SmartChef: Post-Mortem

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1. Introduction

Physical impairment is a prevalent issue that affects individuals worldwide. Everyday tasks that are seemingly easy for the able-bodied population present unremitting obstacles for those who are physically disabled. While many home automation solutions already exist, we want to push these limits and further improve the quality of life for the disabled. We want to provide them with an additional degree of independence, regardless of their impairment.

In an aging population such as Canada, it is important to implement solutions for assisted living that eliminate the burden of home care services. Presently, a vast amount of home automation technologies exist. They encompass simple devices such as wireless remotes that control home appliances or lights, and can range to more complex solutions such as emergency assistance systems. Despite such a diverse scope of technologies, one area that is notably overlooked is kitchen automation in domestic environments. While a number of automated kitchen devices currently exist, they are costly, and are generally tailored towards industrial food applications. This is where the SmartChef seeks to fill the void.

The SmartChef is a home automated cooking system that prepares meals using fresh ingredients with the simple push of a button. The main objective of the system is to prepare rudimentary meals with limited human interaction. The SmartChef system includes four distinct processes: dispensing ingredients, heating and mixing the ingredients, and finally serving the meal onto a plate. We strive to create an effective and safe product, such that it is appropriate for domestic use with little risk to the customer. Thus in addition to the aforementioned functions, our system includes safety mechanisms should the system fail during runtime.

2. Current System State

2.1 Dispensing Unit

The system has been designed in such a way to deliver one food item with the use of one motor. The food items are stored in non-reactive polyvinyl chloride (PVC) cylindrical containers that can breathe just the right amount, making it an ideal food grade storage element. The solid dispenser is depicted in Figure 1.

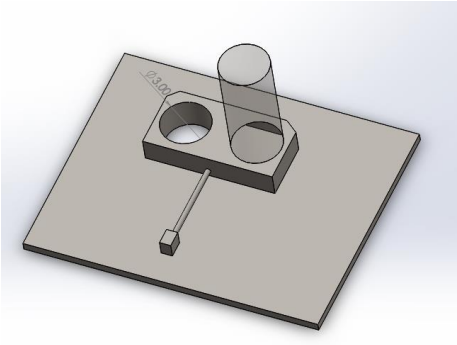

Figure 1: Solid Dispenser

Additionally, there is also be a motor dedicated to dispensing water and oil during the cooking period. The liquid dispensing device has been designed in a cost-effective and efficient manner to deliver a controlled amount of liquid in a fail-safe constraint for our SmartChef consumer's safety. The key engineering behind this design involves the development of a mini fluid pump powered by an inexpensive 6V DC motor. The design implementation is purely based on the DC motor that can generate up to 8100 RPM which rotates the propeller that is inserted into the liquid container. The high RPM of the blades in turn builds enough water pressure to pump up the liquid out of the container into the pan through the pipe.

2.2 Stirring Mechanism

The main purpose of the stirring mechanism is to thoroughly mix the ingredients in the pan while it's over the heating element to ensure they don't stick to the cooking utensil. The stirring unit uses a lid to cover the pan to protect food from falling out of the pan. Furthermore, the stirring mechanism lifts up and down with the lid so that the cooking pan can be removed from the heating element should the addition of ingredients be required.

The stirring unit consists of two different motions: rotational and vertical. Each motion serves its own purpose. The vertical movement moves the entire stirring unit up and down, allowing the pan to move freely if needed. The rotational motion rotates the inner arm of the unit in a circular motion to stir the food while cooking.

The top part of the screw is directly attached to the motor, while the motor is in a fixed position at the top of the stirring unit. A nut connects one side of the ball bearing while the other side is attached to the rod that is responsible for rotational movement. By changing the direction of the motor (either clockwise or counter clockwise), the entire stirring unit moves up and down.

When the entire stirring unit moves up or down, it also moves the rotational unit simultaneously. Rotational movement has been achieved by using a combination of different components, including circular gears, rods, and ball bearings. The top part of the rod is connected to the ball bearing, and the bottom portion is be connected to the stirring portion. The gear has been attached onto the rod near the upper portion of the stirring unit. The final design of the stirring mechanism is shown in Figure 2.

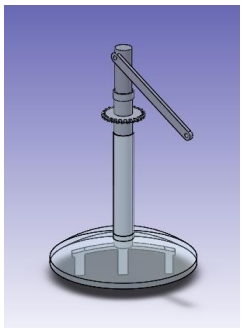

Figure 2: Stirring Mechanism

2.3 Pan Automation

The system includes an automated pan motion that serves two purposes: to move the pan between the heating and dispensing areas, and to serve the meal onto a dish. The pan is controlled by two high-torque servo motors. The servo motors have been placed in an arrangement demonstrated in Figure 3. One motor is responsible for controlling the motion between the heating and dispensing units (labeled “servo motor 1”), while the other motor is responsible for rotating the pan to serve the meal onto a dish (“servo motor 2”).

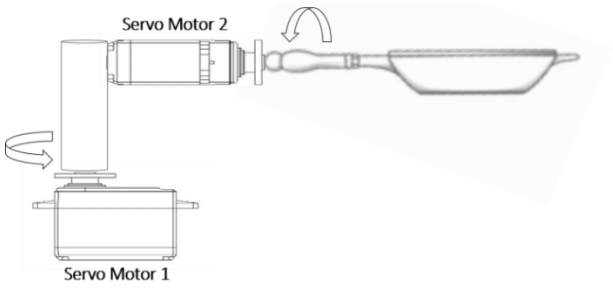

Figure 3: Pan Automation

This subsystem has been designed using a 9” pan, keeping the stall-torque under its specification (17kg·cm). It is able to efficiently transfer ingredients between the dispensing and heating unit, and serve the final ingredients onto a dish.

2.4 Heating Element

The heating element is required to heat food to a proper cooking temperature. We used a standard electric coil range element. The coil has been secured to a metal bracket and connected to the frame of the system. The coil receives AC power which is gated by a mechanical switch and a 5V relay. Both the relay and mechanical switch are rated for 5A+ at 240V AC. All of the high voltage elements have been enclosed in a certified electrical box which is grounded. The current design for the device isolates the high power electronics from the DC microcontroller subsystem, with the 5V connections required for the relay bridging between the two. Our microcontroller is able to toggle the power to the relay in a controlled fashion, to achieve a bang-bang style temperature control.

3. Financial Summary

We were allotted $250 from the Engineering Science Student Endowment Fund (ESSEF). We initially found servo-motors available for $250, however we were able to find motors suitable for our application for $32 each. This drastically reduced our budget from what we originally proposed. Additionally, we intended on purchasing a wireless component to include a Wi-Fi feature in our project, however we did not include this feature in our system, and thus it is not listed in our final budget. Table 1 elicits our initial proposed budget, while Table 2 shows our final budget.

Table 1: Original Proposed Budget

Equipment List	Estimated Unit Cost
High torque Servo motor #1	CAD $250
High torque Servo motor #2	CAD $250
Kitchen Appliances (Pans, lids, pipes, spatula etc.)	CAD $100
Potentiometer	CAD $50
Other metal pieces (Mounted on the motors)	CAD $50
Wireless component (Transceiver)	CAD $50
DC motors	CAD $50
Motor drivers	CAD $100
Arduino Microcontroller	N/A
Total Cost	**CAD $900**

Table 2: Final Budget

Purchased Items	Amount
High torque servo motors x 6	CAD $192
DC motor	CAD $10
Lumber	CAD $40
Circuit components (buttons, perfboard, connectors)	CAD $55.96
Kitchen appliances (pan, cooling racks)	CAD $11.20
Miscellaneous (glue, sandpaper, screws, etc.)	CAD $80
Total Cost	**CAD $389.16**

The majority of our budget was allocated to the high-torque servo-motors. We salvaged some kitchen appliances from various sources for free, and purchased others at a low cost to minimize our expenditure. In total, we were well under the budget we originally proposed. However since we were allotted $250 from the ESSEF, we were $139.16 over budget, which has been split between the team.

4. Schedule Summary

The initial schedule we proposed is summarized in Figure 4.

ID	Task Name	September				October				November				December			
		6	13	20	27	4	11	18	25	8	15	22	28	6	13	20	27
1	Research																
2	Proposal																
3	Functionality																
4	Design Schematics																
5	Ordering Parts																
6	Implementation of Scheme/Build Prototype																
7	Testing/Modifications																
8	Documentation																
9	Final Write-up																
10	Prototype Demo																

Figure 4: Proposed Schedule

When we proposed this schedule, we didn't have a clear idea of how the system was going to be assembled, and who was going to be responsible for designing each subunit. Moreover, we carried out our research for the project throughout the entirety of the project instead of completely finishing it by October, which was proposed in our original schedule. We were able to complete and test our system by December 13, 2015. A more realistic version of our final schedule is summarized in Figure 5.

ID	Task Name	September				October				November				December			
		6	13	20	27	4	11	18	25	8	15	22	28	6	13	20	27
1	Research																
2	Ordering Parts																
3	Implementation of Subsystems																
4	Testing/Modifications																
5	Documentation																
6	Final Product Ready																

Figure 5: Final Schedule

5. Problems and Challenges

5.1 Dispensers

The dispensers need to be able to dispense a variety of ingredients. Conceptually the dispensers work very well, but the mechanism is prone to jamming. We reduced the stress on the dispensers during

the demonstration as a compromise. We need an accurate positional feedback that can be passed into software and detect a jam. Better machining can reduce the chance of a jam, but ultimately jamming is an unavoidable issue in the consumer product (they can put anything into the dispensers).

5.2 Water Dispenser

Watertight seals are difficult to make, and therefore water pumps are difficult to make. We could only dispense water within a certain range due to this problem. A plastic casing could have been machined from appropriate materials to improve this system.

5.3 Stirring Mechanism

The stirring mechanism was the most sensitive subsystem which was difficult to raise and lower, and also was very prone to the stalling issues similar to the dispenser. After a few revisions to the raising/lowering mechanism and the inclusion of the proper stirring blades, we still had issues fitting the device to the rest of the system. This mechanism was later designed to be more adjustable and easy to fit, to reduce the difficulty attaching it.

5.4 Pan Automation

The pan did not make perfect contact with the heating element because the pan was light and not very flat after attaching. The heat was not distributed evenly on the surface. We resolved to cook using water for the demonstration, because water helps distribute heat evenly. To solve the real problem, we need a heaver pan with a nice flat bottom.

5.5 Motor Stalling/Failure States

When the motors stall, they consume more current. The power supply is only rated for 1000mA, which means the other motors will not get enough current. When the motor finally does get enough current, it suddenly is being told to move quickly to a new position. This causes a fast movement, and when hot food moves fast, it is a real danger. The design is such that under normal conditions, two motors will not move simultaneously, but a positional feedback mechanism should be used to eliminate this risk in failure conditions.

5.6 Wireless Module

We added and tested a Wi-Fi module, but the number of pins on the prototype Wi-Fi consumed six input/output (IO) pins. We decided the mechanical parts were more important, so we removed the wireless feature. There are two viable options: IO expanders, or selecting a different microcontroller. The IO expanders are superior, because of the inherent extensibility. If we wanted to connect 20 more motors, very few microcontrollers can accommodate that. We did not purchase, experiment, or debug different IO expander modules.

6. Group Dynamics

The SmartChef project work was split into four different parts where each individual team member was assigned to take care of different subsystems of the SmartChef control units. In addition, Christine and Wesley were also involved in writing up the final SmartChef cooking code on the Arduino compiler. With the equal distribution of work among all the team members, the team also kept close-communication among each other with frequent meetings to update the progress of each unit and how it can affect other designs of the overall system. Most importantly, each individual's opinion in the team was equally valued and well respected during all stages of design and implementation.

The distribution of the project work involved four different sub-parts. Amandeep was responsible for building the lid and stirring mechanism. Christine was assigned to build the pan element. Wesley was involved in designing the solid dispenser and the heating element. Pasang was involved in designing the liquid dispenser. With all the systems built separately, they were collaborated once each unit had their own test run completed. All the team members were involved in the final integration of the system.

7. Individual Assessment

7.1 Wesley Kendall

Coming into the project, we had little experience with mechanical design, and developing large scale projects. I was personally drawn to the project for the excitement of working with moving parts, and making a unique project. Ultimately we were able to deliver our final goal: Cook a simple meal with purely robotic components. From the beginning the task is very daunting. Cooking is a complex procedure. There are a lot of tools needed. The design phase was critical, and unfortunately very time consuming. Time spent 'thinking' is underestimated, and also underappreciated in engineering. If you look at the time spent actually building or testing the project, it is a fraction of the time spent 'thinking'. But the building could not have been done without this thinking stage.

Some of the difficulties with the project were not technical in nature, but rather sociological. It felt as though we were short on manpower, but with better defined roles, we may have been able to achieve more. Having a dedicated manager would be ideal, but no one was comfortable taking an authoritative role for the project. As a result, I was working outside of the scope of my assigned tasks. I was in charge of building dispensers, integrating all the circuitry, programming the microcontroller, and developing the wireless connectivity. It's hard to see if I'm using my time effectively, and others in the group could work more effectively if I was out of their way.

Working at a university instead of an office poses a lot of challenges. Frankly, the facilities for doing mechanical work were abysmal. One of our team members is experienced in metal working but we were not given access to a machine shop. I had access to better tools in my high school workshop.

When you have to make all cuts using a jigsaw, the quality of the mechanical system suffers. Full access of to the machine shop should be given without hesitation to senior engineering students at SFU. The quality of the capstone projects will improve, if they accommodate the needs of the students. Another problem with working in a university environment is time commitments. Students have a flexible schedule, and as a result, we are not in sync. If a student doesn't have classes for the day, they may not commute to school. There was not a fixed time to work on the project and discuss in a peer group. Also advisors are typically available during the day, but we are on late schedules. Overall we would have been able to communicate and work better if we were organized in a nine-to-five work environment or even nine-to-noon.

Project selection is very important. There are a few weaknesses with our concept. The project is not entirely commercially viable. The project was not perfectly in sync with our education and interests. But as a learning experience, it was close to optimal. We had an opportunity to develop skills and solve problems, because the problems in cooking are diverse and challenging. It also helps us understand what aspects of engineering we enjoy. Mechanical stuff can be fun, and it is an important aspect, but after experiencing this project, I prefer signal processing and algorithms over moving parts and making shapes.

7.2 Christine Huang

One of the first things that Steve says in the capstone project is: "You are already behind schedule". This is probably the most accurate statement I've heard throughout the semester. Developing an idea before you begin the capstone semester is essential. It takes a lot of time developing a well thought out concept that is not only feasible to complete in 4 months, but something that is marketable. This is something that I wish we were able to do for our project. It would have allowed more time for hardware design, more time for improvements, and more time to perfect the entire system.

Prior to this project, I did not have any experience with mechanical design. In this aspect, I gained a lot of knowledge and experience. I gained a lot of carpentry skills, and I was also exposed to using the Arduino for the first time. Building my own subsystem was time consuming, but straight forward. It was easy to fix the problems I encountered. The main problem for me, however, was integrating all the subunits to form an entire system. Parts did not fit together, they got caught on one another, they obstructed each other, etc. I learned that it takes an incredible amount of time to debug a mechanical system.

I feel that even if the project is completed well before the day of the demonstration, there is still never enough time to make it meet the standards you initially expected – especially given a timeline of 4 months. There will always be something that can be optimized and changed to perfect the system. Seeing things that I constantly wanted to change in the system is something that I really struggled with during the project. Fortunately, we were still able to complete the system with its appropriate functionality, which was our ultimate goal that we set out from the beginning.

Overall, up until this semester, the capstone project has always seemed like a daunting/impossible task to me. Knowing that I've gotten through the project has given me a pretty good sense of accomplishment.

7.3 Pasang Sherpa

First of all, I am very pleased to have the opportunity to work with all the SmartChef team members. I received full support from all of my team members in terms of moral support to accomplish our project goal and lots of technical areas where I needed help. Upon choosing our project topic, I knew that it was going to be a challenging project due to high complexity of all the electromechanical design and the final integration of all the units. I am happy that we were successfully able to present our demonstration of a fully synchronized cooking system at the end of the term.

I had a very little experience in working with various microcontrollers and this was a great opportunity for me to be exposed to Arduino UNO processor. I got familiar with various libraries of the Arduino IDE and its limitations in terms of performance for various applications. I specifically got familiar in looking up data sheets for various components and their usage. This has definitely equipped me to be efficient in grasping information from other data sheets for other components in future projects. Although, we weren't able to deliver our additional software solutions of connecting a Wi-Fi module, I had the opportunity to connect our system to a Wi-Fi module and learned to make a basic iOS application that could have been used as a mainline GUI to the SmartChef system. We weren't able to deliver this functionality due to the limited number I/O pins on the Arduino. With my past experience of working on SolidWorks, I was also able to build a SolidWorks design of the overall framework of the system. Additionally, I also had the opportunity to learn Eagle Software for PCB layout design to make our PCB design for the SmartChef circuitry.

In building the water pump, I am very pleased that we were able to make a water pump that was as efficient as the submersible water pump available in the market. We were able to build it with a very low budget as compared to submersible pump that added a high overall cost to our final product. I was able to test out a switch circuit for the water pump and also the relay switch control for the heating element. In addition, working in this project also provided me with some carpentry skills of precisely drilling, sawing, cutting and attaching different components.

Overall, the team dynamics was well settled. Even though I lost my focus when finals were approaching, I personally would like to thank all of my team members for a proper guidance and support during such period. This project provided a good opportunity to think in an entrepreneurial way of designing a marketable product with minimum budget that can compete with the existing market. It has provided me with higher level of confidence in designing future products in different markets and would like to carry on my entrepreneurial ship spirit.

7.4 Amandeep Singh

In this course, I am a part of the SmartChef team with other three group members: Pasang, Wesley and Christine. Our project was a home automated cooking system called “SmartChef”. Being the CFO of SmartChef team, my job was to work with the team and make sure that all the purchases that were made were absolutely required. Our project was very challenging because it contained four different parts namely: Heating, Dispensing, Pan Movement and Stirring Mechanism. All these part were distributed evenly in our group.

I learned a lot about time and financial management throughout this project. I was mostly involved in the hardware design as our project was more towards electromechanical design implementation. I also helped with other important aspects of the project as required. I was responsible in building the Stirring mechanism attached to a lid that has a vertically positioning feature. During the building process, I ran into a lot of issues as our group was not allowed access to machine shop in spite of having past experience of using milling machines. Since we were not able to use a milling machine, I had to change my design for the stirring mechanism and approach it in a different way. I am very proud that at the end I was able to finish the stirring mechanism and I got it fully working and aligned up before our demo time

For the technical part, I got to learn a lot about Arduino processer and the way to control different features of it by using sketches and libraries. We also tried to connect our SmartChef system with wifi so that it can be accessed by smart phone or computer. We ran into an issue and found out that the wifi and servo libraries are not compatible with each out and whenever we call the servo function it resets the Arduino. During the process, I got very familiar with libraries of the Arduino and its limitation.

With my ability of SolidWorks skills, I was able to team-up with Pasang and create our initial SolidWorks design of the overall system. This was our base feature of the entire framework. With precise dimensioning in the SolidWorks file, it provided viability in positioning different components and their performance without physically building it. I also improved a lot in my writing and reading skills after this course as we are required to do a lot of paperwork such as proposal, functional spec and design spec. Working on all these documentation, I was able to improve my writing and reading skills.

Overall, my team did not have any conflicts and we learned to support each other with any issues we have while implementation. As a group we were able to overcome all the obstacles and we all worked very well with each other so I am very pleased that I got a chance to work with them. This project provided me with the confidence to work with other team members while working on a big project that takes a lot of effort. During this project I felt more like a real engineer and less like a student.

8. Workload Distribution

Table 3 summarizes the work that was distributed throughout the SmartChef team.

Table 3: Work Distribution Table

SmartChef Team Members	Main Role	Contribution
Christine Huang	CEO	Arduino Programmer, Pan Element, Final Assembly and **Chief Executive Officer**
Wesley Kendall	COE	Arduino Programmer, Solid Dispenser, Heat Element, Final Assembly and **Chief Operating Engineer**
Pasang Sherpa	VoP	Liquid Dispenser, PCB layout, Final Assembly and **VP Operations**
Amandeep Singh	CFO	Lid and Stirring Mechanism, SolidWorks design, Final Assembly and **Chief Finance Officer**

Table 4 shows the work load chart for each individual member of the team. A single 'X' represents a low contribution, 'XX' represents a medium contribution, and 'XXX' represents a high contribution.

Table 4: Work Load Chart

Task	Christine Huang	Wesley Kendall	Pasang Sherpa	Amandeep Singh
Documentation	XXX	XXX	XXX	XXX
Documentation Editing	XXX	X	X	X
Financial/Funding	XX	XX	XX	XXX
Purchasing parts	XXX	XXX	XXX	XXX
Pan Element	XXX	X	X	X
Heat Element	X	XXX	X	X
Lid and Stirring	XX	X	X	XXX
Solid Dispenser	X	XXX	XX	X
Liquid Dispenser	X	XX	XXX	X
System overview design	XX	XX	XXX	XXX
Software	XX	XXX	X	X

9. Conclusion

As a team who cares about standards and safety issues, the SmartChef team put a lot of time into the design and implementation process of each subsystem. In this course, we were required to build a marketable product that can equally compete with other products of similar functionality in the existing market. We came up with our own solution of solving our objective problem. Our group was able to overcome all the issues and successfully meet all of our timeline and personal goals to deliver a working cooking "SmartChef" system for the demonstration. Our system is not yet in a fully constructed phase to be injected into the consumer market to meet the competing demands but with proper re-work on our prototype, we can definitely lead this into a successful product. For future work, we need to decrease the size of the entire framework of the system that was built on and add linear motion control of the motors to reduce the cooking area. Furthermore, we have plans to have an enclosed system that is safe so that the consumer is only able to access the dispensing area for filling up ingredients and the serving area for replacing the pan and take the served food. Furthermore, we will need to integrate the refrigerator for the food storage that can keep the ingredients fresh once they are loaded in the dispenser. We also have plans to include a Wifi module to control the system through a GUI and have better control of the system.

References

[1] D. Sppivey, Home Automation For Dummies, Wiley, 2014, pp 300-362.

[2] D.G. Calswell and T. Acarman, Robotics and Automation in the Food Industry, Woodhead Press, 2013, pp 260-285.

Appendix: Meeting Minutes

Agenda

September 9, 2015 11:00 am-12:00 pm
Library meeting room (2nd floor)

Purpose of Meeting: To discuss project ideas

Items for Discussion:

- Project topic ideas
- Telus competition

Minutes

September 9, 2015 11:00 am-12:00pm
Library meeting room (2nd floor)

Present: Christine, Wesley, Paniz, Amandeep, Pasang

Purpose of Meeting: To discuss project ideas

Minutes: Meeting called to order at 11:00 am

A. Topic ideas

Discussion: Project ideas include:

- Stress monitor
- Security camera
- Biometric model
- Sign language glove
- Controlling lights/oven/TV through an app
- Device to lower blood pressure or stress

Action: Topic will be narrowed down in further meetings

B. Next Meeting Date

The next meeting is arranged for September 11, 2015 at 10:30 am

Meeting was adjourned at 12:00 pm

Agenda

September 11, 2015 10:30-11:30 am
Library meeting room (2nd floor)

Purpose of Meeting: To further discuss project ideas

Items for Discussion:

- Project topic ideas

Minutes

September 11, 2015 10:30-11:30 am
Library meeting room (2nd floor)

Present: Christine, Wesley, Amandeep, Pasang

Absent: Paniz

Purpose of Meeting: To further discuss project ideas

Minutes: Meeting called to order at 10:30 am

A. Topic Ideas

Discussion: Project ideas has been narrowed down to home automation. In particular, a mechanical device to place on light switches to allow elderly/disabled to turn lights on/off through a remote from a different room in the house

Action: Further home automated ideas will be discussed during the next meeting

B. Next Meeting Date

The next meeting is arranged for September 17, 2015 at 12:00 pm

Meeting was adjourned at 11:30 am

Agenda

September 17, 2015 12:00-1:00 pm
Library meeting room (2nd floor)

Purpose of Meeting: To finalize the project idea

Items for Discussion:

- Final project topic
- Project proposal

Minutes

September 17, 2015 12:00 -1:00pm
Library meeting room (2nd floor)

Present: Christine, Wesley, Paniz, Amandeep, Pasang

Purpose of Meeting: To finalize the project idea

Minutes: Meeting called to order at 12:00 pm

A. Topic ideas

Discussion: The project idea has temporarily been narrowed down to a motion sensor security camera. The security camera will detect any type of motion, capture an image, and send it to the user either through an app or through a web application.

Action: After speaking with Dr. Rawicz, it seems that home automation is a preferable topic. Further discussion on a project idea will ensue during the next meeting.

B. Project Proposal

Discussion: The project proposal will be divided as the following:

- Aman: introduction/background, project planning
- Wesley: scope/risks, benefits
- Christine: market/competition/research rationale, formatting issues
- Pasang: company details, cost considerations
- Paniz: conclusion/references

Action: Further action will be taken on the project proposal once an idea is finalized.

C. Next Meeting Date

The next meeting is arranged for September 18, 2015 at 10:30 am

Agenda

September 18, 2015 10:30 am-1:00 pm
ASB 10803

Purpose of Meeting: To finalize the project idea

Items for Discussion:

- Final project topic idea

Minutes

September 18, 2015 10:30 am-1:00pm
ASB 10803

Present: Christine, Wesley, Paniz, Amandeep, Pasang

Purpose of Meeting: To finalize the project idea

Minutes: Meeting called to order at 10:30 am

A. Topic ideas

Discussion: The final idea has been narrowed down to a home automated kitchen. The system will prepare meals for those who are physically impaired. This idea has been approved by Dr. Rawicz.

Action: The topic has been finalized. Group members will start to work on the assigned portions of the proposal.

B. Next Meeting Date

The next meeting is arranged for September 25, 2015 at 10:30 am

Meeting was adjourned at 1:00 pm

Agenda

September 25, 2015 10:30 am-12:00 pm
Library 2nd floor

Purpose of Meeting: To come up with a schematic of the cooking system

Items for Discussion:

- Division of work (ie. who is responsible for designing specific parts of the system)

Minutes

September 25, 2015 10:30 am-12:00 pm
Library 2nd floor

Present: Christine, Wesley, Paniz, Amandeep, Pasang

Purpose of Meeting: To come up with a schematic of the cooking system

Minutes: Meeting called to order at 10:30 am

A. Division of work

Discussion: A temporary schematic of the cooking system has been designed. The design of the project will be divided as the following:

- Ingredient storage/delivery: Pasang & Wesley
- Heating element: Wesley
- Stirring mechanism: Christine & Amandeep
- Serving mechanism: Christine & Amandeep
- Arduino, wifi connectivity, mobile/web interface (if implemented): Paniz

Action: Each member of the group will research their portion of the system design and create a list of parts that need to be ordered by October 1st.

B. Next Meeting Date

The next meeting is arranged for October 2, 2015 at 10:30 am

Meeting was adjourned at 12:00 pm

Agenda

October 2, 2015 10:30-11:30 am
ASB 10803

Purpose of Meeting: To further discuss the design of the system

Items for Discussion:

- Proposed design for each group member's assigned portion of the system

Minutes

October 2, 2015 10:30-11:30 am
ASB 10803

Present: Christine, Wesley, Amandeep, Pasang

- Note that Paniz will no longer be a part of the group due to medical conditions

Purpose of Meeting: To further discuss the design of the system

Minutes: Meeting called to order at 10:30 am

A. SmartChef Design

Discussion: The cooking system has been designed to have two sections: one area where the heating element will be with the stirring mechanism, the other area where the ingredient dispensing system will be. The pan will slide between the two sections when necessary. The aim of this design is to have a safer and organized system by minimizing the amount of elements that need to be motorized.

Action: Each member of the group will continue their research on their portion of the system design.

B. Next Meeting Date

The next meeting is arranged for October 14, 2015

Meeting was adjourned at 11:30 am

Agenda

October 14, 2015 12:00-1:00 pm
ASB 10803

Purpose of Meeting: To divide the work for the Functional Specifications report

Items for Discussion:

- Details regarding the Functional Specifications report
- Dividing the work for the report

Minutes

October 14, 2015 12:00-1:00 pm
ASB 10803

Present: Christine, Amandeep, Pasang

Absent: Wesley

Purpose of Meeting: To divide the work for the Functional Specifications report

Minutes: Meeting called to order at 12:00 pm

A. Functional Specifications Report

Discussion: The report will be divided as the following:

- Amandeep: Introduction, intended audience, scope, classification, system general requirements – stirring mechanism and lid, user documentation, sustainability/safety
- Christine: Executive summary, cover letter, system general requirements – controlling the pan, motor requirement, formatting
- Pasang: System overview, system general requirements – food delivery, processor module, sustainability/safety
- Wesley: System general requirements – heating element, relay unit requirement, system test plan, conclusion

Action: Each member of the group will finish their assigned portion of the report by Saturday midnight to allow time for editing/formatting

B. Next Meeting Date

The next meeting is arranged for October 26, 2016

Meeting was adjourned at 1:00 pm

Agenda

October 26, 2015 5:30-7:30 pm
ASB 9800

Purpose of Meeting: To construct a prototype of the SmartChef system out of cardboard with the correct dimensions

Items for Discussion:

- Generalize the dimensions of the system and each individual subsystem

Minutes

October 26, 2015 5:30-7:30 pm
ASB 9800

Present: Christine, Amandeep, Pasang, Wesley

Purpose of Meeting: To construct a prototype of the SmartChef system out of cardboard with the correct dimensions

Minutes: Meeting called to order at 5:30 pm

A. Cardboard prototype of the SmartChef system

Discussion: A cardboard prototype is constructed to generalize the dimensions of the system

Action: The system dimensions were built as the following:

- Dispensing and heating units are at the back of the system; the dispensing on the left, heating unit on the right
- The serving area is in front of the dispensing unit
- The control box and pushbuttons is in front of the heating unit
- The entire system is 30x30”
- The heating and dispensing units are elevated 5” above the serving and control area

B. Next Meeting Date

The next meeting is arranged for November 1, 2015

Meeting was adjourned at 7:30 pm

Agenda

November 1, 2015 3:00-7:00 pm
ASB 9800

Purpose of Meeting: To divide the work for the Design Specification, and to determine how to control multiple servo-motors with the Arduino using pushbuttons

Items for Discussion:

- Design Specification work division
- Control of servo-motors with Arduino

Minutes

November 1, 2015 3:00-7:00 pm
ASB 9800

Present: Christine, Amandeep, Pasang, Wesley

Purpose of Meeting: To divide the work for the Design Specification, and to determine how to control multiple servo-motors with the Arduino using pushbuttons

Minutes: Meeting called to order at 3:00 pm

A. Design Specification work division

Discussion: The design specification has been divided as the following:

- Amandeep: Introduction, scope, intended audience, lid and stirring unit, test plan
- Christine: Letter of transmittal, abstract, pan-control, conclusion, test plan, formatting
- Pasang: System overview, dispensing unit, test plan
- Wesley: Heating element, processor module, test plan

Action: Each member of the group will finish their assigned portion of the report by Friday midnight to allow time for editing/formatting

B. Control of servo-motors with Arduino

Discussion: Determine a method of controlling multiple motors using pushbuttons

Action: Motors were controlled with pushbuttons using 5V and a pull-up resistor (~10kohms). To control multiple motors *simultaneously*, an external power supply needs to be used in addition to the 5V supplied from the Arduino board

Meeting was adjourned at 7:00 pm

Agenda

November 24, 2015 1:00-4:00 pm
SFU Workshop

Purpose of Meeting: To adjust the size of the frame

Items for Discussion:

- Frame size dimensions

Minutes

November 24, 2015 1:00-4:00 pm
SFU Workshop

Present: Christine, Amandeep, Pasang, Wesley

Purpose of Meeting: To adjust the size of the frame

Minutes: Meeting called to order at 1:00 pm

A. Size of the SmartChef frame

Discussion: The SmartChef frame should be dimensioned to suit the size of the pan to ensure its range of motion is contained within the frame

Action: The wood was cut to the set sizes, ready to be assembled

Meeting was adjourned at 4:00 pm

Agenda

December 10, 2015 2:00-10:00 pm
SFU Workshop

Purpose of Meeting: To ensure the dispensers are able to dispense accurately onto the pan

Items for Discussion:

- Fitting the subsystems together

Minutes

December 10, 2015 2:00-10:00 pm
SFU Workshop

Present: Christine, Amandeep, Pasang, Wesley

Purpose of Meeting: To ensure the dispensers are able to dispense accurately onto the pan

Minutes: Meeting called to order at 2:00 pm

A. Dispensing accurately onto the pan

Discussion: The SmartChef dispensers need to be capable of dispensing ingredients directly onto the pan without spilling

Action: Pan angles have been adjusted to accommodate dispensed ingredients

Meeting was adjourned at 10:00 pm

Agenda

December 11, 2015 3:00-10:00 pm
SFU Workshop

Purpose of Meeting: To fit the stirring mechanism into the rest of the system

Items for Discussion:

- Fitting the stirring mechanism into the system

Minutes

December 10, 2015 3:00-10:00 pm
SFU Workshop

Present: Christine, Wesley

Absent: Amandeep, Pasang (due to final exams)

Purpose of Meeting: To fit the stirring mechanism into the rest of the system

Minutes: Meeting called to order at 3:00 pm

A. Fitting the stirring mechanism into the system

Discussion: The stirring unit needs to be fitted into the system so that it is capable of stirring ingredients in a non-obtrusive manner

Action: Many adjustments were made to fit the stirring mechanism into the system to allow it to perform its functionality. More adjustments need to be made

Meeting was adjourned at 10:00 pm

Agenda

December 12, 2015 3:00-10:00 pm
SFU Workshop

Purpose of Meeting: To continue fitting the stirring mechanism into the rest of the system

Items for Discussion:

- Adjusting the stirring mechanism into the system

Minutes

December 12, 2015 3:00-10:00 pm
SFU Workshop

Present: Christine, Wesley

Absent: Amandeep, Pasang (due to final exams)

Purpose of Meeting: To adjust the stirring mechanism into the rest of the system

Minutes: Meeting called to order at 3:00 pm

A. Adjusting the stirring mechanism into the system

Discussion: The stirring unit needs to be adjusted into the system so that it is capable of stirring ingredients in a non-obtrusive manner

Action: The teeth of the stirring mechanism have been removed and replaced with a spatula to achieve a better stirring motion

Meeting was adjourned at 10:00 pm

Agenda

December 13, 2015 3:00-10:00 pm
SFU Workshop

Purpose of Meeting: To fit the water pump into the system, and cook various food ingredients

Items for Discussion:

- Fitting the water pump into the system

Minutes

December 13, 2015 3:00-10:00 pm
SFU Workshop

Present: Christine, Wesley, Amandeep, Pasang

Purpose of Meeting: To fit the water pump into the rest of the system

Minutes: Meeting called to order at 3:00 pm

A. Fitting the water pump into the system

Discussion: The water pump needs to be implemented into the system in order to dispense liquid ingredients

Action: Water pump was implemented and is capable of performing its functionality

B. Cooking different food items

Discussion: Food selection needs to be made to ensure it is able to be demonstrated for December 15th

Action: Food items cooked with the system: popcorn and noodles. Noodles will be used for the demonstration day

Meeting was adjourned at 10:00 pm

Agenda

December 14, 2015 3:00-10:00 pm
SFU Workshop

Purpose of Meeting: To practice the final presentation

Items for Discussion:

- Adjustments in the presentation

Minutes

December 14, 2015 3:00-10:00 pm
SFU Workshop

Present: Christine, Wesley, Amandeep, Pasang

Purpose of Meeting: To practice the final presentation

Minutes: Meeting called to order at 3:00 pm

A. Practicing the final presentation

Discussion: Adjustments need to be made to incorporate all the information of the project into 20 minutes

Action: Presentation has been adjusted accordingly and includes the necessary information

Meeting was adjourned at 10:00 pm