Post-Mortem for *Shop Smart*

'The Self-Checkout on Wheels'

Project Team

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Submitted to

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Issued on: December 17th, 2015

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1. Introduction

Buying groceries takes the average person roughly 40 minutes per week [1]. When you factor in the amount of time needed to create a shopping list, budgeting, finding items in the store and waiting in checkout lines, this time can easily increase to 2-3 hours per week. Although fast checkout lanes currently exist, studies have found that they only reduce the average time by roughly 10 minutes [1]. It is evident that a solution is needed for this time consuming problem.

Our product, Shop Smart, aims to solve this problem in such a way that both the consumers and producers benefit. The Shop Smart solution consists of a shopping cart system that works with a Graphical User Interface (GUI) and a smartphone application. The GUI will provide options, such as adding and removing items from a shopping list, checking an item's price and displaying where an item is located. The smartphone application will assist users in creating a shopping list that can be transferred to the GUI with the simple touch of a button on the cell phone screen. Furthermore, with the implementation of an RFID system, the consumer will be able to track their expenditures and use the on-cart self-checkout option.

2. System Overview

Our device consists of a design that features a touch screen module, an RFID tracking system, and an android cell phone application for planning. The solution is comprised of four major subsystems shown in the Figure 1.

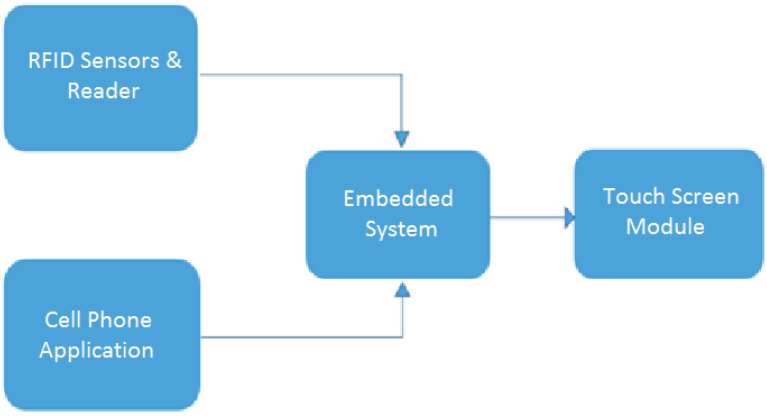

FIGURE 1 - HIGH LEVEL SYSTEM DESCRIPTION

The main electronic component of our device is an embedded system called the BeagleBone Black board. This embedded system runs the software application which enables users to find information on various items that are in the store. The RFID reader

will be used to scan each item into the system, and the touchscreen module is implemented for user interaction, and particularly to display the items present in the cart that need to be processed and checked out.

The software section consists of an easy to use GUI application and a smartphone application that allows the customer to bring a pre-planned shopping list and simply importing it onto the shopping cart.

3. System Specifics

Shop Smart is an automatic checkout system on wheels that consists of a wide range of functionalities and features that have been integrated using various hardware and software components.

3.1 Software Design

The software design is divided into two subsections: the python GUI application and the android application. The python GUI runs on the BeagleBone embedded system and is designed to be simplistic, so that users of any age group have no difficulties working with it. The GUI will enable users to keep track of their expenditures, to find an item's location, to view/import a shopping list from their android smartphone and to access the fast-checkout option. The android application enables users to create a shopping list, to access the store's inventory and to keep track of previous shopping lists. Together, these two software systems encompass our basic user interaction design.

3.2 Hardware Design

The main hardware component of the Shop Smart system is the BeagleBone Black board. This board is connected to a touchscreen module, a WiFi module, an RFID reader and a rechargeable battery. The touchscreen module allows users to interact with our system, and the WiFi module enables the transferring of the user's shopping list from the android application onto the GUI. The RFID reader is used to scan each items RFID tag, and is the basis for our expenditure tracking. The battery is used to power the entire system, and can be recharged at a designated station.

3.3 Device Enclosure

The device enclosure is composed of two ABS plastic boxes that encompass the entire Shop Smart system. One enclosure is used to contain the BeagleBone system, including the WiFi module and the battery, and another enclosure has been used to fix the RFID reader so that users can scan each item that they will place in the shopping cart.

3.4 Major Technical Challenges

The device enclosures were surprisingly one of the greatest hurdles we had faced. Originally, we had ordered the enclosures from a company in the United States, but they had canceled our order, stating that they would only be doing business with businesses as opposed to individuals. This delayed the assembly of our final product by roughly a week, and as such we had to find local solutions. Thankfully we were able overcome this obstacles thanks to two local electronics stores where we could purchase and cut-out the enclosures, as to fit our product properly.

Another major challenge we faced was for the connection of the RFID system and the BeagleBone Black system. We had difficulties with polling and updating the GUI with the tag information. Thankfully, we were able to overcome this struggle by logging all the data that came through the serial port onto the BeagleBone Black board and parsing the information for the latest item that was added in. We also made sure that this process is repeated every 100ms, so as to not lose any tag information.

Lastly, another major challenge we faced was creating an android application, as none of the members had done this before. As such, implementing and integrating a mobile application to our Shop Smart system was not a particularly easy task, particularly for our main developer as he spent roughly two months just learning how to code in Java and use Android Studio. However, with the team coming together and using our expertise in various programming backgrounds we were able to overcome this major hurdle and successfully implement the android application.

4. Schedule Overview

When comparing our actual timeline, with our expected timeline, seen in Figures 2 and 3, it is evident that there are some basic differences. First off, we greatly miscalculated the amount of research we would need to conduct in order to have our final prototype functional. In terms of documentation, we also collectively decided to use the 3-day grace period on the Design Specifications but remained on schedule otherwise. The final major change in our schedule was for the implementation of the communication between the android application and the GUI. This took us surprisingly long to accomplish, as none of our team-members were too familiar with FTP file transfers, and the creation of a WiFi hotspot. All-in-all, our team met the final deadline and we were able to create a working prototype by the demo date.

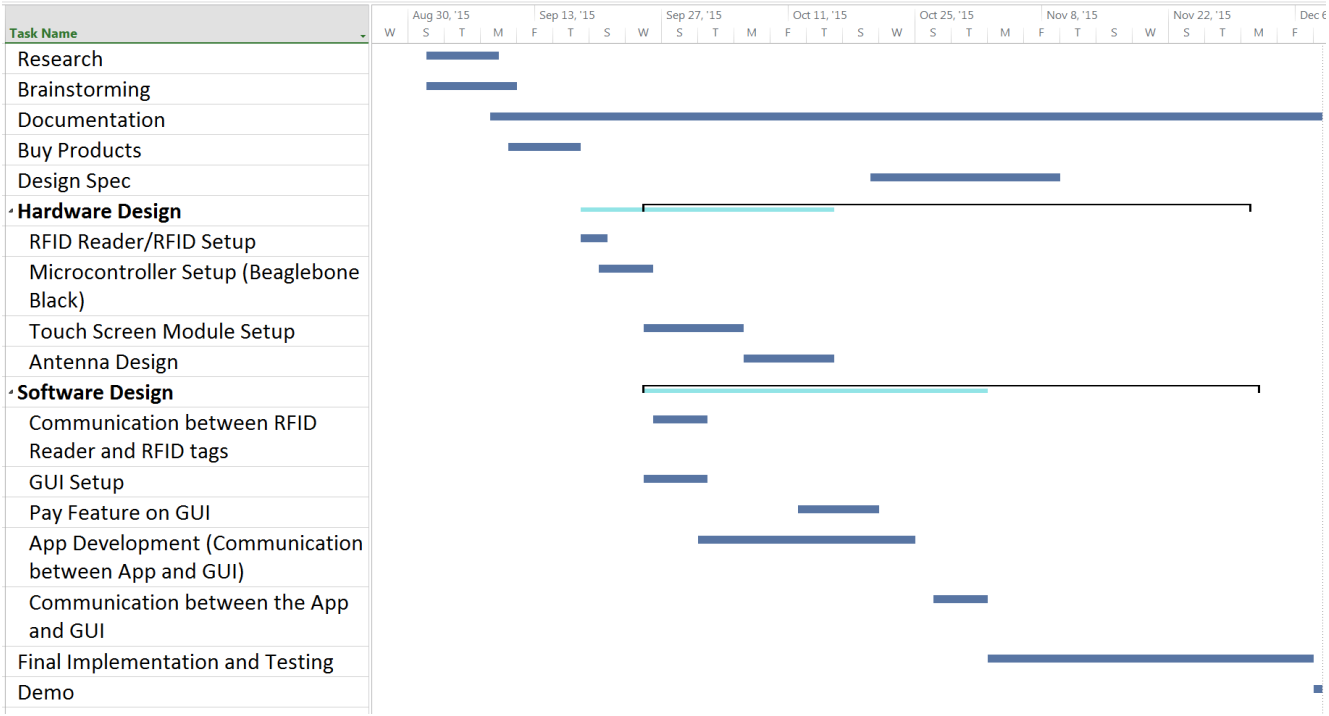

FIGURE 2 - EXPECTED TIMELINE

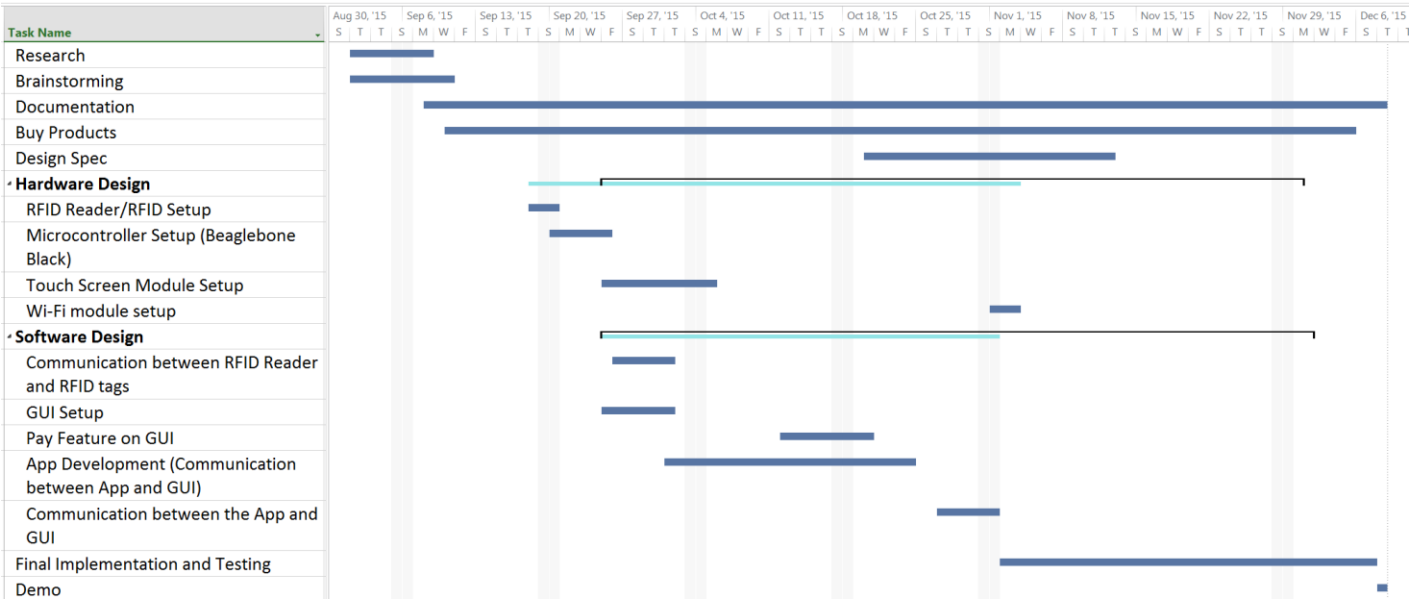

FIGURE 3 – ACTUAL TIMELINE

5. Material Overview

One of our major goals was to use materials that would work with the cradle-to-cradle design principle. Although this is particularly challenging with PCB boards and ICs, there currently are companies that are creating decomposing algorithms to solve this exact problem. In the future, we hope to partner up with such companies in order to maintain a zero waste policy for our company.

TABLE 1 - MATERIALS USED IN THE SHOP SMART SOLUTION

Component	Materials
Shopping Cart	Alloy, Nylon
BeagleBone Black Board	PCB, Silicone
RFID Reader	Alloy, PCB, Silicone
RFID Tags	IC, Metal, Plastic
WiFi Module	Alloy, PCB, Silicone
Enclosure	ABS Plastic
Battery	Lithium-Ion

6. Financial Review

As seen in Tables 2 and 3, when comparing our expected costs and our actual costs, it is evident that we have indeed stayed within our pre-defined budget. This was possible due to purchasing a majority of items locally, thereby eliminating shipping and customs costs. Additionally, we opted for borrowing a shopping cart for our basic prototype as opposed to purchasing one, as we had originally planned. Furthermore, with the help of the $500 we received from the ESSEF fund, we were able to minimize the out-of-pocket expenses needed from each team-member.

TABLE 2 - EXPECTED COSTS

Beaglebone Black	$87.05
LCD 4.3”	$72.53
2 RFID Readers	$113.52 *2 = $227.04
RFID Tags	$84.70
Shopping Cart + installation components	$200
Antenna Design + PCB	$300
Shipping and Customs Costs	$360
Sub-Total	**$1331.32**
Unexpected Costs and Expenses (Sub-Total * 15%)	$199.70
Total Cost	**$1531.02**

TABLE 3 – ACTUAL COSTS

LF Passive RFID Desktop Reader/Writer	$200.19
RFID Tags	$170.50
SparkFun RFID Reader Starter Kit	$122.75
Beaglebone Black – Rev C	$72.53
Beaglebone Black Cape – LCD 4.3”	$87.05
WiFi Module	$22.40
Battery	$22.40
RFID and BeagleBone Enclosures	$50.45
Enclosure Cut-out	$67.20
Assembly Tools	$48.12
Total Cost	**$863.59**
ESSEF Funding	- $500.00
Out of Pocket Expense per Person	**$72.72**

7. Work Distribution

Table 4 displays our team’s work distribution for the Shop Smart solution.

	Zargham	Manpreet	Shaihryar	Jashan	Yasamin
Research	X	X	X	X	X
RFID Implementation	XX	XX			
GUI Development	X	X	XX		
Android Application	X	X	X	XX	X
WiFi Module Implementation	X	X	X	X	X
Enclosures and Assembly	X	X	X	X	X
Financial Budgeting	X				XX
Documentation	X	X	X	X	XX

Please note that XX refers to it being a main task, and X means general contribution.

8. Individual Learning and

8.1 Zargham Amer

The entire capstone project was a great learning experience. Seeing an idea and just a concept on paper becoming reality as an actual working device was a feeling of success for all the members in our project. It was not an easy journey as we went through iterations for changing the original idea according to the feasibility of the device. I would say it was four months of struggle, pain and hard work but the joy we had at the end when everything was put together and the prototype was completed overcomes all the other feelings. It was hard for me to believe whether I would be able to pull it off and keep my team on track and motivated throughout the semester and there were ups and downs and highs and lows but at the end I am happy with what we have achieved. The first few weeks of the semester everything was either on paper or a general idea that I would convey to the team members but as we went to the development and implementation phase things got real. There were times when I would ask myself would we be able to pull this off?

One thing that I noticed among some of the team members is that they were afraid of taking initiatives i.e. they would only look into tasks or things that are assigned to them. The drive for taking on extra technical tasks was missing unless they were pushed and told that they could do this. Nonetheless, all the members managed to provide assistance where they could. While I was designing the entire system I kept all the team members in loop so that they all would know how things would come together and what bottle necks and issues we would end up facing. Once the design was complete we would sit down and start the implementation based upon the tasks I would assign to everyone and in some cases I ended up assisting and finishing the task assigned to someone myself which helped me learn more than I expected. Even though there were time constraints for me as I was taking a heavy course load along with a part time job I was surprised to see that I managed my time in the most efficient way and completed everything on time with results close to perfection.

I have learned a lot of new skill throughout the capstone project and learned how to use the skills that I have acquired over the four years of school. I've become more comfortable while dealing with serial inputs and data parsing when it comes to large amounts of data coming and keeping them in synchronization. I learned ways to lead a project and assign tasks based on people's interest so that they would bring the task to completion in suitable amount of time. Certain problems needed to be looked at from multiple angles, and I became more comfortable at weighing different solutions and suggestions from other team members. I gained valuable knowledge of proper coding standards as different people were working on the same project I made sure the coding standard was kept constant throughout the project. I learned more about ftp protocols and how to set up a server on an embedded system such as Beaglebone. I was successfully able to keep everyone on track and meet the deadlines for the development, implementation, testing and documentation. I learned new ways of becoming more efficient to improve the design process.

I was impressed by what we put together as a prototype and made our ideas a real working device that could potentially be something big. I would like to thank all the team members for being there and supporting my ideas and taking my suggestions under consideration. They all deserve high praise, for dealing with me as their team lead as I can be very pushy

sometimes, but it was for the project and I am happy that I made good team members out of people who were just good friends four months ago.

8.2 Manpreet Singh

In this section I will be outlining my experience of the capstone project and how I was able to execute the project successfully while working with my group. We started working during the early summer where we brainstormed several different ideas. Eventually we all agreed on Shop Smart and after getting a formal approval from Dr. Rawicz, we began to divide the tasks.

My very first step before beginning to start working on this project was to research as much as I can and get familiar with the different (possible) components of our solution system. I started with doing an online research on RFID technology and why it is becoming a new trend in shopping industry. Once the different components were decided, my main role in the team was mostly to do with software architecture both on the backend as well as the front end. Besides finishing the tasks, I took, I also voluntarily helped others in debugging their tasks since I wanted to make sure I am familiar with all the aspects of our system. I was also able to gain professional writing skills after finishing several documenting tasks throughout the semester. There were few stages where it seemed like documenting our prototype is actually taking more time than the actual implementation of the prototype but in the end these documents only helped us to keep on track.

As a member of a software team, I was exposed to new programming languages throughout the semester. I started working with Python scripting with which I never had any experience before. Although, I quickly picked up on Python due to my experience in software development and realized how easily it could be used to solve complicated tasks. For instance, I wrote script which would read a dynamically generated text file.
During the later phase of the semester we had to integrate an android app to our solution. Since I was eager to learn android development, I took on the task of establishing a communication between Beaglebone Black and Smartphone App. This was one of our major requirement of the project. After talking to Lukas we learned about File Transfer Protocol (FTP) which can be used to setup Beaglebone as a server (listener) and the smartphone app as a client. This whole process was done on the android studio platform.

This course taught me different traits of engineering but I believe the development of embedded system and setting up its communication with smartphone app helped me the most in enhancing my technical skills. I would like to thank my group members for collaborating with each other and trying to finish their tasks to the best of their ability.

8.3 Jashan Dhaliwal

It has been a great journey throughout these 4 months of Capstone Project. Technically our project started way back in June when we started discussing ideas and made a rough-draft of our proposal. After discussing our initial proposal with Dr.Rawicz, we made changes to the proposed project. I believe all of us team members have enhanced our soft skills as well as programming skills after this capstone project. Since the beginning of this project, our intention was to stay on schedule as far as the documentation and prototyping was concerned. With the passage of time, we soon began to understand each other's working styles and help each other in the best possible way as we could.

There were many difficult parts to this project. However, I was particularly concerned about one post our team meeting with Lukas when he suggested to incorporate an android application into this project. Since this feature was added in the 3rd week of September to our project, I was given the task to start on this add-on feature whereas other group members had to split the rest of the work amongst themselves all over again. Not only was I unsure about pulling this off successfully but I also lacked confidence to start coding in Java initially,

However, seeing the rest of the group steadily working on the various other parts of this project gave me a strong sense of responsibility and motivation to work on the app development and make it a reality. Once the application development was successfully implemented, I also worked on being able to export this list onto the shopping cart display using a text file where all of our selections are automatically written when items are selected. One thing that I would like to change about the application past the prototype phase would be its overall layout and to include database approach. This will allow users to actually type into a search bar without having to select items from a pre-defined list.

While three members of the group were into working on the File Transfer Protocol (FTP), I was assigned the task to look into exploring the Bluetooth option for sending this text file to the LCD Cape. I was able to successfully implement a Java code for Bluetooth file transfer but by that time, we also had our FTP server/client working. Although the Bluetooth file transfer was successfully tested on the cellphone application, we chose not go forward with the Bluetooth on BeagleBone since it was more desirable to have File Transfer Protocol. Two main reasons for this choice was cost (additional Bluetooth cost would have increased the overall cost of the device) and weight of the embedded system (since it will have to be attached to the Beaglebone thereby, increasing the weight of the overall system. Also, I helped Shaihryar and Zargham in re-organizing the Python dictionary for our project as it was critical for the system to be able to recognize the inventory on Cart Screen and the application in accordance with each other.

There were high and low points during the course of this project amongst team members but we made sure to overcome our difference and maintain a professional working environment. Besides all of the invaluable technical knowledge I gained from this project, it has also made a great positive impact on my time management skills. I have learnt how to manage my workflow effectively and also troubleshooting problems faced by any member of the group.

8.4 Yasamin Houshmand

This entire semester was fantastic, particularly for our capstone project. Now, this doesn't mean that our team didn't have our difficulties and did not need to overcome some major hurdles, but we were able to overcome our differences and work as a team. As such, one of the most important things I learnt this semester was how to put aside my pride and not to take things too personally.

At the beginning of the semester, we were extremely organized, and were even ahead of schedule, since we had started working on our capstone project the summer before. However, as exams, assignments and projects started piling up we began to fall behind. One of the most time consuming, and underestimated parts of capstone was the documentation that was needed for ENSC 305W. Although we managed to stay on top of these deadlines, it did become particularly challenging, and even at times, a cause for argument amongst our team-members. One thing I would like to note is that word documentation, although is easy to use, is horrendous because the document may look completely different in one version of Microsoft Word as opposed to another. This caused a lot of issues, particularly for our proposal documentation, and resulted in our team spending an excess amount of time editing the report.

Technically, it was challenging for me to learn how to program in Java and in Python since I am not an experienced programmer. Thankfully, I had the summer to learn how to program in Python, so it was not as bad. Unfortunately, with the addition of the android application during the semester, and working on the WiFi module, I was required to learn Java at an accelerated rate. This caused quite a bit of stress, but thankfully we have access to extremely good learning tools, such as Lydia.com, and was able to ask questions about specifics from my team-members who had prior Java experience.

For the WiFi module, I had originally found an application that turns the android phone into a WiFi hotspot, and could then transfer files via an IP address to the BeagleBone board. All that was needed was for us to launch the third party application and have it do all of the work. Unfortunately, our team could not find a way to have this third-party app working in the background, so we were forced to add-in code that would make our application run in the same manner. Of course, we had to implement this during the two weeks prior to our demo, and as a result caused quite a bit of stress for our team. Thankfully, by combining our group's knowledge and by talking things through, we were able to complete this part of our project on time.

The last major hurdle we faced was for the enclosures. Originally, we had ordered the enclosures from a company in the United States and were expecting them to arrive exactly a week later. Despite two phone conversations with representatives of the company, and being assured that the enclosures would arrive on time, I received an email Monday morning (they were supposed to arrive by Tuesday) saying our order had been canceled. The company claimed that they had decided, due to international laws, to only work with businesses as opposed to individuals. This drawback caused a bit of panic amongst our

team, as it was the final component needed for our presentation that was 2 weeks away, and shipping it from another vendor could easily take up this entire time. Additionally, we still had to cut-out the holes in the enclosures and make sure everything fit properly. As a result, our team frantically began looking for local vendors where we could purchase the enclosures. Thankfully, there was a local electronics store, Main's Electronics, that sold exactly the right size and type of enclosure we needed. After a phone call with them I was told that there was also another local electronics store where we could get the boxes cut.

All-in-all, I learnt not only the importance of working as a team, talking through our difficulties, keeping track of what was due to stay on top of deadlines or where to find resources needed to learn new skills, but also the importance of communication. Although this end-of-degree capstone project was extremely challenging and frustrating at times, I feel as though it taught me to trust the skills I gained from my degree and to have hope that things will work out, so long as you keep trying and working as a team to push through.

8.5 Shaihryar Khan

Working on the Shop Smart project has been a great learning opportunity for me. The project not only helped me gain valuable technical skills but also gave me a chance to brush up my interpersonal, communication and planning skills that will help me greatly in my career ahead as an engineer.

I contributed to this project by coming up with a design of the GUI Application, adding features such as Look-Up Item, as well as testing and debugging of the system. Before the start of this project, I had very limited experience working with Python language and wasn't familiar with programming based for real time applications. I had to start by going through a number of online tutorials and sample codes to understand the basics. There was a large learning curve involved as self-directed projects similar to this one really pushes you to your limits.

One of the problems we faced was during the integration phase of the project. We all had our work on different stages of development and when we tried to put it all together we had some compatibility issues. Also, we were using a manual method to update the development work on daily basis using Dropbox Cloud storage that came out to be very difficult to track. In future, in order to cope up with a similar problem, the best way is to setup a team repository on Git so that every team member can update and also download the latest versions of the development work.

The biggest lessons to get out of this experience was on how to successfully work and operate in a team environment. We had some issues in the beginning of the project and this was due to a difference of opinion on various matters. With the passage of time, as the project progressed and things started to work, the group dynamics changed for the better and all the disagreements changed into friendships. I really wish the best of luck to every team member in their future endeavors.

References

[1]. Goodman, 'Who Does the Grocery Shopping, and When Do They Do It?', *The Time Use Institute*, 2008. [Online]. Available: http://timeuseinstitute.org/Grocery%20White%20Paper%202008.pdf.

Appendix – Meeting Minutes

Date	Monday, September 7th, 2015
Start Time	1:30pm
Members Present	Jashan, Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	None
Agenda	**Update – First team meeting**
Minutes	▪ Went over our main roles: • Jashan → Working on GUI • Manpreet → Working on RFID • Zargham → Working on RFID • Shaihryar → Working on GUI • Yasamin → Working on GUI ▪ Went over the main features for our project (need to still come up with a name for our company/project!!) • Shopping cart system • Will be on a Beaglebone Black board with a touchscreen • Will have a list of items on the GUI that can be added into a shopping list • Will use RFID tags and an RFID reader to scan the items that will be placed into the shopping cart • GUI will update the shopping list with the name of items in the cart • GUI will also include "item location" – aka where you can find an item (aisle info, not an actual navigation system) ▪ Gave each-other updates on what we did over the summer for the project • Shaihryar, Jashan and Yasamin looked into python programming • Manpreet and Zargham looked into RFID basics (concepts, what we'll need, etc.) ▪ Discussed what we need to work on in the upcoming few weeks: • ESSEF proposal, so we can get funding for our project ➢ Will discuss this in detail later • ENSC 305 proposal ➢ Due September 28th

Date	Friday, September 11th, 2015
Start Time	10:30am
Members Present	Jashan, Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	None
Agenda	**ESSEF Proposal and ENSC 305 Proposal Update**
Minutes	▪ Brief meeting after class to discuss the ESSEF funding proposal and the ENSC 305 proposal ▪ We decided to split the two proposals up into 2 "teams"/"groups": ➢ Jashan, Shaihryar & Yasamin will work on the ESSEF funding proposal ➢ Manpreet & Zargham will work on the ENSC 305 proposal ▪ We will setup times to meet in our groups and work on each proposal, and if we get stuck or want more input, we will send a message to the other team on the WhatsApp group ▪ Next Meetings: ➢ ESSEF proposal meeting: Monday, September 14th ➢ ENSC 305 proposal meeting: Sunday, September 13th

Date	Friday, September 18th, 2015
Start Time	10:30am
Members Present	Jashan, Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	None
Agenda	**ESSEF Proposal and ENSC 305 Proposal Update**
Minutes	▪ Team meeting setup to go over the ESSEF proposal and ENSC 305 proposal ▪ ESSEF Proposal ➢ The whole team read over the proposal, and we discussed what needed to be changed/added in ➢ Jashan, Shaihryar and Yasamin wanted opinions on what to include on the timeline: • Plan and design • Prototyping phase • Testing phase • Need to include time for the presentation/demo prep ▪ ENSC 305 Proposal ➢ Zargham and Manpreet did a large part of the proposal, but we need to further split up the sections for each person to work on ➢ Once Zargham and Manpreet finish up their sections, they will let us know what other sections are left/need to be completed

Date	Monday, September 21th, 2015
Start Time	2:00pm
Members Present	Jashan, Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	None
Agenda	**Team Meeting & Meeting with Lukas**
Minutes	▪ After reviewing the ESSEF funding proposal requirements, we realized that we also have to create a presentation for our ESSEF proposal ➢ Yasamin will create a short PowerPoint presentation & send it to the group for review by tonight ➢ The entire team will meet before the presentation, and practice together ▪ The hard-copy of the ESSEF proposal was submitted today ▪ Meeting with Lukas: ➢ He wanted to discuss our project with us – apparently a group did a very similar thing last year ➢ He said our idea was good, and although there is a team who did the same type of project previously ours is different so we are okay and do not need to come up with another idea ➢ Note: We had previously gotten the approval for our idea from Dr. Rawicz ➢ Lukas gave us a few ideas on how to expand our project ▪ Add a stand-alone android app ▪ Have it connect with the Beaglebone Black board for a payment process ➢ Told us to email him and let him know if we had any other questions or needed any advice on implementation

Date	Friday, September 25th, 2015
Start Time	2:00pm
Members Present	Jashan, Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	None
Agenda	**Meeting with Jamal**
Minutes	▪ Setup a meeting time with Jamal to go over the requirements for the Proposal document that is due on the 28th ➢ We have almost fully completed the Proposal, just have the conclusion and a few other sections to add/edit ▪ He gave us some very good pointers on what to improve/focus on ➢ Focus on Scope/Risk/Benefits, Market/Competition/Research Rationale and Cost Considerations as this is where students lose most of their marks ➢ Do not use vague statements, or the word "it" or "them" – need to use clear language in order to get the message properly across ➢ They will be marking on grammar, as well as formatting ▪ He said he would send out an email to the whole class with a list of common errors students make on the Proposal documentation

Date	Wednesday, October 7th, 2015
Start Time	6:30pm
Members Present	Jashan, Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	None
Agenda	**Group Meeting/Update**
Minutes	▪ The new RFID arrived ▪ We received $500 from the ESSEF fund ▪ Updates: • Jashan ➢ Started the app ➢ Need to do: fill in the list names and Java • Yasamin: ➢ Received the RFID reader and some tags • This past week ➢ Goal: make it compatible to the cellphone OR figure out a way to transfer/connect the cellphone with the BeagleBone wirelessly • Shaihryar: ➢ Added events for buttons on GUI • Need to put it all together • Being mocked using a sample list • Manpreet: ➢ Need to work on RFID • Zargham: ➢ Need to work on RFID antenna • Will look at schematics ▪ **Next Report Due:** Functional Specifications, due on October 19th • To do list for Everyone: ➢ By this Thursday evening, everyone should have looked at 3 Functional Specification documents from the past ➢ By Saturday evening, should divide the sections/tasks for the F.S. document and start working on it • Main goal: Finish the report by Friday, October 16th so we have time for editing ▪ Who needs help? • Shaihryar ➢ Needed help with GUI (Zargham) ➢ Opening up new windows for button events • Jashan/Yasamin → No help • Manpreet → Sanity check for old keys with new reader • Zargham → Antenna and pins for RFID reader

Date	Monday, October 19th, 2015
Start Time	1:30pm
Members Present	Jashan, Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	None
Agenda	**Oral Presentation and Design Specifications**
Minutes	▪ Discussed the oral presentation (tomorrow at 2:30pm) ▪ Went over our new plan for documentation ➢ Set a few separate days as deadlines for our report ➢ Split up the work into 2 tasks/sections ➢ Each person has a specific section due on 2 different days ▪ **Next Report Due:** Design Specifications – November 9th, 2015 ▪ **Deadlines:** October 25th: Zargham → Intro; Manpreet → Exec. Summary; Yasamin → System Design; Jashan → Overall System Design; Shaihryar → ½ Software Design November 6th: Zargham → Conclusion; Manpreet → Test Plan; Yasamin → ½ Hardware; Jashan → ½ Hardware; Shaihryar → Finish Software

Date	Tuesday, October 20th, 2015
Start Time	1:30pm
Members Present	Jashan, Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	None
Agenda	**Oral Report with Lukas**
Minutes	▪ Lukas told us to define our project in 1 sentence or less: ➢ Helped us come up with: "The mobile self-checkout system on wheels" ▪ We discussed possibly implementing NFC tags as well as RFID tags ➢ If time permits we will look into also implementing NFC tags ➢ Main concern is just getting the basics running at this point ▪ He asked us: ➢ Who charges the device and how will they charge it? ➢ How long is the battery life? ➢ What is the power consumption? ➢ Told us to look into buying a battery and possibly a DC converter ▪ Lukas suggested that we start putting more time on the capstone project ➢ He suggests roughly 30 hours per week

Date	Monday, November 2nd, 2015
Start Time	2:00pm
Members Present	Jashan, Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	None
Agenda	**Group Meeting/Update**
Minutes	▪ Progress reports/updates: • Jashan: ➢ Done with the android phone application! ➢ Will send it to Yasamin so she can begin the implementation of the WiFi Module • Shaihryar: ➢ The GUI is up and running! • Zargham & Manpreet: ➢ The RFID portion of our project is working! • Yasamin: ➢ Did research on which WiFi module we could purchase: • Between one on Sparkfun and one at Lee's Electronics, need to decide which (do we want to pay for shipping/wait?) ➢ Requested Zargham bring the Beaglebone board for her to test the WiFi module with

Date	Thursday, November 19th, 2015
Start Time	4:30pm
Members Present	Jashan, Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	None
Agenda	**Working Group Meeting**
Minutes	▪ The entire group got-together to work on combining each part ▪ WiFi module implementation is being quite tricky to implement ➢ Was successfully able to connect the android app to another application which creates a WiFi hotspot, and then uploads the shopping list text file up on an IP address, from where it can then be downloaded ▪ The group has agreed to meet almost every day around 3pm to collectively work on the project so we can have it complete ASAP

Date	Friday, November 20th, 2015
Start Time	10:30am
Members Present	Shaihryar, Manpreet, Yasamin, Zargham
Members Absent	Jashan
Agenda	**Group Meeting with Lukas**
Minutes	▪ Needed to meet with Lukas to ask a few questions regarding the implementation of the Shop Smart system: ➢ Can we mock the payment process? ▪ Yes! Got the approval from Lukas ➢ WiFi module/FTP transfer implementation – would using a 3rd party app be okay? If no, does he know of a way for us to automate the use of the 3rd party app? ▪ No, it is not okay to use the 3rd party app ▪ He does not know of a way to do this, but is surprised that there isn't an application/way to do this if you do not have the 3rd party app's source code, etc. ➢ Battery for the Beaglebone board ▪ The Beaglebone specifications suggests using a 5V, 1AH battery ▪ Lukas suggested using a 7.5V, 2500mAH battery, with a DC-DC converter ▪ Lukas also suggested that we use a lithium ion battery, and to either get one from Lee's Electronics or from DigiKey (6-day shipping)

Date	Thursday, November 26th, 2015
Start Time	1:30pm
Members Present	Shaihryar , Yasamin, Zargham, Jashan
Members Absent	Manpreet
Agenda	**Update Everyone on Project Progress**
Minutes	<u>Things Done:</u> • FTP Server on BeagleBone Black (BBB) ➢ Up and Running [Sherry and Zargham] • Order the boxed enclosures ➢ Expected delivery by Wednesday [Yasamin] • FTP client on cell phone established [Manpreet] • Back-up Bluetooth transfer for file ➢ Implementation complete, not testing [Jashan] • Thank you letter for ESSEF Funding [Yasamin] • Progress report complete [Yasamin] ➢ Just need the gantt chart and test plan [Manpreet] • *** TECHNICAL SIDE = COMPLETE*** <u>Things left to do:</u> • Everyone needs to update their journals • Tuesday, Dec 1st – individual self-evaluation (email Prof Whitmore) • Jashan → try getting Bluetooth running on his laptop • Shaihryar → add the delete/remove item button • Jashan will give Manpreet the updated Java file for names • Yasamin → Start presentation slides, post-mortem • Instead of a curser have a dot for the pointer • Shaihryar → needs to write a scripft for the video ➢ Each person should talk for 2-5 minutes

Date	Friday, December 4th, 2015
Start Time	5:30pm
Members Present	Manpreet, Shaihryar , Yasamin, Zargham, Jashan
Members Absent	None
Agenda	**Box Enclosure and Demo**
Minutes	**System Assembly** • Assembled the box enclosure, and placed it on the shopping cart that was borrowed from Nester's • Placed the shopping cart in the IEEE office **Demo/Presentation** • Distributed the sections for the demo, and who would be talking about what ▪ Yasamin → intro, conclusion, finances, cost analysis, materials & cradle-to-cradle, NFC/RFID, WiFi setup ▪ Zargham → tag ID dictionary, system design, backend software development, serial to file, system start, ftp server ▪ Shaihryar → Everything to do with the GUI ▪ Jashan → Everything to do with the android application development ▪ Manpreet →RFID items, implementation into GUI, app text file segment, ftp client • Went over the basic layout for the power point presentations and discussed what else needs to be added ▪ Will meet up on Monday to go over the presentation and to practice until we perfect it