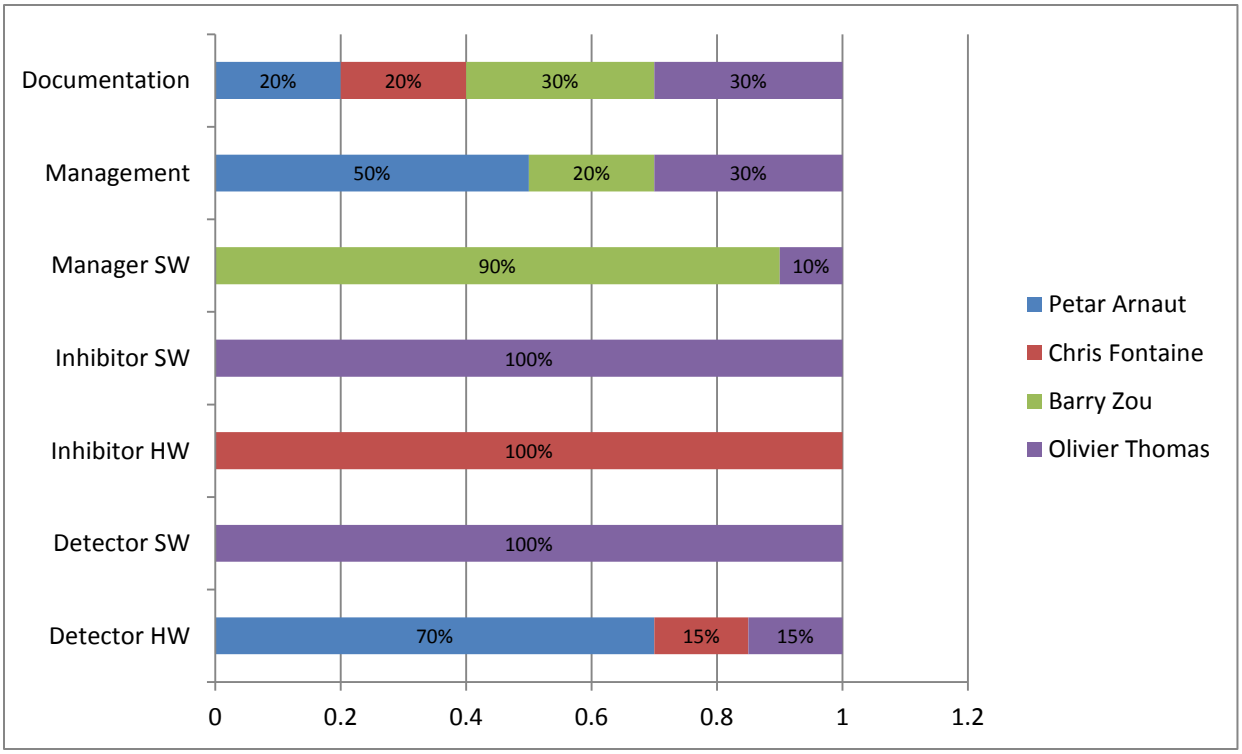

Figure 7: Workload Distribution Chart

6. Lesson Learned

Petar Arnaut – Chief Executive Officer (CEO)

Last four months will be the most memorable time of my university career because of a Capstone project. I was in charge of the meeting meetings and also responsible for dividing tasks between group members. In addition, I worked on the mechanical and electrical part of a detector. ENSC 440 course will definitely not be forgotten for the rest of my life. All challenges throughout this course helped me improve my skills in engineering field in different ways.

I am really glad that we started working on the project right after everyone in the group agreed with the idea. Research took a long time, which I really did not expect to happen. I had a feeling that everything could be done in one month, and I was really wrong. I was mostly working with Olivier since he needed to test my parts with his embedded software. In the middle of semester, I had to change a design for a water sensor, and that freaked me out since I thought that everything would be working perfectly. We had only one month left, and there was pretty much no room for mistakes. In addition, testing all circuits on a breadboard was not an issue at all. However, in the beginning I had problems with soldering, and that caused the design on the perfboard to be delayed. A lack of certain skills and added stress due to a time management made our timeline different. In the middle of November, I decided to accept the fact that even the smallest detail could go wrong and cause our project to fail.

One of the biggest challenges in this course was a time management. I was sure from the beginning that the project will go smoothly, and that we will not have problems with majority of the parts. A lot of times, we experienced a positive outcome of testing but after applying the same test for multiple times, the output was not as expected. After that hours of work would be put on this part which made more stress to all group members. This course definitely improved my time management skills and knowledge about electrical circuits.

I really enjoyed working on this project during the last four months. Finally, we got a chance to build our own project from scratch and it made me feel proud of all of us that spent hours of work in order to achieve project expectations. I would like to thank all my group members for their contribution during this semester and memorable moments.

Olivier Thomas J – Chief Operating Officer (COO)

Beware of Murphy's Law! Coming into this project I was under the impression that if we carefully designed and planned our project it would be smooth sailing till its completion, having reached the end I can see that I was wrong. The past four months have been quiet the lesson in system design and project management. I can confidently say that I have learned a great deal in terms of system integration and designing RF schemes. Working on this project was a lot of fun, but tremendously time consuming and hard work. This project couldn't have been completed without every team member's contribution. The technical background of each member worked out exceptionally well in terms of dividing work, and I couldn't have been more pleased with the outcome.

As COO my activities included day to day management and finding solutions to problems that inhibited project development. Furthermore, I designed the initial system solution which was further developed and optimized with the help of our team. It was critical during the design phase to choose the correct components to achieve a working product, keeping in mind the time constraints imposed. Throughout the design process I learned that every detail must be considered and must be looked at in order to refrain from future problems in the integration phase. For instance, when we initially tested the system with the management software, packets were being lost between the inhibitor and detector module, but were received properly with the manager module, this was due to the ACK feature implemented in the design without full knowledge of its use with multiple transceiver modules, this could've been avoided if every detail of the feature was looked at carefully. As far as project management, the team itself was motivated, and so managing the project was more or less an easy task, the majority of the work came from verification, design discussions, and choosing which task needed to be completed first. Moreover, I was also in charge of the embedded software for the Arduino to interface the transceiver modules for both the detector and inhibitor. The leak detection algorithm and valve control schemes were also part of the embedded solution which I had to provide.

During the course of the project I observed that documentations were a time consuming obstacle which slowed project development. However, I quickly learned that it pushed us to think of future problems that we had not foreseen. This helped us prevent issues with our design that had not been addressed. Time management was a critical part of this project, and due to our communication we were able to organize ourselves to complete deadlines on time. Failures that arise were needed in order to learn and obtain the proper way of designing certain modules; this made me acquire proper skills in the field of embedded systems.

As a result of all our hard work we were able to reach our goal. The benefit of this course was its ability to allow engineers to bring an idea into reality, and giving us the knowledge of the entire design process from start to finish. As a team of skilled engineers we successfully designed a product from scratch, and I would like to thank everyone who contributed to our success.

Chris Fontaine – Chief Technical Officer (CTO)

Firstly, a note to anyone taking 440 in the future… Have fun and hang on until the very end. Do not get discouraged by blowing up various electrical parts and number one... run unit tests on everything.

This project was a lot of hard work, many weeks of early mornings and late nights and much stress, but in the end I can say I'm proud of what our group managed to achieve in such a small amount of time. I'm glad we managed to start our design shortly after choosing our project. If we had of postponed this any longer, we would have had a much harder time getting everything to work by the end of the semester.

There were numerous difficulties encountered along the way. Firstly, don't assume anything until you've tested it. Being sold the wrong type of electronic valve caused a lot of issues initially. Soldering parts onto a perfboard was both time consuming and took a lot of care. I'm glad I ordered extra parts, because we ended up blowing up more than a couple transistors throughout the soldering phase. Also, purchasing a rubber mat that conducts electricity (even barely) can have some rather adverse effects on your final product just days away from the demonstration. This list barely scratches the surface of the amount of things that will go wrong during the course of the semester. But hang in there and become proficient at testing and diagnosing issues and it will go fine.

I can say that the success of our product came solely from relying on each of our team members to focus on their own areas of expertise and also from doing numerous unit tests on each component before integrating them together. While doing unit tests may take up a lot of time, the amount of time saved by diagnosing the causes of issues before integration will more than make up for it.

All in all, this project was a success. As a group of engineers, we were able to build a device that functioned correctly using all of our past experience from classes taken at SFU. I can honestly say, I will never forget the moment where we had just placed everything inside the mat and without any water, all four sensors were going off. Two hours later (and two days before our demonstration), after extensive testing, we find that the rubber mat we purchased was conducting electricity. We're all running off of no sleep, it's 2am and we're placing electrical tape over every bare connection we can find. Nobody could have thought that this would be an issue until we encountered it, but this is what the Capstone Engineering Project teaches you more than anything else; nothing will work correctly the first time around and diagnosing the reasons why something fails is just as important, if not more important, than trying to come up with a correct solution in the first place.

Barry Zou – Chief Financial Officer (CFO)

It has been a crazy period the past three month working the Wireless Leak Detector and Inhibitor System. The time went by fast with ups and downs, but it has been a great experience working alongside three other senior Engineering students. I already knew a couple of the members in the group and this course gave me the opportunity to know them even better. All of us and our different technical backgrounds came together and decided to apply those skills in a system that we believed could be beneficial to home and property owners.

As the CFO I was responsible for purchasing and keeping track of equipment list and project budgeting. Overall our project budget estimates were close to final development cost. I learned it is key to prepare your budget as early as possible. Online deliveries can take a long period you may not be able to afford, and missing an item means another delivery fee. For the technical side our team consisted of two hardware engineers and two software engineers.As one of the software engineers , I was responsible for designing and implementing the User Management module. I didn't have previous experience in developing a GUI application. Many challenges arose during the learning, implementation and debugging process. No previous course learned can prepare one for all the new challenges. It is through this learning process and experiencing it as one that allows you to gain new skillsets and evolve closer from an engineering student into a professional engineer.

Some other difficulties in the course include balancing between the documentations and the actual project, it was definitely different comparing to previous courses. I also believe having proper communication skills is one of the most important skills to have, not only for ENSC440 but for life in general. Our group had some issues in the initial project proposal phase in deciding project ideas. But once a decision was made, everyone was fully committed in making the idea a success.

Overall there were a lot of difficulties, but the end result is definitely worth it if you are able to persevere. Your technical knowledge, time management, communication, and more are tested to the limits. I believe Signatus and I were successful because of the great team I have been a part of, and I believe I contributed to the team at the same time. I would love to work with my team given a choice again. Overall the course ENSC440 is very challenging but rewarding. There is a reason why every accredited Engineering degrees in Canada all offer a Capstone project course, and those reasons are what makes this course one of the best.

7. Conclusion & Future Plans

Over the last 3 month, Signatus Inc. has been working extensively in developing a working Wireless Leak Detector and Inhibitor System. We are proud of what we were able to deliver in a short period of time. By applying our knowledge and expertise in the field of Engineering, we believe we have delivered a system that demonstrates the potential for a product that can affect and improve the lives of property owners. Although there were difficulties along the process, in the end we were able to persevere. There are definitely considerations and improvements to take into account for the project to move forward. However that exact path is currently unknown as team members of Signatus Inc. have different short term goals. Signatus Inc. would like to thank everyone who has been involved in the project: team members, investors, professors and mentors for having helped and guided us for the past 3 month.

8. Appendix

Meeting minutes attached below.

I. People at the meeting:

1. Olivier Thomas
2. Barry Zou
3. Chris Fontaine
4. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about the potential projects	Olivier Thomas and Petar Arnaut – A car driver wanting to turn left at the intersection cannot see if there is car coming from the far left line of the oncoming traffic. Therefore, if there is sensor installed in the car that can sense the temperature of the object of the vehicle (using infrared light), there would be a small chance of a car accident. [1]

III. Date, Start Time, and Duration of the meeting:

September 5th, 2013	1300 hours	1 hour

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Barry Zou
3. Chris Fontaine
4. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about the potential projects	Olivier Thomas – Automatic wi-fi relay breaker. For example, if the owner of an apartment leaves his/her place, and leaves the stove on (or any other device that can set on fire), there would be a sensor that checks it the owner's cell phone is out of home's wi-fi connection. If that is the case, the stove would turn off automatically. [1] Chris Fontaine - Automated utensil/cutlery packaging machine. In a restaurant, waitresses have to fold cutlery tools into a napkin before putting them on the table. There would be a machine build that does it automatically for them. Usually, it takes 30 seconds for a person to fold them up. Therefore, it would save time and money for the owner of the restaurant. Also, waitresses could go home earlier. [2] Barry Zou – A golf glove that calculates the force, acceleration, distance and angle of the golf ball. Therefore, a golf player can adjust his arm the next time he/she kicks the ball. [3] Second Barry's idea was an assisting walker for elderly to reduce stress on knees when returning to standing position. [4] Petar Arnaut – A sensor that measure a temperature on the phone/laptop charger and ejects the charger cable from the outlet in case of a high temperature of the cable. [5] Olivier Thomas and Petar Arnaut – a robot that detects ants, and vacuums them. [6] Project selected - Automated utensil/cutlery packaging machine. Group members spoke to Lucky who accepted the project. [7]

III. Date, Start Time, and Duration of the meeting:

September 10th, 2013	1300 hours	1 hour

I. People at the meeting:

1. Olivier Thomas
2. Barry Zou
3. Chris Fontaine
4. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about the potential projects	Petar Arnaut and Olivier Thomas are against the idea due to the time for fabrication cost and the project complexity. [1] Petar Arnaut and Olivier Thomas proposed another idea : wireless leak detection and inhibiting system. This device would detect a water leakage in the house, and turn off the valve in order to prevent water from going through the broken pipe. [2] Chris Fontaine wanted to do something related to lights system during the DJ performance in the club. [3] Petar Arnaut, Olivier Thomas, and Barry Zou agreed that they want to work on the wireless leak detection and inhibiting system. Chris Fontaine decided that he would agree in case Lucky accepts the idea. [4]

III. Date, Start Time, and Duration of the meeting:

September 12th, 2013	1230 hours	2 hours

I. People at the meeting:

1. Olivier Thomas
2. Barry Zou
3. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about the potential projects	Group members wanted to talk to Lucky to see if he will approve the project. Luckly was not in his office. [1] Group members did more research about the potential project (Wireless leak detection and inhibiting system). There was an agreement that the project would be beneficial in terms of costs and complexity. [2] Group members decided that Olivier Thomas and Barry Zou will meet up with Lucky on Friday afternoon.

III. Date, Start Time, and Duration of the meeting:

September 12th, 2013	1630 hours	2 hours

I. People at the meeting:

1. Olivier Thomas
2. Barry Zou

II. Topics included and Speakers:

1. A discussion about the Wireless leak detection and inhibiting system project related to the insurance policy for houses	Group members did more research about the insurance policy of the house in case of a water leakage. Research showed that the insurance company will not cover the expenses in case of a poor maintenance of the house. [1]
2. A discussion about a company name	Group members decided to called the company SIGNATUS (it means 'field' in latin). [1]
3. Meeting with Lucky to ask about the approval	Lucky told the group members to post everything on sfu canvas, and that he will check it on Saturday. [1]

III. Date, Start Time, and Duration of the meeting:

September 5th, 2013	1300 hours	1 hour

I. People at the meeting:

1. Barry Zou
2. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about wireless leak detection and inhibiting system regarding a meeting with Lucky (this discussion was done on Skype)	Barry Zou explained what Lucky said during his meeting with him and Olivier Thomas. [1] Barry Zou told Petar that the proposed name of the company is SIGNATUS. [2]

III. Date, Start Time, and Duration of the meeting:

September 13th, 2013	1900 hours	30 min

I. People at the meeting:

1. Olivier Thomas
2. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about the project proposal funding.	Olivier Thomas completed project proposal funding. Also, Olivier Thomas found out that the project proposal funding presentation is tomorrow at 6 pm. [1]
2. A discussion about the project logo	Olivier Thomas gave an idea about the project logo. [1]
3. A discussion regarding dividing rankings among group members	Olivier Thomas said that Barry Zou wants to be a chief financial officer. [1] Other group members need to discuss how the rankings will be distributed about the remaining team members. [2]
4. A discussion regarding a specific project tasks	Most likely, Olivier Thomas and Barry Zou will be working on the software part of the project. Chris Fontaine and Petar Arnaut are supposed to work on the electronics' parts.

III. Date, Start Time, and Duration of the meeting:

September 16th, 2013	1700 hours	1 hour

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Barry Zou
3. Chris Fontaine
4. Petar Arnaut

II. Topics included and Speakers:

1. A discussion related to rankings among teammates	Petar Arnaut – CEO Olivier Thomas – COO Chris Fontaine – CTO Barry Zou – CFO Definition of CEO - A chief executive officer (CEO) is the highest-ranking corporate officer (executive) or administrator in charge of total management of an organization. An individual appointed as a CEO of a corporation, company, organization, or agency typically reports to the board of directors. [1] Definition of COO - The COO is responsible for the daily operation of the company, and routinely reports to the highest ranking executive, usually the Chief Executive Officer (CEO). The COO may also carry the title of President which makes him or her a clear second in command at the firm, especially if the highest ranking executive is the Chairman and CEO. [2] Definition of CTO - A chief technology officer or chief technical officer (CTO) is an executive-level position in a company or other entity whose occupant is focused on scientific and technological issues within an organization. [3] Definition of CFO - The chief financial officer (CFO) or chief financial and operating officer (CFOO) is a corporate officer primarily responsible for managing the financial risks of the corporation. This officer is also responsible for financial planning and record-keeping, as well as financial reporting to higher management. In some sectors the CFO is also responsible for analysis of data. [4]
2. A discussion related a project logo	Olivier's idea related to the logo was accepted by the other group members. In case someone comes with another idea, it will be discussed. [1].

	Chris Fontaine will work on the logo. [2]
3. A discussion related to specific tasks between teammates	This needs to be determined after the project proposal funding meeting. [1]
4. A discussion related to a project funding proposal meeting	All team members will show up for a meeting at 8:15 pm in ASB 9705. [1]
5. A discussion about a company name	Teammates agreed to call the company SIGNATUS. [1]

III. Date, Start Time, and Duration of the meeting:

September 17th, 2013	1300	1 hour

IV. Actions to be met and deadlines:

1. Petar Arnaut needs to check what the full name for the company should be	September 18th at 11:59 pm
2. Petar Arnaut needs to add the title of each teammate	September 18th at 11:59 pm
3. Petar Arnaut needs to find out when the first draft of the project proposal is supposed to be delivered	September 18th at 11:59 pm
4. Barry Zou needs to complete the project proposal (all parts except the timeline and gantt charts)	September 18th at 11:59 pm
5. Barry Zou needs to order parts for the project	TBD
6. Chris Fontaine needs to create a project logo	September 20th at 11:59 pm
7. Olivier Thomas needs to create a timeline and gantt charts	September 18th at 11:59 pm

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about project conceptual and high level design diagrams	Petar Arnaut decided to work on these two diagrams. [1]
2. A discussion about timeline graphs	Olivier Thomas confirmed that he has completed these two graphs. [1]
3. A discussion about perfboards	Olivier Thomas and Petar Arnaut agreed that Petar Arnaut needs to do research about using perfboards. [1]
4. A discussion about sensor circuits	Olivier Thomas and Petar Arnaut decided that Petar Arnaut needs to do research about how Signatus will implement sensor circuits. [1]

III. Date, Start Time, and Duration of the meeting:

September 19th, 2013	1230 pm	30 min

IV. Actions to be met and deadlines:

1. Petar Arnaut's conceptual and high level design diagrams	September 19th at 11:59 pm
2. Petar Arnaut's research about using perfboards	September 24th at 11:59 pm
3. Petar Arnaut's research about sensor circuits	September 24th at 11:59 pm

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Petar Arnaut
3. Chris Fontaine

II. Topics included and Speakers:

1. A discussion about tasks related to the future documentation	Petar Arnaut told Olivier Thomas and Chris Fontaine that the content of the future documents will be equally shared among all the members of the team. Olivier Thomas and Chris Fontaine agreed. [1] Petar Arnaut told meeting participants that Olivier Thomas will be responsible for formatting of all future documents. Oliver Thomas agreed. [2] Petar Arnaut told Chris Fontaine that he will be the main person for peer reviewing of the future documents. [3] Petar Arnaut said that Oliver Thomas and he will be responsible for all future diagrams/images. [4]
2. A discussion about tasks related to the project proposal document	Petar Arnaut said that the final proposal needs to be modified. The other two members agreed. [1] Olivier Thomas said that he will work on the logo and theme. [2] Chris Fontaine said that he will check the entire content of the draft proposal document. [3]
3. A discussion about sensor circuit	Oliver Thomas told Petar Arnaut to check the way of doing a sensor circuit and the breadboard to be used (perfboard). Petar Arnaut agreed. [1]
4. A discussion about protecting a circuit	Chris Fontaine said that teammates can build 'a wall' around the circuit so when the entire part is sealed, no one will be able to step on the circuit and damage it. Also, it prevents circuit from moving. [1]
5. A discussion about MCU and transceiver	Olivier Thomas told teammates that they need to check if Arduino mini pro can be used with NRF 34 L01+ transceiver as the best option for this project. Otherwise, if there is some other

	idea, it will be discussed. [1]
6. A discussion about funding	Olivier Thomas said that if there is no other solution, team members will be buying parts for the project on Monday. [1]

III. Date, Start Time, and Duration of the meeting:

September 24th, 2013	1 pm	1 hour

IV. Actions to be met and deadlines:

1. Olivier's logo and theme	September 25th at 11:59 pm
2. Chris' review on the content of the project proposal	September 25th at 12:00 pm
3. Oliver's formatting of the final project proposal content	September 25th at 11:59 pm
4. Everyone's final review of the project proposal after Oliver's formatting	September 26th at 18:00pm
5. Petar Arnaut's research about sensor circuits	September 26th at 11:59 pm
6. Petar Arnaut's research about perfboards	September 25th at 11:59 pm
7. Everyone's task but Oliver's related to discussion #5	September 29th at 11:59 pm

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Petar Arnaut
3. Barry Zou

II. Topics included and Speakers:

1. A discussion about ordering project parts	Barry Zou said that he will order parts online. Arduino, transceivers, etc.[1] Olivier Thomas said that he will send Barry Zou a completed list of parts that needs to be bought. The shipping takes 5-7 days. [2]
2. A discussion about adding a buzzer in the water sensor circuit	Olivier Thomas wants to include a buzzer in the water sensor circuit. For example, if there is a leak, the owner of a house might want to be notified that there is a leak if case he/she is sleeping at that moment. Petar Arnaut and Barry Zou agreed to it. [1] Barry Zou said that he will make a button on the user management GUI so the user can turn on/off a buzzer. [2]
3. A discussion about a functional specification document	Petar Arnaut said that the order will be the following: 1. Barry Zou– introduction., software GUI requirements [1] 2. Olivier Thomas– MCU software requirements, executive summary, formatting [2] 3. Chris Fontaine– Electronic valve hardware requirement, user documentation, test plan, conclusion [3] 4. Petar Arnaut– system overview, water sensor hardware requirements [4] Barry Zou and Olivier Thomas agreed. Chris needs to agree (not at the meeting since he is sick) [5]

III. Date, Start Time, and Duration of the meeting:

October 1st , 2013	11 am	1 hour

IV. Actions to be met and deadlines:

1. Barry Zou needs to order parts	October 2nd at 11:59 pm
2. First draft for the functional specification	October 10th at 11:59 pm

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Barry Zou
3. Chris Fontaine
4. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about parts that Barry Zou ordered	Barry Zou received the following parts: batteries, cables, boxes, buzzers, etc. [1]
2. A discussion about functional specification documents	Chris Fontaine said that all group members have to submit their parts by Monday evening so he proofread it. [1] Olivier Thomas will work on formatting after that. [2]

III. Date, Start Time, and Duration of the meeting:

October 10th, 2013	1230 pm	30 min

IV. Actions to be met and deadlines:

1. Functional specification parts that need to be sent to Chris	October 14th at 11:59 pm
2. Functional specification document formatting	October 17th at 11:59 pm

I. People at the meeting:

1. Barry Zou
2. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about functional specification document	Petar Arnaut and Barry Zou had a conversation on Skype about parts of functional specification. Petar Arnaut agreed with Barry Zou that a few requirements had to be modified related to a detector. [1]

III. Date, Start Time, and Duration of the meeting:

October 14th, 2013	1500	1 hour

IV. Actions to be met and deadlines:

1. Changing a few requirements in the detector part of functional specification	October 14th at 11:59 pm

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Barry Zou
3. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about functional specification document	Olivier Thomas, Barry Zou, and Petar Arnaut went over the priorities of each requirement. [1]
2. A discussion about arduino MCU and tranceivers	Barry Zou received the arduino MCUs with transceivers. [1]
3. A discussion about formatting	Olivier Thomas said he will be working on formatting. [1]

III. Date, Start Time, and Duration of the meeting:

October 17th, 2013	1300	1 hour

IV. Actions to be met and deadlines:

1. Olivier Thomas' formatting of functional specification document	October 17th at 11:59 pm

I. People at the meeting:

1. Olivier Thomas
2. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about water detector circuit	Petar Arnaut wanted to do the circuit as a voltage divider. Olivier Thomas did not agree with that since the voltage divider can be only used as an analog input to the MCU (i.e voltage will vary). [1] Olivier Thomas said that the circuit needs a BJT that will be used as a switch. [2] Petar Arnaut told Olivier Thomas that a BJT cannot be used since it is only used for a switch for obtaining low currents (for example, in order to turn the LED on). Olivier Thomas told Petar Arnaut to check if the circuit will work with MOSFETS. [3]

III. Date, Start Time, and Duration of the meeting:

October 27th , 2013	1700 pm (phone conversation)	30 min

IV. Actions to be met and deadlines:

1. Water leak detector circuit with a MOSFET (Petar's task)	October 30th at 11:59 pm

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Chris Fontaine
3. Barry Zou
4. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about a detector circuit.	Petar Arnaut said that he will do the circuit with an NMOS 2N7000. [1]
2. A discussion about a battery holder for the detector battery inside the rubber mat	Olivier Thomas proposed a solution for a battery holder inside the rubber mat. [1]
3. A discussion about a rubber mat measurements	Olivier Thomas and Petar Arnaut said that we need to wait until the detector circuitry is completed. [1]
5. A discussion about a buzzer (needs to be tested)	Petar Arnaut, Olivier Thomas, and Barry Zou tested the buzzer. Olivier Thomas said that the buzzer is wrong and that Barry Zou needs to order a new one. [2]
6. A discussion about a perfboard	Petar Arnaut said that he will go buy a perfboard. [1]
7. 4. A discussion about electronic valve, pipe, and enclosure for the MCU+transceiver inside the inhibitor (update)	Chris Fontaine said that he only found an electronic valve with a 12 V battery. Therefore, we will need a voltage divider since the MCU works with a voltage 5-12 V. [1] Chris Fontaine said that the pipe is ¾ inch. It could be bought at Home Depo. [2]
8. A discussion about user management software (update)	Barry Zou said that he is currently working on GUI but he will be moving to communications part. [1] Each detector will have its own address, the user management reads it, and the customer assign to a location to it. [2]
9. A discussion about software+hardware parts of Arduino and transceivers (update)	Olivier Thomas should be done by the end of next week. [1]
10. A discussion about the oral presentation (November 1st)	Petar Arnaut told group members that they have to know what each members of the group is working on. [1]

III. Date, Start Time, and Duration of the meeting:

October 30th, 2013	1030 am	1 hour

IV. Actions to be met and deadlines:

Water sensor circuit solution (Petar Arnaut's task)	November 4th at 11:59 pm
Buying pipes and electronic valve (Chris Fontaine's task), NMOS, perfboards (Petar Arnaut's task) and buzzers (Barry Zou's task)	November 4th at 11:59 pm

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Barry Zou
3. Chris Fontaine
4. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about water sensor circuit solution	Petar Arnaut showed group members his solution with an NMOS. However, he told them that the professor Lucky One does not agree with it. Lucky One told Petar Arnaut and Chris that they should use a Wheatstone bridge with an amplifier to achieve an analog voltage for the arduino MCU. [1] Chris Fontaine decided to work on it during the day. [2]
2. A discussion about a rubber mat measurements	Olivier Thomas said that group members should place a piece of wood on top of the middle layer of the rubber mat so the weight placed on the mat will not damage the circuit. Group members agreed [1] Petar Arnaut showed the order of parts inside the rubber mat. Group members agreed [2]
3. A discussion about perfboards	Petar Arnaut bought a perfboard that will be used for a water sensor circuit [1]
4. A discussion about the user management	Barry Zou said that he completed the GUI. He is working on the communications between the user management and the other parts of the project. [2]
5. A discussion about a pipe, electronic valve	Chris Fontaine bought an electronic valve. [1] Chris Fontaine said that he needs to add a switch for the inhibitor part in order to shut down the valve (NMOS should be used) [2] Chris Fontaine said that he will get a pipe with a container from Home Depot. [3]

III. Date, Start Time, and Duration of the meeting:

November 5th, 2013	1030 am	2 hours

IV. Actions to be met and deadlines:

1. Petar Arnaut's and Chris Fontaine's water sensor circuit solution	November 5th at 11:59 pm
2. Chris Fontaine's pipe and container shopping	November 9th at 11:59 pm

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Chris Fontaine
2. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about a water sensor solution	Petar Arnaut told Chris Fontaine that there could be issues if an amplifier is used. Issues are the following: the gain will give an output voltage higher than 5 V(maximum allowed for arduino). If the differential voltage is lowered, that means that the difference between them is really small, and therefore it would be hard to see the difference in the voltage range for no leak and leak since water resistance varies. Also for smaller gain (if possible), more resistances need to be added, but the circuit needs to be as smallest as possible. [1] Petar Arnaut told Chris Fontaine that he would rather go with the comparator since once IC could be used (the one that has four op amps), and the circuit would be simplified. All group members were notified and agreed with the solution. Petar Arnaut said that it is the most important part of the project (nothing works, if this does not work), and therefore if a solution does not guarantee the expected result, it cannot be used [2]

III. Date, Start Time, and Duration of the meeting:

November 7th , 2013	1230 pm	30 min

IV. Actions to be met and deadlines:

1. Petar Arnaut's water sensor circuit on a breadboard	November 9th at 11:59 pm

I. People at the meeting:

1. Olivier Thomas
2. Petar Arnaut

II. Topics included and Speakers:

1. An integration of water sensor circuit and arduino	Petar Arnaut and Olivier Thomas integration their parts. Conclusion: the water sensor circuit with the arduino are able to detect the leak[1]

III. Date, Start Time, and Duration of the meeting:

November 10th , 2013	2 pm	1 hour

IV. Actions to be met and deadlines:

1. Petar Arnaut's water sensor circuit (on a perfboard) integration with Olivier's work on arduino	November 17th at 11:59 pm

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Barry Zou
3. Chris Fontaine
4. Petar Arnaut

II. Topics included and Speakers:

1. A discussion about design specification document	Chris Fontaine said that he will complete his parts by tomorrow morning. [1] Petar Arnaut needs to email professor Mike to ask him if group members can use the extension option. [2]
2. A discussion a buzzer	Olivier Thomas sent a description of a buzzer to Barry Zou since he needs to order it. [1] Olivier Thomas said that a buzzer will be added with an NMOS since it could be used as a switch. [2]
3. A discussion about mechanical parts	Petar Arnaut will work on the rubber mat design during the weekend. [1]
4. A discussion about each members work and their progress	Barry Zou said that he completed 75% of LU1 transceiver part. Barry Zou and Olivier Thomas will be testing their parts next week. [1] Petar Arnaut tested his circuit with 4 sensors with Olivier's arduino MCU part. It worked. Petar Arnaut and Olivier Thomas made a video of it. [2]

III. Date, Start Time, and Duration of the meeting:

November 14th, 2013	1230 pm	1 hour

IV. Actions to be met and deadlines:

1. Petar Arnaut's water sensor circuit on the perfboard	November 16th at 11:59 pm
2. Petar Arnaut's rubber mat design (middle layer)	November 17th at 11:59 pm
3. Integration of Barry Zou's user manager with Olivier's Arduino and transceivers	November 18th at 11:59 pm

SIGNATUS Meeting Agenda
Group 06

I. People at the meeting:

1. Olivier Thomas
2. Petar Arnaut
3. Chris Fontaine
4. Barry Zou

II. Topics included and Speakers:

1. A discussion about parts that are needed to be bought in order to finish up the project	Barry Zou proposed an idea for the top layer of a rubber mat. It is supposed to use four buttons in order to open up the middle layer. [1] Olivier said that bras pins need to be bought as the water probes [2] Chris Fontaine needs to find metal pieces to hold the electronic valve [3] Petar Arnaut said that a plastic cover needs to be bought in order to put a rubber mat on it and prevent water from going on the carpet during the demo time [4]
2. A discussion about future work on the project	Petar Arnaut said that group members have to get together every day from today until the project is done to work on the design together and its implementation. Group members agreed on that [1] Petar Arnaut said that he needs to complete a buzzer circuit and work on the rubber mat. [2] Olivier Thomas said that he needs to work on the transceivers. 90 % of the work done. Also, he said that he will help Petar Arnaut with a rubber mat[3] Barry Zou said that he needs to work on the user management part. Progress is made, but not completed yet. [4] Chris Fontaine needs to construct a circuit for the inhibitor and enclose it. [5]

III. Date, Start Time, and Duration of the meeting:

November 21st, 2013	1230 pm	2 hours

IV. Actions to be met and deadlines:

1. Buying last parts for the project	November 23rd at 11:59 pm
2. Petar Arnaut's buzzer circuit and rubber mat	November 25th at 11:59 pm

3. Olivier Thomas' transceivers	November 25th at 11:59 pm
4. Barry Zou's user management	November 26th at 11:59 pm

NOTE: After this Signatus members met up every day to work on integrating and testing their project. On Sunday December 1st, we met up to prepare for the presentation which took 4 hours. I didn't count these days as a meeting.