ENSC 305W/440W Grading Rubric for Project Proposal

Criteria	Details	Marks
Introduction/Background	Introduces basic purpose of the project. Includes clear background for the project.	**/05%**
Scope/Risks/Benefits	Clearly outlines project scope. Details both potential risks involved in project and potential benefits flowing from it.	**/15%**
Market/Competition/ Research Rationale	Describes the market for a commercial project and details the current competition. For a research project, the need for the system or device is outlined and current solutions are detailed.	**/10%**
Company Details	Team has devised a creative company name, product name, and a logo. Outlines relevant skills/expertise of team members.	**/05%**
Project Planning	Details major processes and milestones of the project. Includes Gantt, Milestone, and/or PERT charts as necessary (MS Project).	**/10%**
Cost Considerations	Includes a realistic estimate of project costs. Includes potential funding sources. Allows for contingencies.	**/05%**
Conclusion/References	Summarizes project and motivates readers. Includes references for information from other sources.	**/10%**
Rhetorical Issues	Document is persuasive and could convince a potential investor to consider funding the project. Clearly considers audience expertise and interests.	**/10%**
Presentation/Organization	Document looks like a professional proposal. Ideas follow in a logical manner. Layout and design is attractive.	**/10%**
Format Issues	Includes letter of transmittal, title page, executive summary, table of contents, list of figures and tables, glossary, and references. Pages are numbered, figures and tables are introduced, headings are numbered, etc. References and citations are properly formatted.	**/10%**
Correctness/Style	Correct spelling, grammar, and punctuation. Style is clear concise, and coherent.	**/10%**
Comments		

September 23, 2013
Lakshman One
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Re: ENSC 440 Project Proposal for SmartPlant™ design

Dear Mr. Lakshman One,

We are writing with regards to our project proposal for SmartPlant™, which describes our prospective project for Engineering Science 440. The objective of the E-Plant Innovation is to motivate and help everyone to easily grow plants. This product will be designed such that it can be used by everyone.

The purpose of this product is to develop an easy strategy to motivate people to grow their own organic vegetables or any other plants. The alluring aspect about our product is being adaptable to different garden sizes or can even be used for small flowerpots.

Attached to this letter, we have provided an outline of our product, the overview of project design, marketability of the product and project budgeting and funding. Also this proposal includes information on team organization, company profiles and project planning.

E-Plant Innovation is composed of four talented and motivated team members whose knowledge and skill set is superlative. These include, David Hsu, Jae Sung Park, Mandan Vahabzadeh and Yang Zhang who are all fourth-year engineering students majoring in electronics and systems engineering.

If you have any questions or concerns regarding our proposal, please do not hesitate to contact me anytime at mvahabza@sfu.ca.

Sincerely,

Mandan Vahabzadeh

Mandan Vahabzadeh
Chief Executive Officer (CEO)
E-Plant Innovation

Team Members:

David Hsu
Jae Sung Park
Mandan Vahabzadeh
Yang Zhang

Date: September 23, 2013

Executive Summary

"Everything in the garden looks great in May and it is hard to imagine the lovely lush plants I see won't last forever. BUT, experience tells me that a garden that is lovely and green and productive in late May or early June will be mostly burnt up and used up by mid-July to late-July or early August."

This is a quotation from a plant enthusiast's notebook. It seems that it is difficult for anyone who wants to plant a garden unless they have suitable knowledge about different plants' growth cycles and environment. By creating automated plant systems, E-Plant Innovation has come up with a solution to make sure that the user's garden is blooming in all seasons. Our goal is to develop an affordable and simple design, which helps everyone to easily have their own little garden even with a limited amount of knowledge and time.

The SmartPlant™ system has sensors which monitor the temperature and moisture levels. The brain of our system is a microcontroller, which is responsible for comparing the sensors' feedback data with the ideal temperature and moisture levels. The feedback data determines if the plant is in its ideal growth environment. If not, the watering system and shading get activated automatically to maintain pre-set temperature and moisture levels.

The E-Plant Innovation team consist of four engineers specialize in system engineering, programming and electrical hardware development. In the next three months, we hope to design and construct a SmartPlant™ which is encouraging everyone to grow their own plants. The project budget is estimated to be around $600 where we will seek funding from ESSEF and Wighton fund.

In order to meet the project deadline, the tasks are divided between the team members and group meeting will be held on a weekly basis to recognize any concerns and prevent them from becoming larger issues.

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List of Figures and Tables:

Introduction

Plants are known as bringing positive energy and abundance into your home. These days, plants are used as decorations for gardens and flower pots. However, these beautiful decorations are not common artistic handicrafts, because they need to be provided with long term, careful nurturing. In each season, plants need to be supplied with different care, such as suitable temperature, compatible moisture and moderate sunlight. People usually want to grow their own flowers and vegetables, but they don't have enough time nor knowledge to raise their plants. Imagine growing a plant and taking care of it, but because of lack of water or excess sunlight, the plant will be damaged; the sentiment one would feel is clearly disappointment.

Plants need right amount of sunlight to make food for them, but too much light can also be a source of stress. Also, a large quantity of water is required for plants to grow, however, providing the plant with right amount of water can be challenging. Now, imagine a kind of technology that can assist everyone to grow their own plants regardless of weather, season and terrain. A technology with such capability would be very useful and convenient for people who enjoy making their own goals and reaching them, especially through the use of nature.

The E-Plant Innovation provides a product that will meet these requirements and is guaranteed to motivate the plant enthusiasts. With the help of the SmartPlant™ system, the program will automatically adjust the growth environment of plants based on the pre-set value. Our product has a touch screen LCD that supplies customer with rich information containing a variety of plants' growth habit. When the user plant seeds, by simply entering the type of seeds, the monitor can show the information about that specific plant such as suggesting the right season to plant the seeds, estimates how long does it take for a seed to sprout through, harvest time and etc. In addition, temperature and moisture sensors act as plant protector. The temperature sensor can sense the heat and if the weather is hot, the shade will open to keep the plant hidden from the sunlight. Also, by sensing the moisture of the soil, the water tank will be activated to water the plant.

This design encourages and helps everyone to easily have their own little garden with even a limited amount of knowledge concerning gardening. Users may grow various plants at the same time, based on their individual preferences, and each plant can grow at a different cycle speed. This will make sure that the user's garden blooms all seasons long without taking the extra time to learn about every kind of plants' suitable grow environment.

This proposal will discuss the SmartPlant™ design consideration while outlining the system overview, proposed design solution, project scope, marketability, budgeting, and company profile information.

System Overview

The SmartPlant™ system welcomes the user with a display that provides the information about the plants. The encyclopedia of plants is saved in the display's memory, which informs the user about the plants they are trying to help blossom with facts such as their watering-cycle, species information, and ideal climate environment. At the same time, the temperature and moisture levels are monitored by its integrated temperature and moisture sensors. Using the data from the sensors as a feedback to the entire system, the watering and shading get activated to maintain pre-set temperature and moisture levels. Figure 1 shows the setup of the SmartPlant™ system and describes the interaction among components.

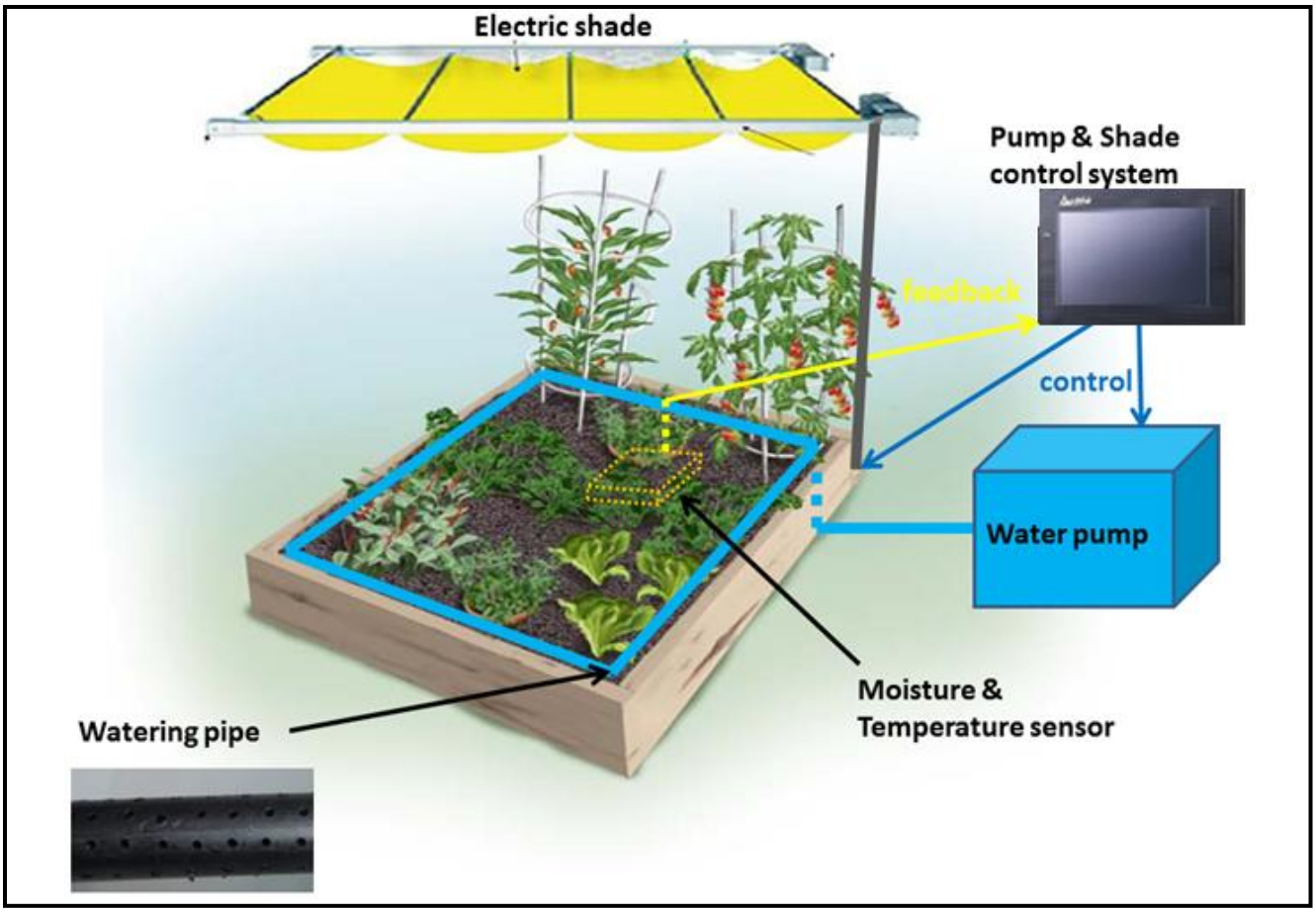

Figure 1: SmartPlant Setup

Figure 2 shows the flowchart that describes the mechanism of the SmartPlant™ system. When system starts, the two major sub-systems run independently and in parallel, the moisture and temperature sensors. In order to determine whether or not to activate the water pump or electric shade, in each process, the control system receives the data from the sensors and compares them with the ideal temperature/moisture levels that are readily stored in its memory.

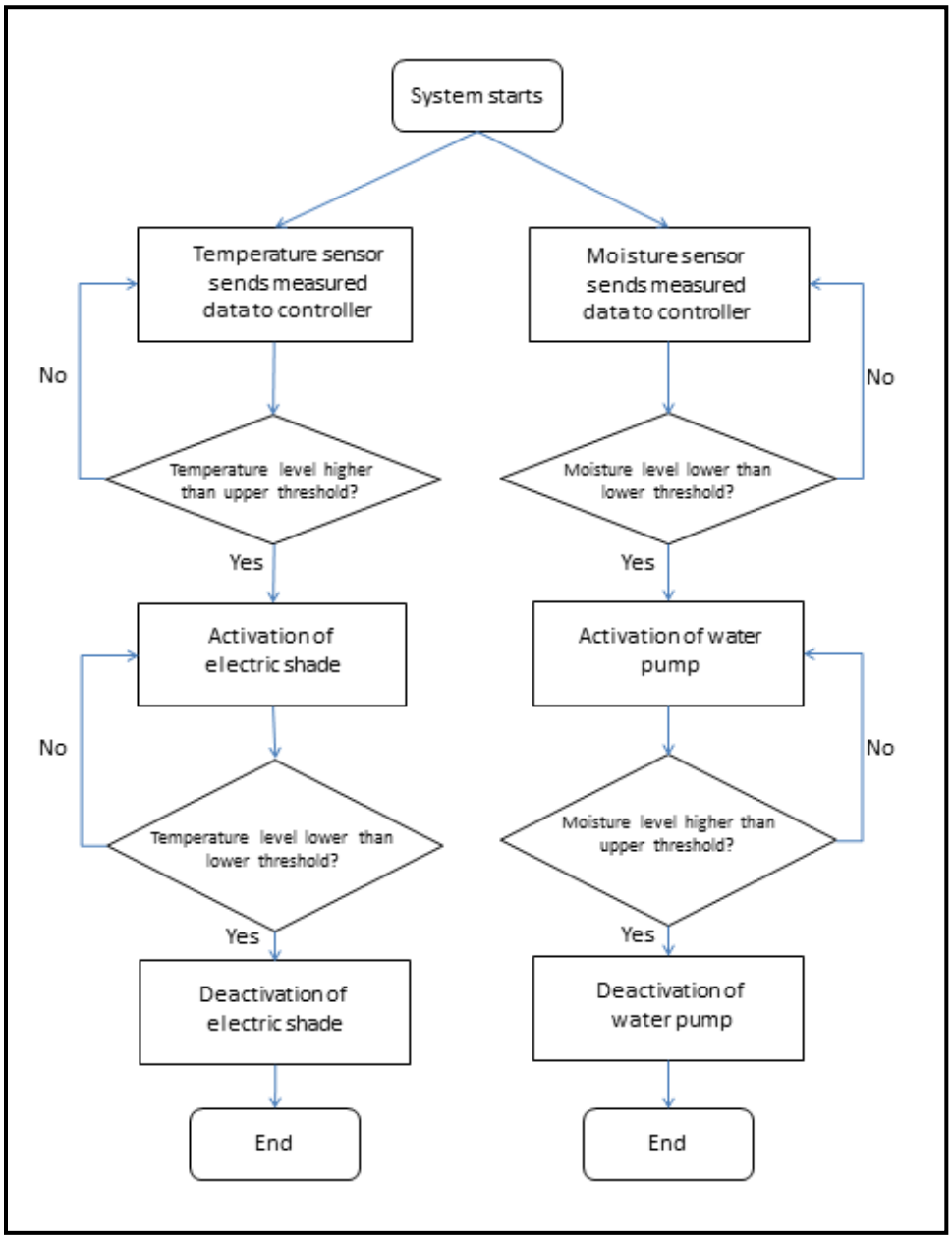

Figure 2: Flowchart of SmartPlant™

Current Technologies

There have been a couple of planting-aid products in the market. These products have decent features, such as automatic watering and fertilizing functions or providing information of the planting environment to the user. However, these products either passively interact with users or cannot be used for every plant species in the nature and do not allow a wide range of user's plant selections.

1. EasyBloom™ Plant Sensor

This product gathers the information about the soil that the user is going to raise the plants. It basically tells the user what kind of plant the user can grow with the soil that the product has analyzed. It is stabbed into the soil and after a while, the user connects it with a PC to get information about the soil. And with the plant library in the PC, the plant recommendations that are appropriate to the soil get shown to the user. While this product is simple and easy to use, it only permits passive interactions with the user or in other words, it does not actually grow the plants for the user.

2. Click and Grow™ Smart Flowerpot

The automatic watering and fertilizing features were adopted in this product. It requires a few efforts from the user: four commercial AA batteries, a cartridge of seeds, and water refills about every three to six weeks. Although it perfectly manages to grow the plant by itself, the selections of plants are currently limited to ten, which does not give many choices to the user. The biggest problem is its aspect of preventing the joy the user gets from raising a plant. The automatic growing procedure is done quietly. It actually does everything for the user with its "refill seed-cartridges" without informing the user about the plant, which makes the user miss the happy or educational moments that come solely from growing plants.

Proposed Design Solution

Our proposed solution is a flowerpot with a micro-controller based display that notifies the information of the growing plants and at the same time controls the automatic water-pump and electric shade. The joy of planting and learning about flowers, vegetables, and crops are not ignored in the system. Such a SmartPlant™ system helps as an assistant for people with lack of time; instead of being a "planting robot" that does all of the jobs for people.

Unlike the current automatic planting system, the proposed system also adopts a wide range of plant species. All that is needed is setting up the temperature and moisture levels at the micro-controller for different kinds of plants. The encyclopedia of plants that include ideal growing temperatures for each plant is saved in the memory of micro-controller. With a help of temperature sensor, the electric shade is controlled to maintain a pleasant environment for the plant. For the watering cycle, on the other hand, the water pump gets activated by monitoring the actual moisture level of the soil instead of depending on rough, recommended cycles. This is certainly beneficial due to the fact that in dry climates, the moisture level can severely decrease with a shorter time, while it takes a longer period in wet regions.

The main constraints for this project will be the given short, three-month time-span and the research that will need to be made about the micro-controller and its connections with the water pump and the motor of the electric shade. The micro-controller's software application must be developed to receive the data from sensors and compare with its pre-set values so that the water pump and electric shade can be controlled.

Project Scope

Our project consists of several stages that we must overcome, in particular the tasks depicted in Table1. The following table shows a detailed description of each of our planned tasks, its start date, planned duration, and the projected end date:

Tasks	Start Date	Duration(Days)	End Date
Research	06-Sep	6	12-Sep
Proposal	11-Sep	10	21-Sep
Functional Specification	12-Sep	8	20-Sep
Design Specification	16-Sep	5	21-Sep
Assembly of Modules	22-Sep	20	12-Oct
Integration/Testing	15-Oct	20	05-Nov
Debugging/Modification	20-Oct	35	25-Nov
Documentation	06-Sep	90	06-Dec
Process Report	20-Nov	20	10-Dec

Table 1: Project Scope

Before we start assembling the modules, two to three weeks of research and planning are required. After this, we could start ordering the parts and prepare to assemble our prototype. The initial estimate for our project is just under $600, as we are still experimenting with different parts to use that might prove to be more efficient and/or cost-friendly.

During the next stage of integration and debugging of the prototype, we expect the largest difficulty, and so we planned for at least a month of duration. However, once we overcome this stage, the rest will be easier to complete.

In terms of the risks and benefits of this project, we determined that this project has a much better ratio of benefits compared to risks.

One of the risks of this product is that if we use a battery system to power our electronics, there might be a small risk of a faulty battery being used, therefore leading to leaking chemicals in the surrounding area. Another potential risk is that the circuit might short-circuit if the system is damaged in a critical situation, such as by storm. Lastly, since this product is designed to operate outdoors, there is always the potential risk of it being exposed to other animals and different organisms, as well as potential thieves.

However, there are also several benefits involved. For one thing, once one of these models bought and used, it can be thought of as a long-term investment, due to the fact that this system will continuously produce plant products that would save on grocery money. Also, with the rich database that the system provides, users will be able to learn different things about various plants, including information on the appropriate season for planting, the amount of water needed for each species, and the recommended humidity and sunshine needed for the plant to thrive. Lastly, this system will be programmed to counter several contingencies, such as lack of water and an over-abundance of sunlight, so whether an individual is too busy or has simply forgotten to care for their plant, the SmartPlant™ system will take care of the plant for you.

Market

This product would be targeted at three main audience groups:

1. Plant enthusiasts: These people just love to grow different plants, and with this product and the information that the database contains, it will make growing plants much easier and enjoyable, especially if they wouldn't need to put 100% of their effort and time into their crops.

2. The average household & nature lovers: If you have the prospects in mind of growing your own grocery, this will be a good idea to households that can afford the machine, for as long as the machine works, it will continue to provide continuous outputs.

3. Busy individuals: These people have no time to care about their plants, so the smart system in our product will care for their plant with the built in sensors and the appropriate, pre-programmed countermeasures.

Right now on the market, there is a product called "Smart Flowerpot" by the company Click and Grow. Their product is similar in idea as our machine, but it does not have the programmed contingency measures that were previously described. We believe that if our product goes into the market, even with the projected cost that is estimated to be higher than the Smart Flowerpot's $79.00, there will still be people that are more willing to buy our product, as it contains more essential features to care for the plants with limitless plant species selections.

Budget and Funding

Budget:

The cost estimate for this project in order to implement and design SmartPlant™ is shown in Table 100, which provides general overview of each component. The majority of the budget goes to micro-controller and the touch screen LCD, in which the cost evaluation may vary due to choosing the appropriate one. In several stages of the development, there might be possible modifications that will change the budget by as much as 15% contingencies. Moreover, we should indicate that the cost for mass production of this product will considerably reduce. This is because by increasing the purchasing volume, the manufacturing cost declines.

Equipment List	Estimated Unit Cost
Moisture sensor + shipping (Arduino)	$30.00
Digital waterproof Temperature sensor + shipping	$25.00
Water tank	$10.00
Water pipe	$20.00
Water pump + shipping	$50.00
Waterproof wire connector + shipping	$20.00
Wire	$20.00
Motor	$30.00
Shade	$45.00
Touch screen LCD + shipping Tiny6410,7" LCD 533MHz, 2G Android2.3 ARM11 Development Board	$300.00
Material cost	$550.00
15% contingency	$82.50
Total Cost	**$632.50**

Table 2: Cost Estimate

Funding:

The design and development of the SmartPlant™ requires a source of funding to support us in order to construct the project. The two main funding sources for engineering students at Simon Fraser University are the Engineering Science Student Endowment Fund (ESSEF) and the Wighton fund. The written application and presentation have been submitted to ESSEF. The purchase devices for this project are for property of the engineering science student society and need to be returned upon completion. If the ESSEF funding is not sufficient, we will be looking to receive support from the Wighton Development Fund. In the case that we are not qualified for these funding, each team member will distribute an even amount to cover the cost of the project development.

Team Organization

The E-Plant Innovation group is composed of four keen and enthusiastic Engineering Science students: David Hsu, Jae Sung Park, Mandan Vahabzadeh and Yang Zhang. The excellence of this group is the electrical and system engineering background with diverse co-op experience, which is convenient for assigning responsibility for this project. Each member has unique capabilities and fortes which will effect on their task in the project.

As this project requires mechanical, electrical and programming, we have devised the plan in order to organize and succeed in completing the project in a timely manner. Mandan Vahabzadeh, Chief Executive Officer (CEO) is in charge of the project management and ensuring that the group meet their milestones. Mandan is also responsible for budget and funding duties, as well as assisting the group in software side of design. The task of designing and marketing has been given to David Hsu, Chief Marketing Officer (CMO). He is working on finding the ideal target customer for this product and making sure that the functionality and project specifications fall within the customers need. The E-Plant's Chief Technical Officer (CTO), Jae Sung Park, will be responsible for designing and constructing this project. He will be overseeing the software and hardware for this project. Finally, Chief Product Officer (CPO), Yang Zhang, is in charge of managing the assembly of hardware, integration, and testing. Yang will also support David and Jae Sung in designing process as the project moves forward.

In order to succeed in our mission, each member in the group has specific task, but at times, they share responsibilities. Communication and meetings are essential for a successful and organized team so that they can share ideas and information. A Facebook group has been created for the members of E-Plant Innovations to discuss the project, set meeting times, create a to-do list, and share their knowledge. In our weekly meetings, every member discusses their concerns and limitation and suggests some areas for further work. These meetings can help the group to identify any problems early and prevent them from becoming larger issues down the road. At the end of the meeting, we create a list of things that needs to be done and assign these tasks to each person.

Due to the multi-faceted of work required for this project, the E-Plant Innovation members decide to work in a pair group. Each person will rotate based on his or her strengths and limitations. This product idea is an inspiring factor for each member to develop the communication, problem solving and teamwork skills needed in order to accomplish our goal.

Company Detail

Yu-Chuan Hsu is a fourth year electronics engineering student at SFU Burnaby campus. He has done a previous co-op experience before on campus with Dr. Ash concerning a research co-op. During this time, he gained valuable experience with software programs in connection with web design, as well as skills that involved time management and filing reports directly to superiors in a timely and organized manner. He hopes that through this project as the Chief Marketing Officer, he can gain more hands-on experience with working with a group of people to achieve a goal, and also in the process improve his circuit building and programming skills.

Jae Sung is a fourth year electronics engineering student at Simon Fraser University and has past co-op experience at university laboratory. During co-op term, he successfully completed his two main projects, one about piezoelectric nano-generator and the other about stretchable inter-connector for PCBs. He earned valuable nano-technology laboratory equipment skills and 3D CAD software experience. Jae Sung will bring his experience and technical skill to this project to perform his role as Chief Technical Officer.

Mandan is a fourth year system engineering student at Simon Fraser university with past co-op experience in natural gas industry. She spent one year designing and servicing the natural gas stations at FortisBC Energy Inc. She has experience with heaters, regulators, valves, and meter sets. Mandan also has knowledge of Pipeline and Instruments Diagram (P&ID) drawings in order to develop maintenance plans. She has gained industrial knowledge, time management skill during her co-op experience and worked as a team player in a time sensitive environment.

Yang is a fourth year electronics engineering student at Simon Fraser University with past co-op experience in intelligent control company. During his work term, he undertake two industrial automation projects, one about programming logic controller for metallurgy industry and another about low voltage control system applied in a chemical factory. He has got hands-on experience on hardware testing and debugging. And he is familiar with Auto CAD Electrical software. He has earned technical knowledge, troubleshooting, time management and communication between team members in past co-op terms.

Project Planning

The following Gantt chart depicts our projected timeline for our project. Attached are the individual tasks that we planned to follow, as well as the proceeding steps afterwards. With this, we could more easily manage our progress, and analyze if our progress falls behind. We planned this timetable with a certain amount of leeway, but nevertheless, it is our main objective to complete the prototype and the debugging within the planned time frame. The project schedule is also represented on Figure 4.

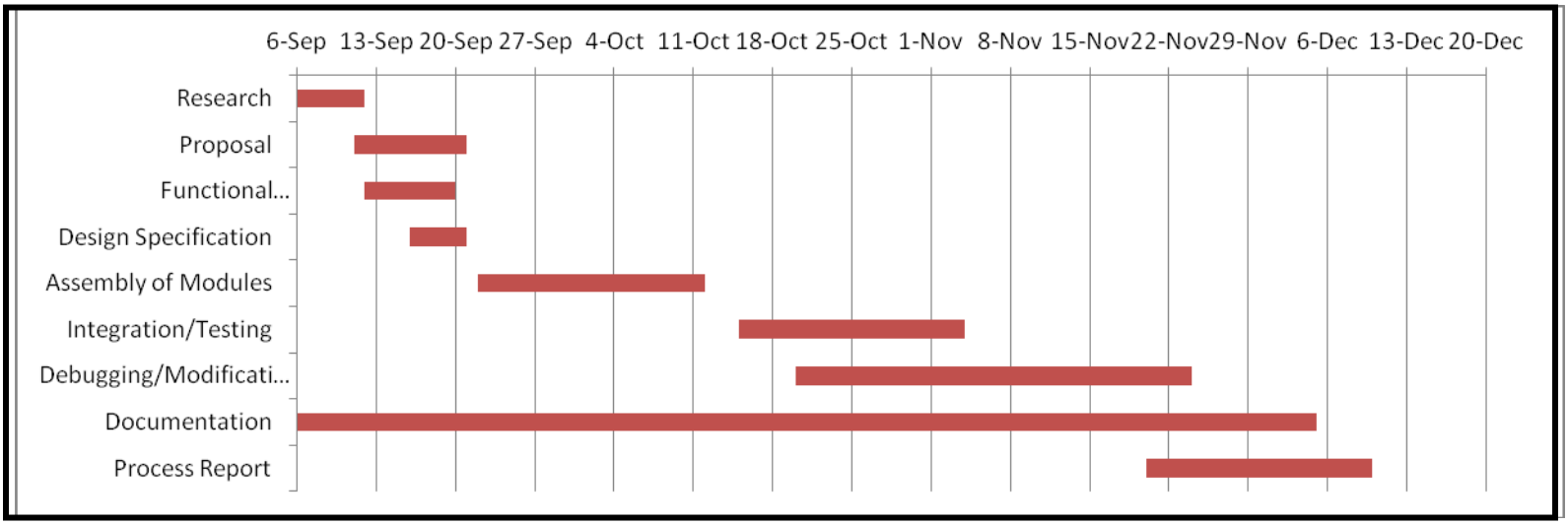

Figure 3: Gantt chart

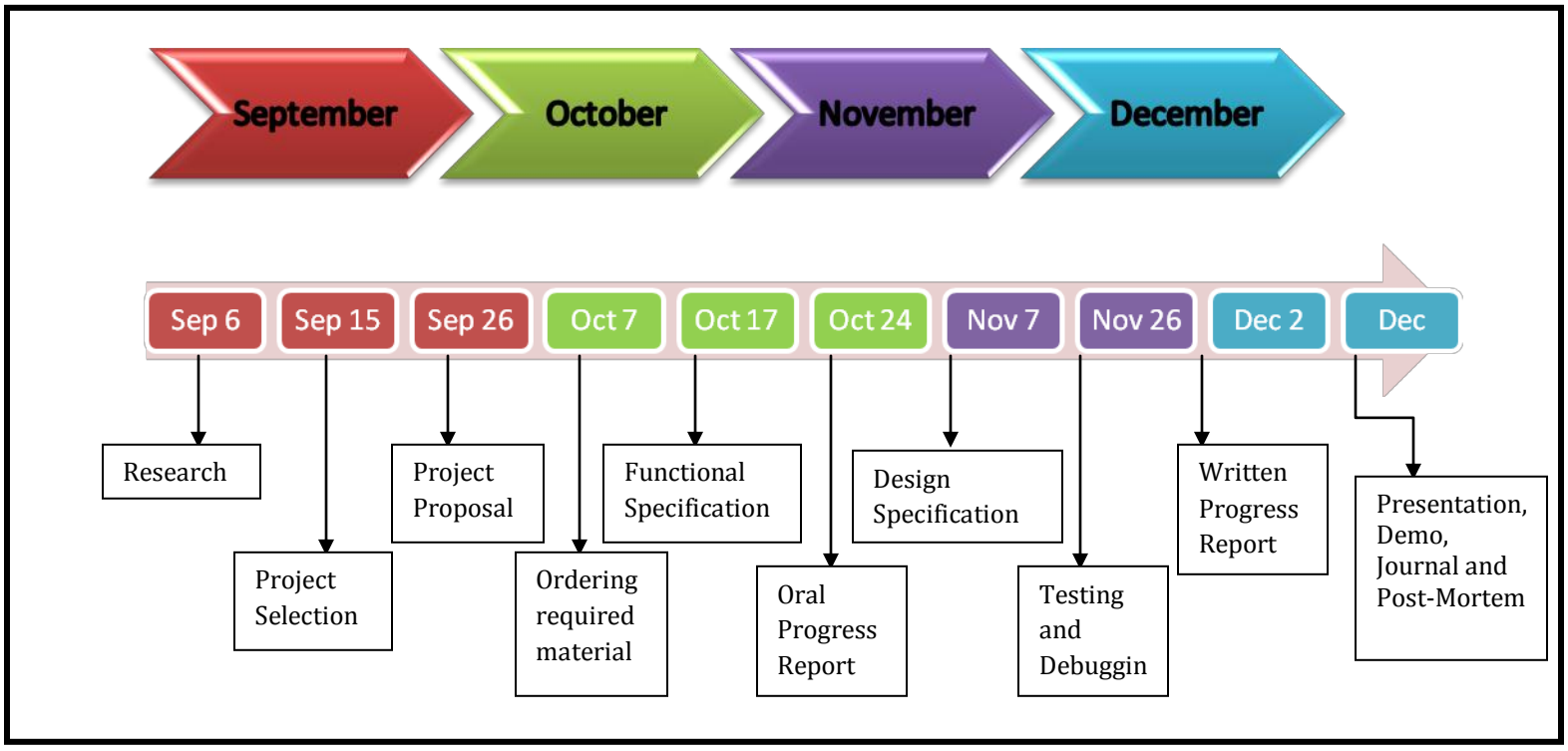

Figure 4: Milestone Diagram

Conclusion

At E-Plant Innovations, we are confident that the innovative design, SmartPlant™, provides a very exciting and motivating opportunity to assist everyone in gardening. The SmartPlant™ can help customers to save time and deliver their gardening needs.

With the development of the SmartPlant™, our goal is to monitor the plant growth process and seasonably adjust and control the plant growth environment. Our design has temperature and moisture sensors to protect the plant from sunlight and lack of water. Also, the touch screen monitor gives information about plants such as recommendation for planting in their correct season, how long it will take for plants to grow and when to harvest them.

At the end of this project, the E-Plant innovation team will have gained valuable knowledge about planting and how to enhance the gardening system. The timeframe for our project is present on the Gantt and milestone chart. Furthermore, this document outlines our design solution, researched material, financial sources and source of information for our SmartPlant™ system.

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