December 5, 2014

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, BC, V5A1S6

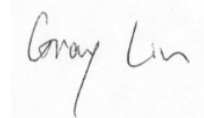Re: ENSC 305W/440W Post-Mortem for Smart Irrigation System

Dear Dr. Rawicz:

Please find the enclosed paper, "Post Mortem for Smart Irrigation System", which discusses the smart control box for automated garden irrigation system designed specifically for the Internet of Things (IOT).

This document provides the current state of our project and first prototype, difference between the original plan and the future development of the design. It includes some of the challenges and problems that we encountered during the developing phase. Meanwhile, the actual budget and timeline will be presented in this document, as well as the individual reflection from each member.

There are five experienced engineering students in our team: Team Chase Technologies (TCT) .If you have any questions or concerns, please contact me by phone at (778)881-5322 or by email at yuhengl@sfu.ca . I will serve as the contact person for our team. We look forward to your comments and suggestions.

Sincerely,

Gray Lin

Gray (Yu Heng) Lin
Chief Executive Officer
Team Chase Technologies

Enclosure: Post-Mortem for Smart Irrigation System

Team Chase Technologies

Post-Mortem:

Smart Irrigation System

Project Team: Gray (Yu Heng) Lin
Chase (Youdao) Wen
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Yuchen Wang

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Submitted to: Dr. Andrew Rawicz – ENSC440
Steve Whitmore – ENSC305
School of Engineering Science
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Issued date: Dec 8, 2014

Revision: 1.5

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Glossary

APP   – Application

IOT   – Internet of Things, IOT is a scenario that objects are capable transferring data to other objects over a network without human interaction [2]

LCD   – Liquid-Crystal Display

PCB   – Printed Circuit Board

RAM   – Random-Access Memory

UI   – User Interface

1. Introduction

The following documentation presents the post-mortem of the smart irrigation system. The current state of the first prototype and deviation of the original plan, estimated budget and timeline will be explained. In addition, the individual reflections will be provided and all meeting minutes can be attached in appendix.

1.1 Project Background

The project, "C-sprinkler", is a smart irrigation system which is designed to help users to free their hands and still maintain their garden well even when they are away from their homes, by providing independent AI, remote control ability and cloud service. Meanwhile, the C-Sprinkler will still retain some functions of a tradition irrigation system, such as timers and changing directions of the sprinkler.

There are three major components of our product,

- Hardware, including control unit and sensors
- Software, including embedded system and networking
- Mobile App, which allows user has easy access to the system on their phone

The C-Sprinkler will use various information to irrigate gardens automatically without requiring human inputs. The system collects data from sensor and online open source, and calculate on the cloud server to determine the best timing for irrigation and the watering amount.

The user can also manually change settings to their preference, either through the mobile app or on actual control box. All settings and history records will be uploaded to cloud servers securely. The system will also give the user warning when there is a sudden change in the environment to ensure the plant's health.

2. System Overview

C-Sprinkler has three main components that allow user to remotely control the system on the mobile app or on the control box itself. **Figure 1** below shows how user can interact with the system.
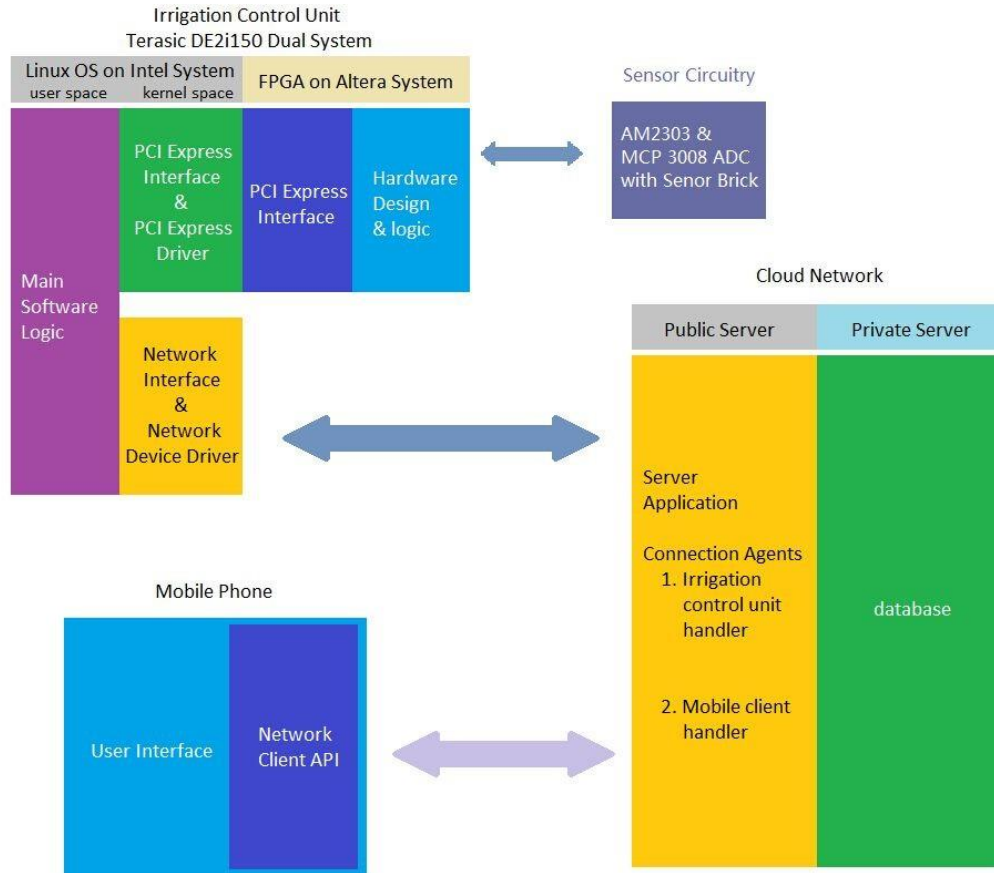
Figure 1: System Overview

The mobile app and control box provides the interface between the user and system. User can use mobile app to remote control the sprinkler and check the current status as long as the mobile phone is connected to the internet. The user may send the command from the phone to the server and server will push the command to the control box. Some functions will be provided, such as irrigation scheduling, turning on/off of the valve and environment status checks. The user can also directly interact with the control box.

2.1 Hardware Overview

The digital circuit module is a subcomponent within the irrigation control unit. Development is done on Altera FPGA by VHDL programming. Main functionalities of this module includes

- Control the valve power either by push buttons or request from Intel processor
- Display sensor results and remaining time of irrigation
- Data capture logic for temperature sensor and soil moisture sensor
- Synchronize the latest changes to the Intel processor through PCI Express interface

2.2 Software Overview

The main logic application in the irrigation control unit contains a main thread and the child threads listed below. The main thread is responsible for initializing PCIE driver and child threads, and then it becomes an infinite loop to ensure the child threads are up and running all the time.

- Measurement thread - an infinite loop for measurements
- Scheduling AI thread - calculates and schedules the time for irrigation
- Server connection thread - maintains the connection between the server and the control unit
- Hardware listener thread - checks if there is any incoming data from PCIE driver
- UI thread - displays current status of the program to terminal in real time

2.3 Mobile App Overview

The mobile app functions as a user interface to control the system remotely. The app contains 5 pages: Login page, Operation page, History page and Block Policy page. All pages involves app-server communications.
- Login Page - account control to access all other pages
- Operation Page - UI to control sprinkler operation activities and display weather forecast
- History Page - display calendar to select days and display charts for temperature, humidity and operation time
- Block Policy Page - display all block time period and UI to modify block time

3. Major Problems/Challenges

Problems and challenges during the hardware development mainly were PCIe synchronization and sensor performance instability. PCIe is the main method to transfer data between CPU and FPGA. Due to the complexity of PCIe, to understand the working mechanism in both physical and theorem of PCIe is challenging to us. Sometimes PCIe sends out noise signal without changes in the logic design. At the end of the debugging phase, we realized the occurrence number of noise signal decrease if we lower the clock rate from 50 MHz down to 100 kHz. This increase the stability of the system and reduce the risk of system crash. In terms of sensor data capturing, sometimes the sensor freezes during the runtime although the power supply and FPGA connection are correct. To solve the problem requires us to comprehend the physical characteristics which needs additional research and debugging. This is difficult because we are not familiar with the internal configuration of the sensor.

4. Future Plan

Due to the limited time and resource, the team was only able to achieve the basic functions in the original plan. The additional functions listed below should be implemented into final product to attract more customers.

- Better UI for the mobile app

The UI on mobile app is for the first prototype testing only. The UI should be more user friendly and easier for user to recognize and access the functions without any manual or instruction provided.

- Implement the calculation algorithm

Currently our calculation is based on research only, we have to use the feedback after second or third prototype from end users to implement our algorithm before the final product being released.

- Switch to ARM solution

For this project the X86 Intel FPGA is being used. This part is the most expensive among other parts and it is too powerful for the project. To reduce the cost the ARM solution should be considered since it is the mainstream in the current market. According to the research in the proposal, by switching to ARM solution could save around 50% of the cost.

- Expand usage of system

During the cloud server debugging, we have simulated to use one console to control over 1000 sensors. This is a potential for us to develop another version for the enterprise such as Vancouver Board of Parks and Recreation. They could easily use our system to monitor the irrigation of the plants without caretakers being on site.

5. Budget and Cost

The financial expenditure for the entire project is similar to the financial status in the written progress report. The following is a list of comparison between the estimated expenditure and actual expenditures. Despite we have to make another two purchases that was not included in the estimate cost, we are capable of staying within the estimated budget.

Item	Est. Cost(CAD)	Actual Cost (CAD)
DE2i-150 FPGA Development Kit	Borrowed	Borrowed
Electronic Components	55	50
Soil Moisture Sensor	10	5
Wire and Jumpers	15	15
Motion Sensor	10	5
DHT22 Sensor	10	10
10 Bit ADC	5	3
5V Relay	5	3
24V DC LED	0	9
Irrigation Auto Inline Valve	20	17
Plug in Transformer 24V	20	20
Plastic Enclose	0	21
Others	100	80
TOTAL	195	188

Table 1: Cost Comparison

6. Timelines

In reality, the project became more time consuming when we approaching to an end. Although the project did progress as scheduled, we had to work extra hours to meet time schedule which are indicated by red highlights. The main difficulties appeared during application development winding up, and the integration and testing at the end of the project.
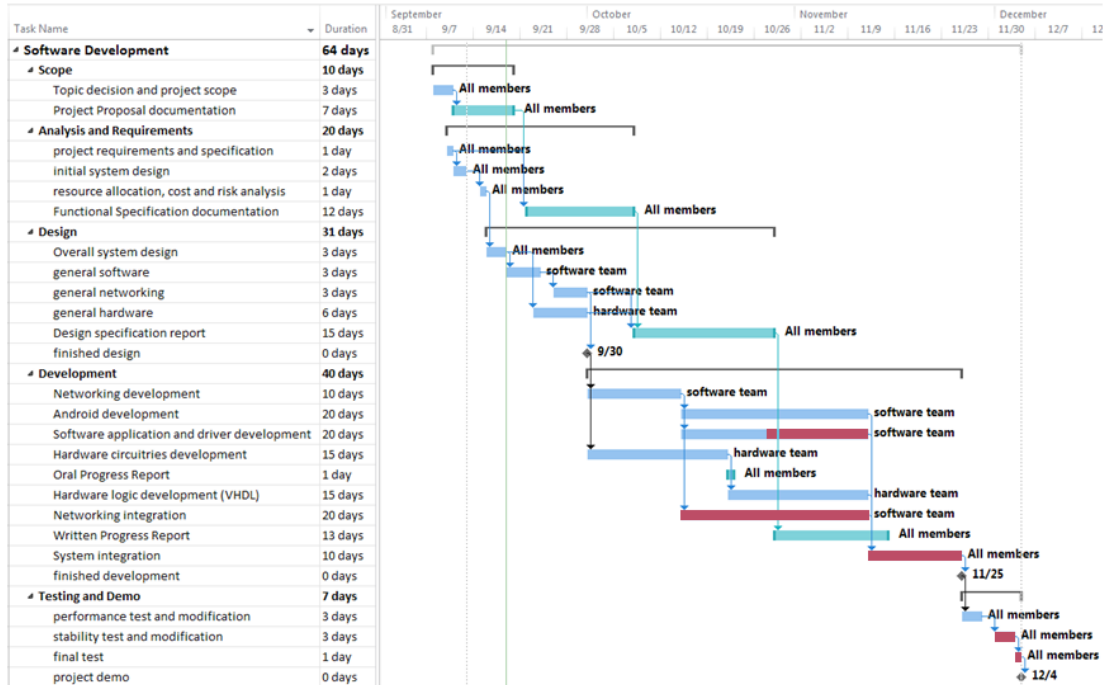

Figure 2: Actual Schedule of the Timeline

7. Group Dynamics

Team Chase Technologies is a group formed by 5 senior engineering students, they have been friends since long time ago and had chances to work together in the previous classes or projects. Hence, they are familiar how other people in the team handle the problems and dealt with the issues. Therefore in the beginning of the project, the workload can be distributed by their strength and weakness.

For the project, the system has been divided into Hardware, Software and Mobile app sections. The documentation is also split into several parts corresponding to the sections mention above. Throughout the four months development phase, the team was using Google Group as the primary discussion and file sharing place, Wechat for instant

messaging and Skype for voice chat to reduce the communication time. Besides that, the team were able to meet together on the weekly basis to discuss the project. Near the end of the project, some members even needed to meet other members alone for the integrating and debugging process.

During the developing phase, when one of the member cannot meet the deadline, the team will reduce his or her workload and forward it to other members who are more flexible unless there is a specific request from that member. If the problem involves two or more members, for example, integrating process, team will ask them to sit together and point one of the rest members to review the case from different perspective. In this way, they can both find out what they are missing during the developing and find the solution which favors both parties.

	Yu Heng Lin	Chase Wen	Abel Lin	Yolanda Wu	Yuchen Wang
Documentation	High	Medium	Medium	Medium	Medium
Administration	Medium	Medium	Low	Medium	High
Financials	High	Low	Low	Low	High
Purchasing	High	High	Low	Low	High
Communication	Medium	Medium	Medium	Medium	High
Hardware Development	Medium	High	Low	Low	Low
Android Development	Low	Low	Medium	High	Low
Firmware Development	Low	Medium	High	Low	Low
Cloud Service	Low	Low	High	Medium	Medium
Enclosure	High	Medium	Low	Low	Medium
Graphic Design	Medium	Low	Low	High	Low
Debugging	Medium	Medium	Medium	Medium	High

Figure 3: Workload Distribution Matrix

7.1 Individual Reflection – Gray (Yu Heng) Lin

Throughout the past four months, I have proud to be a member of the Team Chase Technologies for the ENSC305/440 Capstone Project. In the developing phase, I have improved my communication skills to work in the group, practiced my electrical skills learnt from the school in the real world situation, and used my life experience towards design and testing.

As a CEO in the TCT, I was responsible for the administrator work, communication with vendors and additional help for the hardware developing. From my previous co-op experiences, it required a lot of communication between people. I have used those skills towards the communication in the team and with the vendors. The team organization and work distribution were also part of the administration work. I believe I have spilt the work fairly and had everything under control most of the time. However I think I should have at least two people in each developing team instead of one. My main goal was intend to let everyone focus on their strength to speed up, but the problem happened in mobile app developing made me to reconsider the work distribution which the process got stuck and no other members can help. This really hurt the entire developing progress. In the future I probably will consider to let everyone takes two parts and the overlap between works will also benefit the integration process.

From technical perspective, I have used the VHDL skills learnt from ENSC 350 towards the developing. There are a lot of difference between the real world situation and the assignments in the class, and much more things need to be considered during the process. In the school our study is only limited to certain commands. In the project, everything is available and unknown, therefore it took me some time to figure out which command is more suitable by searching the example and testing on the simulator.

Other than that, I have also learnt how to start up a small company and to prepare for it. I think the most important thing in the team is not the skills that you have, it is the working environment. Being the CEO I had responsibility to keep everything running in order, I tried not to put too much pressure on other members since everyone has their own works to do. We often hanged out together to relax, however during the developing I want them to pay attention to take responsibilities of their work.

Last but not the least, I would really like to thank all of my group members to contribute their time and work towards this project. Even though the prototype is not perfect, it is a representation of our work. If there is a project or work in the future I am highly interested to work with them again. In the end, the project is hard but we have tried our best to overcome the problems and weakness to reach the final.

7.2 Individual Reflection – Chase Wen

Throughout the development of C-sprinkler with my team during the semester, I have gained a precious experience which not only improved my professional ability, but also enhanced my interpersonal skills in a team. It has been amazing to work with my teammates, Abel, Yuchen, Yolanda and Gray who are professional in their fields and accomplished their tasks well. Besides being teammates, each member in the group is also reliable friends in life. Working and struggling for an identical goal with friends makes our development process fun and happy.

I was responsible for the hardware development in the team. During the development, I had opportunities to improve my engineering skills in digital signal processing, circuitry design, material selection and soldering which are all critical abilities as an electronics engineer. One of the most challenging task I encountered was to move the analog circuit from the breadboard onto the perfboard. Resource limitation restricts allowable attempts when soldering. Any damages in sensors will directly result in the failure of the entire project. Even after soldering was done, the solder point might still be loose due to temperature, unappropriated solder amount and vibration. After the task, I have improved my soldering skills and learned circuit development knowledge including perfboard and PCB soldering.

Due to the dynamics of our project, other fields such as Android application and networking also provided me excellent opportunities to study knowledge outside my major. I have learned JAVA programming for Ellipse, sever application and database construction from Abel and Yolanda who are professional engineers in such fields. Even for the hardware development, we designed a handshaking process for data transmission to prevent data lost which is widely used in networking design.

During the teamwork, I realized interpersonal skills and team atmosphere are equally important to technical skills when work as a team. A good working atmosphere not only raises the work efficiency, but also lets everyone enjoy working for the project. I have learned how to appropriately describe the opinion when disagreements occur, how to communicate with the teammate under proper attitude when progress is behind. At the beginning of the project, I blamed teammates whoever made mistakes. However, I then realized blaming dose not solve any problems but making the team atmosphere down. I started to focus on finding the solution instead of tracing whose fault it is. Never blame your teammates when something goes wrong is the most important lesson I learned.

7.3 Individual Reflection – Yolanda Wu

In this project is an excellent mock up for starting up a technical company in the real life and I really appreciate that I was provided with this experience. During the past a few weeks, I have experienced a lot and learnt a lot.

This project motivated me to try starting up a company. I have been collecting solutions to optimize some products in the real life. Starting up my own company can help me apply those solutions to convenient people's life. Actually, I was thinking about it one year ago when I was working for a small company but there was no guide for it. Finally, after this project, I have got some ideas of what to do.

In this project, I realized how important the time management is. My schedule was pretty packed in the past a few weeks so that I was not really freaked out when each deadline approaching. I can't imagine how awful it would be if we didn't have a reasonable time management plan. Furthermore, it is also important to keep meeting minutes on the pager. It happens that we have different understandings about our project design and I used the meeting minute as the reference to find out.

In addition, I felt like the most important thing in a project is to keep the optimistic attitude. During this project, I felt ambitious at the beginning and then I felt anxious and worried for the outcomes of the project. Basically, most of the time I was working under stress. Unfortunately, as we worked in a team, the negative emotions were spread from one to another.   Similarly, positive emotions could also affect other team members. It is true that when each deadline was approaching, keeping calm and optimistic helps keep the work efficient.

I have become more familiar with Android view customization, multithread programming and have much better understanding about app-server communication network. For this time, instead of sending AJAX calls to communicate with the server, I have learnt the new way by connecting to the server by socket directly. By this way, we don't need to maintain the web service.

I enjoyed working in my group. I think it because our personalities were able to get along well with each other and each individual in our group has specialities.   The project we have chosen combines our specialties so that each of us found the position that fit us well.

7.4 Individual Reflection – Abel Lin

My job is to develop the software solution for the embedded system, Networking design, and also the API for communication to sever.

The application running on the clients is the cLogic apps. It is a lightweight performance consuming, and handles functions seamlessly. It synchronizes with hardware, communicates with server, determines actions (logic), provides developer a debug console, and emulates the hardware while executing automation test.

In this design, I learned a lot of communications between systems, including between hardware and software, clients and server, and even clients and clients. The plan is not only to design the irrigation system, but also a platform to connect all the devices. Our vision is for all the sensors to share and exchange data, not just for the single system. The focus will be for communications from sensors to sensors, devices to devices, and even hosts to hosts. Nowadays, the hardware is less expensive, and relatively small compare to few years back.

Networking plays a core for machine-to-machine world. We designed an application overlay network, which prevents the blocking of the networking functions, and provides easy setup to users. User only needs to know the hardware PIN/serial number to locate the devices. Real time data only maintains locally, and server act as a bridge for communications. The server record historical data, and user or system can use these data as their information or calculation.

We also use Amazon EC2 as our testing server, which we can deploy our testing apps with a distribution version on emulation mode that runs automation. We can debug with huge amount of clients at a time, with viable logs and html group management consoles.

I also developed a Java client API for communications to server, which is easily for mobile to create an android app. Due to this API deployment, we can easy to make the android application, or even HTML user interface, or even webpage with Java servlet.

7.5 Individual Reflection – Yuchen Wang

In the past three months, the ENSC 305/440 is the most challenged course during my study in my university life so far. During this period, I had to manage my workload carefully due to the conflict between other courses and limitation of working time. Even though it was a tough time for me, I still enjoyed the entire progress and I am proud to participate in this project.

Firstly, I can apply my knowledge on this project which I learnt in the school. School is only a place for me to gain the knowledge, but in this project I had a chance to use what I have learnt in the past few years. Also during this project I need to do the research alone and test various experiments. This is a very important experience for me, it will not only help me in my school study but also benefit my future career.

Secondly, being the CFO in the team meaning I have to take the responsibility of my work. Financial is the most important part in the team, without proper funding and cash flow no one can be successful in their research. My job is to make sure all the funding and expense are under control and have a clear schedule for the upcoming project. In our team, all the expense needs to go through and approved by me. Meanwhile, I have to keep all the receipts and get the quote of the components for estimated budget to generate the bi-monthly financial report.

Thirdly, I am also responsible for the meeting on the weekly basis. Normally the CEO will set up the topic for the meeting and I have to prepared ahead to propose the sub-topics. During the meeting, I had to take the notes clearly and fully, not just the main points since I need to prepare the minutes for the reference. These tasks help me to improve my documentation skills, also the professionalism in my study and work.

Overall, I highly appreciate everyone in the team and thank the school for giving me this great opportunity to participate in. From this course I have more understand of my strength and weakness. I also realized being responsible and profession are the two main factors to be success in this project. I believe all these experience can help me to achieve more goals in my future career.

8. Conclusion

Throughout four months developing phase, we have learnt how to corporate with other members and have better understanding of our strength and weakness. Even though there were some deviation from the original plan, we have successfully built our first prototype of the smart irrigation system, "C-Sprinkler", with basic functions that we set in the function specification document [1].

Currently the C-Sprinkler is at its first prototype period, the future research and design is required before the next prototype and the production. The team will discuss later to determine if the project should still be carried on, depends on members' interest, market competition and expected loss/gain.

9. Reference

[1]   Functional Specification for the Smart Irrigation System (2015) , Team Chase Technologies
[2]   Internet of Things (IOT) (2014) TechTarget. Retrieved from http://whatis.techtarget.com/definition/Internet-of-Things[Accessed: Nov 6, 2014]

Appendix - Minutes

Team Chase Technologies

September 9, 2014

13:00-13:50

Gray's house

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: To discuss possible research topics for the 305/440 project

Items for Discussion:
- Brainstorm possible topics for the 305/440 project
- Basic design ideas for suggested topic

MINUTES

Gray called the meeting to order at 13:00.

A. Smart control power supply
- Gray started the meeting with his idea about the Smart control power supply
- A power supply for household electrical appliance which is controllable through mobile devices.

B. Smart life jacket
- Yolanda followed with her idea with the smart life jacket
- A life jacket which is equipped when user is swimming. It can automatically puffs when the user is chocked. The condition of the user is determined by the physiology change of the user detected by the heartbeat sensor

C. Multi-function hand tool
- Yuchen bring up his idea which is a multi-function hand tool
- The hand tool can automatically faster/loose the screws base on the reading from a tighten strength sensor

D. Smart sprinkler system
- Abel bring up his idea about the smart sprinkler system
- A smart sprinkler system which can automatically decide when to turn on and off according to the condition of soil

E. Indoor pet care system

- Chase bring up his idea about the indoor pets care system
- The indoor pets care system can automatically record weight change of the pets. It can automatically feed and clean wastes for the pets and also stops the pets to get into the danger zoon

F. Next Meeting Date

The next meeting was arranged for September 14, 2014 at 13:30 in gray's house.

Team Chase Technologies

September 14, 2014
13:00-13:30
Gray's house

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: To determine possible research topics for the 305/440 project and discuss the possible design scheme

Items for Discussion:
- Determine the research topics for the 305/440 project
- Ideas about the function the final product should achieve
- Ideas about design scheme for the determined topic

MINUTES

Gray called the meeting to order at 13:00.

A. The project is determined to be smart sprinkler system
- After reviewed the last meeting minutes, team member decided to choose the smart sprinkler system to be the project topic.

B. discussed the current condition of general valve controller
- Difficult to use
- No interaction with the surrounding
- Sprinkler continuously work even when people approaches
- Some water are wasted

C. What faction should our product achieve if possible
- Responsive to surrounding base on the temperature change, soil condition; water only when it is needed
- Should not water when raining is in close future
- Should be controllable through mobile device gives user more options

D. Discussion over design schemes
- The hardware would need temperature sensors and moisture sensor
- Will need a mobile application in android or iOS template
- Need servers for data transfer

E. Next Meeting Date

The next meeting was arranged for September 17, 2014 at 14:00 in SFU library.

Team Chase Technologies

September 17, 2014
14:00-14:30
SFU library

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: To communicate progress about the project and discuss the work distribution for the oncoming proposal.

Items for Discussion:
- Each member express their progress about the project
- Discuss the work distribution for the proposal

MINUTES

Gray called the meeting to order at 14:00.

A. Each member started to explain what they have done about the project
- It has been decide to use FPGA board for part of the circuit design
- A basic general block for circuit has been drawn
- The mobile application is decide to be under android
- Some background search about watering lawn has been done

B. Each team member is responsible for part of the proposal
- Introduction/background and conclusion/reference   is given to Gray
- Scope/risk/benefits and cost Consideration is given to Chase
- Market/competition/research rationale is given to Yuchen
- Company details is given to Yolanda
- Project planning is given to Abel

C. Next Meeting Date
The next meeting was arranged for September 26, 2014 at 17:00 in SFU Lab 1.

Team Chase Technologies

September 26, 2014

17:00-17:40

SFU Lab 1

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: To share current progress, discuss detailed function for the product, solve possible problem arises

Items for Discussion:
- What are the new progresses for the past few days
- Work on the detailed function designs
- Find solutions for possible problems

MINUTES

Gray called the meeting to order at 17:00.

A. **New progress**
- First version of block diagram for hardware design is drawn
- Rough ideas about basic server loop
- Rough UI design for mobile application

B. **detailed function discussion**
- The mobile device should directly communicate with server
- The server act as a bridge for hardware and mobile device
- A data trough server are stored
- Should provide weather and schedule are created base on weather forecast
- The user should have the top priority and is able to overwrite any command

C. **The mobile application required some extra help**
- The UI needs to be drawn, Gray promised to deal with it
- A library for schedule needed to be find, Yuchen will help with this part

F. **Next Meeting Date**
   The next meeting was arranged for October 7, 2014 at 11:00 in SFU Lab 1.

Team Chase Technologies

October 7, 2014

11:00-11:30

SFU Lab 1

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: Exchange progress on the project and discuss work distribution for each team member for the function specification

Items for Discussion:
- What have been done in the past few days
- Assign work for each team member
- Possible questions about function specification
- Possible problems arise during individual work

MINUTES

Gray called the meeting to order at 11:00.

A. New progress
- The UI has been drawn
- Schedule library for application is solved
- For hardware, we have started VHDL coding
- Started building server, operations system, and application

B. Work distribution
- Introduction/background and conclusion/reference is assigned to Gray
- Hardware part of technical correctness process detail and engineering standard is assigned to Chase
- Server and operation system part of technical correctness process detail and engineering standard is assigned to Abel
- Mobile application part of technical correctness process detail and engineering standard is assigned to Yolanda
- Project planning is assigned to Yuchen

C. Next Meeting Date

The next meeting was arranged for October 14, 2014 at 13:00 in SFU Lab 1.

Team Chase Technologies

October 14, 2014

13:00-13:40

SFU Lab 1

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: Exchange progress on the project and discuss work distribution for each team member for the oral progress reports

Items for Discussion:
- What have been done in the past few days
- Assign responsible parts for each team member
- Possible problems arise during individual work
- Discuss the funding and expenditures

MINUTES

Gray called the meeting to order at 13:00.

A. New progress
- For hardware, the VHDL coding halfway finished
- Basic coding for server, operations system is finished
- Frame for the mobile application is done

B. Work distribution
- Introduction/background and conclusion/reference is assigned to Gray
- Hardware part of the process is assigned to Chase
- Server and operation system part of the process is assigned to Abel
- Mobile application part of the process is assigned to Yolanda
- Expenditure, fund raising and time line is assigned to Yuchen

C. Budget reports
- Main expenditure focused on hardware. Roughly 110 CAD has been spent to purchase necessary electronic parts

D. Next Meeting Date

The next meeting was arranged for October 21, 2014 at 14:00 in SFU Lab 1.

Team Chase Technologies

October 21, 2014
14:00-14:30
SFU Lab 1

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: Communicate about current progress on the project and discuss work distribution for each team member for the design specification

Items for Discussion:
- If there is any issue arises in the following parts: the mobile application, hardware, or server?
- Assign work to each team member for design specification
- Questions about design specification
- Is finding a tutor for grammar necessary?

MINUTES

Gray called the meeting to order at 14:00.

A. New progress
- For hardware, the digital circuit and analog circuit design has been finished, but has not yet move to bread board
- The server has been build, a web page is in building process for server testing
- Four pages of the mobile application has been created, can be tested

B. Work distribution
- Introduction/background and conclusion/reference is assigned to Gray
- Hardware part of the technical correctness and process detail is assigned to Chase
- Server and operation system part the technical correctness and process detail is assigned to Abel
- Mobile application part of the technical correctness and process detail is assigned to Yolanda
- Test plan is assigned to Yuchen

B. Grammar problem
- During the oral progress report we realize grammar is an issue to be fixed
- After discussion the final decision is to finish the design specification first then determine whether or not a tutor is necessary based on the quality of the finish work

C. Next Meeting Date

The next meeting was arranged for November 11, 2014 at 14:00 in SFU Library.

Team Chase Technologies

November 11, 2014
14:00-14:30
SFU Library

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: Report progress on each part of the project and discuss issues related to the written progress report.

Items for Discussion:
- Member report the current standing in contrast with schedule for the following parts: the mobile application, hardware, or server
- Expenditures reports
- Specific question about the progress of each part

MINUTES

Gray called the meeting to order at 14:00.

A. New progress
- For hardware, the VHDL circuit coding is finished
- The server is in buildup process, operations system is finished
- Some feature of the mobile application is useable

B. Work distribution
- Introduction/background and conclusion/reference is assigned to Gray
- Hardware part of the process report is assigned to Chase
- Server and operation system part of the process report is assigned to Abel
- Mobile application part of the process report is assigned to Yolanda
- Expenditure, fund raising and time line is assigned to Yuchen

C. Budget reports
- No extra budget has been spent yet

D. Next Meeting Date
The next meeting was arranged for November 21, 2014 at 11:00 in SFU Lab 1.

Team Chase Technologies

November 21, 2014

11:00-11:40

SFU Lab 1

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: To share latest progress on the project and discuss the future integration plan

Items for Discussion:
- What are the new progress on the project
- If there is unsolved problem with the following parts: the mobile application, hardware, or server?
- Find solutions for problems appeared
- Discuss detailed integration plan

MINUTES

Gray called the meeting to order at 11:00.

A. Current progress
- For hardware, the digital circuit and analog circuit are soldered and mounted on perfboard
- The server has been build, a web page is created and ready for test
- The mobile application is still under construction with a few noticeable bugs and long delay.

B. Integration and testing plan

- Most individual components development has come to a close
- Determined to integrate in the following days
- Detailed testing items for the server and hardware
- Since the mobile application has not yet complete, the integration and testing will begin without the participate of mobile application

C. Next Meeting Date
The next meeting was arranged for November 28, 2014 at 15:00 in SFU Lab 1.

Team Chase Technologies

November 29, 2014

13:00-14:10

SFU Lab 1

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: Discuss the results for the integration plan and determine the future works

Items for Discussion:
- What are the new progress on the project
- Behavior of mobile applications
- Find solutions for problems appeared
- Inform other member for the progress about Post Mortem

MINUTES

Gray called the meeting to order at 13:00.

A. Current progress
- Problems discussed in last meeting have been solved
- The mobile application is integrated with server and hardware. The working features have been tested

B. Integration result
- All components have been tested together
- Spotted bugs from previous tests are fixed
- The application works with long delay
- The server cannot work with sub command with current timer is 0

C. Integration debug and future test
- The bugs from server are fixed during the meeting period
- The mobile application will be further optimized in the future dates

D. Next Meeting Date

The next meeting was arranged for December 4, 2014 at 14:00 in SFU Lab 1.

Team Chase Technologies

December 3, 2014
14:00-15:20
SFU Lab 1

Present: Yu Heng Lin, Chase Wen, Yolanda Wu, Abel Lin, Yuchen Wang

AGENDA

Purpose of Meeting: To share latest progress on the project, discuss the responsible presentation sections and final warp up

Items for Discussion:
- Results for final test of all components
- Hot fix for all spotted bugs
- Assign work distribution for pretention
- Solve possible problems

MINUTES

Gray called the meeting to order at 14:00.

A. **Current progress**
- Hardware and server has been optimize, all bugs previously found are fixed
- General tests and extreme cases we considered would work properly with expected results
- The mobile application is also integrated with other component
- All function of the mobile application are tested and the result is acceptable

B. **Integration result**
- All components have been tested together
- Spotted bugs from previous tests are fixed
- The sensors are tested with generally conditions

C. **Last group meeting**
- Final warp up
- Future test will be done together
- Finish post-mortem and prepare for presentation together in the following days