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		

AccuTag

By

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September 26, 2013

Mr. Lucky One
School of Engineering Science
Simon Fraser University
Burnaby, BC V5A 1S6

Re: ENSC 440 Project Proposal for Wireless Electronic Price Tags

Dear Mr. One,

The attached document, *Proposal for Wireless Electronic Price Tags*, outlines our project for ENSC 440W (Capstone Engineering Science Project). Our main goal is to design and implement one or more E-Ink screens with the ability to display prices and product information wirelessly. It is through this product that we hope to reduce the use and maintenance of paper price tags currently in practice in the market today.

In the following proposal, our company has included an overview of key objectives regarding design and functionality that we hope to achieve this coming December. The document also includes information regarding research on existing products, detailed project justification, budget and funding, product assessment, and resource allocation in terms of team member roles and schedules.

Precision Wireless consists of five of SFU's most determined and talented fourth year engineers coming from a variety of disciplines and backgrounds which were personally picked due to common interest and diligent work ethics. These students and company chief officers are Mahyar Mehran, Joemini Poudel, Tauseef Alwaris, David Negrabee, and Steven Hoang.

As a team, we would appreciate your consideration and time in reviewing our project proposal and encourage questions or concerns which may arise in the process. Feel free to contact me at mmehran@sfu.ca or by phone at 778.859.8070

Sincerely,

M. Mehran

Mahyar Mehran
Chief Executive Officer (CEO)
Precision Wireless
Enclosure: *Proposal for Wireless Electronic Price Tags*

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1. Executive Summary

One of our chief officers has firsthand experience in this field of study as he himself was a working employee at the Real Canadian Superstore. He was deemed the store "price-checker", in charge of relaying the actual price on the shelves to cashiers when there were price discrepancies. In his detailed description of his duties and roles, he explained that price-checkers are paid minimum wage to focus primarily on checking an item's price in the aisles and changing them if they were wrong. Changing the price simply meant ripping the price portion of the paper tag off, leaving just the product name and serial code behind. It is obvious that time could be better spent in the many other duties available at Superstore.

He goes on to explain that in the circumstance that the prices were displayed incorrectly on the shelves, Superstore along with many big time supermarkets such as Costco, Shoppers Drug Mart and Wal-Mart, adhere to a policy known as the scanner price accuracy voluntary code [1]. This code dictates that any product under $10 scanned at a price different from what was displayed on the shelves would be written off as free for the customer and any product above $10 was reduced by that amount. As tempting as that sounds for consumers, it is a huge flaw in the utilization of paper price tags. Motivated by this personal experience, our team aimed to improve upon the existing paper tag method by creating a new system that would solve a variety of other problems along with the one listed, while still being easy for stores to adopt.

Our product is primarily a set of digital E-Ink LCD price tags. These digital tags will be wirelessly controlled by another piece of hardware which will have access to a catalogue of prices that is constantly up to date. Essentially each digital tag is connected to its corresponding row somewhere inside a database. This connection is what makes our product so convenient. Store workers are no longer required to update the tags manually on their own unless the digital tags are broken or their batteries die out.

Our development and implementation process consists of building two separate and standalone prototypes. One of these will be a rat's-nest prototype of the E-Ink tag. This will be capable of receiving signals from a central transmitter and translating that into new prices or new information to display on the LCDs. The second prototype will be the transmitter itself. This will have an interface with computer software from which it receives control signals to update prices. Both prototypes will use the same development boards purchased from Atmel.

This system of communication between the tags, the transmitter and the database will be referred to as the *AccuTag system*.

Having researched several different options in terms of E-Ink displays and development boards, we have chosen a set of components that will provide us with the functionality to create our prototypes with ease. These components are listed later in this document and our costs come out to a total of $500.

The remainder of this document will provide in depth analysis of what our product does, how it works and how we plan to complete this project. We have provided a detailed timeline of our deliverables, milestones, and a breakdown of how tasks are assigned to different members.

2. Introduction

Paper tags have always been the go-to solution for displaying the prices of items at stores. They are simple, they are easy to use, and they work. But they are not without their drawbacks. Drawbacks that one would not necessarily notice until they were given a better solution.

The biggest disadvantage to using paper price tags is the manual labour required to change them with every update to the price. A retailer must actively spend money to pay their workers to change these price tags. On top of that, this method is prone to human error. It is very common for some price tags around the store to display the incorrect price. The least significant disadvantage and incurred cost of the paper tag method is the cost of paper and it's environmental impact. Although it is a small price to pay, over time it can add up making it a problem worth combating.

The AccuTag system aims to be an easy-to-use and easy-to-adopt alternative to the traditional paper tag solution. Our system consists of three basic components: digital price tags, a central in-store transmitter, and a computer-stored price catalogue. The digital price tags will be roughly the same size as paper tags and will use E-Ink displays to show the price. The size of the frames for the tags will also allow them to be affixed to the edges of store shelves like paper tags, allowing stores to easily adopt this technology. The in-store transmitter will be used as a means to wirelessly transmit new prices to all the tags in the store. This transmitter will interface with computer software through which prices for items can automatically be updated as soon as a change is detected in the database.

With this system we envision a scenario where a short script running on a store's server, at its headquarters, will be able to update the price on a rack of Mac n Cheese thousands of kilometres away in only a matter of seconds.

We believe that our product is a better alternative to paper tags. More importantly, it is cost effective. The largest cost sustained will be the initial setup of the system for the store. Maintenance costs will be minimal as we aim to optimize power consumption and battery life of the system. Our AccuTag system will be convenient both to the customers and the store employees. Through the use of E-Ink displays, visibility and resolution will be as clear, if not clearer, as paper price tags. The transmitters' effective range will be enough to cover even the larger supermarkets. However, the feasibility to implement such a system will be dependent upon the domain of the coverage field.

With this proposal we aim to provide a full and thorough overview of the AccuTag system scope. This will be accomplished in terms of functionality, a discussion and critique of the alternatives to our product, the methods with which we want to build our prototypes, and with the research and cost analysis that enabled us to arrive at the product's design. We have also provided a Gantt chart in the scheduling section which shows that this project will keep five students active and working in parallel optimizing time and resource allocation.

3. System Overview

A high level diagram of the components of the AccuTag system is shown below.

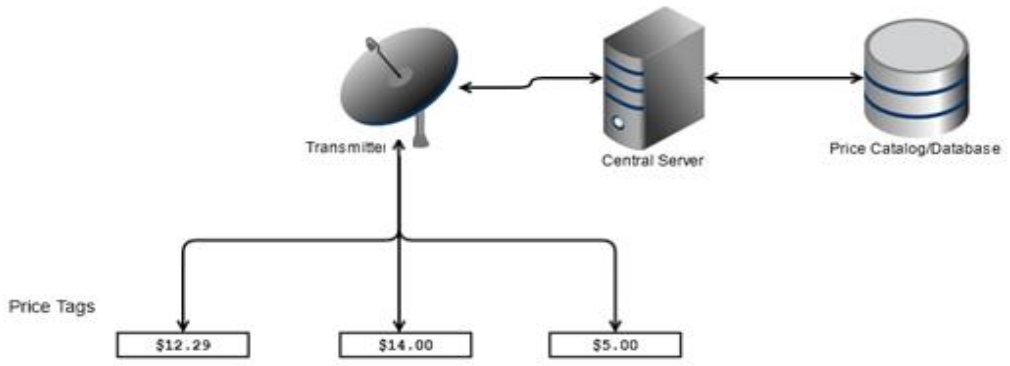

Figure 3.1: High-level diagram of the AccuTag system

Note by the above diagram that the source for prices and item information is a database. Human error is taken out of the equation as the prices no longer need to be entered manually by a worker from a catalogue to some software that prints sheets of tags.

The nature or behaviour of the control software that runs on the central server is flexible and dependent on what the user requires. The simplest way to operate the system is by periodically checking the database for updates to prices. Any changes that are detected can be used to generate control signals to the transmitter which would then send the new information to the individual tags. Software development for operating this can be made simpler through a set of basic APIs that provide fundamental functionality such as changing price by tag identifier or retrieving price by tag identifier.

By adopting this database solution, becoming more reliant on it, and populating it with fine-grained item details, retailers can have the option of making apps and such centered on providing customers with information to make their shopping experience more convenient. For example, one of the columns in our database catalogue is a 'Location' property. A store may choose to create a mobile app that allows users to make a shopping list that also shows them the designated aisle that that item is in, allowing the customer to finish shopping more quickly. This additional app is not something we plan to implement unless our schedule permits it. It is more of an artefact of our system's database rather than something we originally planned on creating. We plan on leaving this option to be further implemented by the retailer itself or external software companies as our system will provide the necessary foundation.

The database can be located on a machine somewhere in the store but a high-end supermarket chain such as Wal-Mart may choose to have their database accessible via the internet, in which case price changes can be controlled from a headquarters and fed to price tags across the globe.

The transmitter is basically composed of a combined microcontroller and transceiver along with some other peripherals (e.g. LED status lights, USB ports) pending our final design. The microcontroller will receive signals from the software which it will use to control the transceiver and send signals to all the tags in the store. This will interface with the computer via USB. Thus, we plan on using USB to send control signals from the software to the transmitter.

The tags will be composed of a microcontroller, transceiver, and an E-Ink display. The microcontroller and transceiver used for the prototype will be the same for the tag and transmitter. In our case we have chosen the Atmega256RFR2 RF transceiver. This is a board that provides us with a microcontroller and transceiver on a single chip. The same board also includes some basic peripherals such as a USB port and a JTAG port for programming. These boards will not be used for the production prototype's design but they will allow us to quickly program and put together a functioning proof-of-concept in the span of one month.

4. Existing Solutions

Over the past decade, Retail companies such as Altierre Digital Retail[3] and DIGI Canada Inc[4]. devised a genuine solution to replacing paper tags, i.e. LCD display tags that are wirelessly updated via the central computer. At first glance, it seems like a nice idea, however before we proceed, we need to address some issues. The first one being the question of power consumption, one might ask whether replacing paper price tags with digital price tags will actually save the cost of manual labor and resources if these batteries need to be replaced. According to NY times, Altierre "asserts that outfitting a store with 20,000 to 25,000 tags, each costing about $5, would produce labour savings that would pay back the investment in two to two-and-a-half years"[2]. This is a very short time considering the lifetime of the average store but it still does not justify the power consumed by these display tags. This is where we were inspired to use E-Ink technology, which is more energy efficient and flexible in terms of resolution and display. According to the E-Ink website, E-Ink displays are 60% cheaper on energy consumption compared to LCD displays[6]. E-Ink tags unlike ordinary LCD display tags will only need power in the case of data updates. Hence, they don't need power while displaying the price even when the power is switched off. Another advantage of E-Ink technology is that it uses microcapsules containing black and white molecules, which can align themselves persistently, hence giving rise to a high definition display mimicking the paper ink display of printed word. This means, unlike LCDs, we can have a full control of the font size providing more and better display options.

Other than the E-Ink technology we also looked into LED and OLED display options but we abandoned those due to their high price (with respect to E-Ink displays), temperature dependence and voltage sensitivity issues.

5. Project Justification

It was only recently that digital price tags were introduced into the Canadian market which is why we believe our product will have the opportunity to compete with those companies already listed. What we are trying to accomplish is to reduce the clutter and complications in choosing LCDs and provide one solid E-Ink display that will be cost effective and useful for the market in all circumstances. Furthermore, we want to solve the problem by having coupled transmitter-receiver network in order to keep things as simple as possible with setup and maintenance costs at a bare minimum.

We are also aiming to target large Canadian supermarkets; specifically Superstore, Costco, Wal-Mart and Shoppers Drug Mart, as we believe the use of digital tags will be of most benefit to them in terms of their efficiency, convenience and financial needs.

Efficiency and Convenience

According to New York Times magazine, "a typical grocery store puts 5,000 items on sale in a week and removes sale prices from another 5,000. That creates an abundance of opportunities for mismatches when workers print out the new price labels in a back room, then hunt for the proper place on the shelf to attach them[2]". Not only does this indicate environmental problems but also efficiency concerns. Typically the stores allocate one day out of the work week for a set group of workers to change the prices for the bulk of the items in the store, usually done as a full shift after store hours. For example at the Real Canadian Superstore, management schedules 3-5 employees for 6-8 hours every week to change the prices around the store. In addition to the 1-2 workers who are already in charge of price checking during regular store hours. We have done extensive research on the procedure behind price tag changes and have included the flow chart diagram from our source[5] below (see Figure 5.1).

With the AccuTag price tags, we can ensure near instantaneous transmission of price changes negating almost all of the processes outlined as there will no longer be human interaction with the individual price tags themselves. This allows better time allocation for employees to be doing more important tasks such as store organization and customer service. We also plan to use lithium batteries which guarantee that the digital price tags won't need to be replaced over several years hence making this solution a great convenience to store operators.

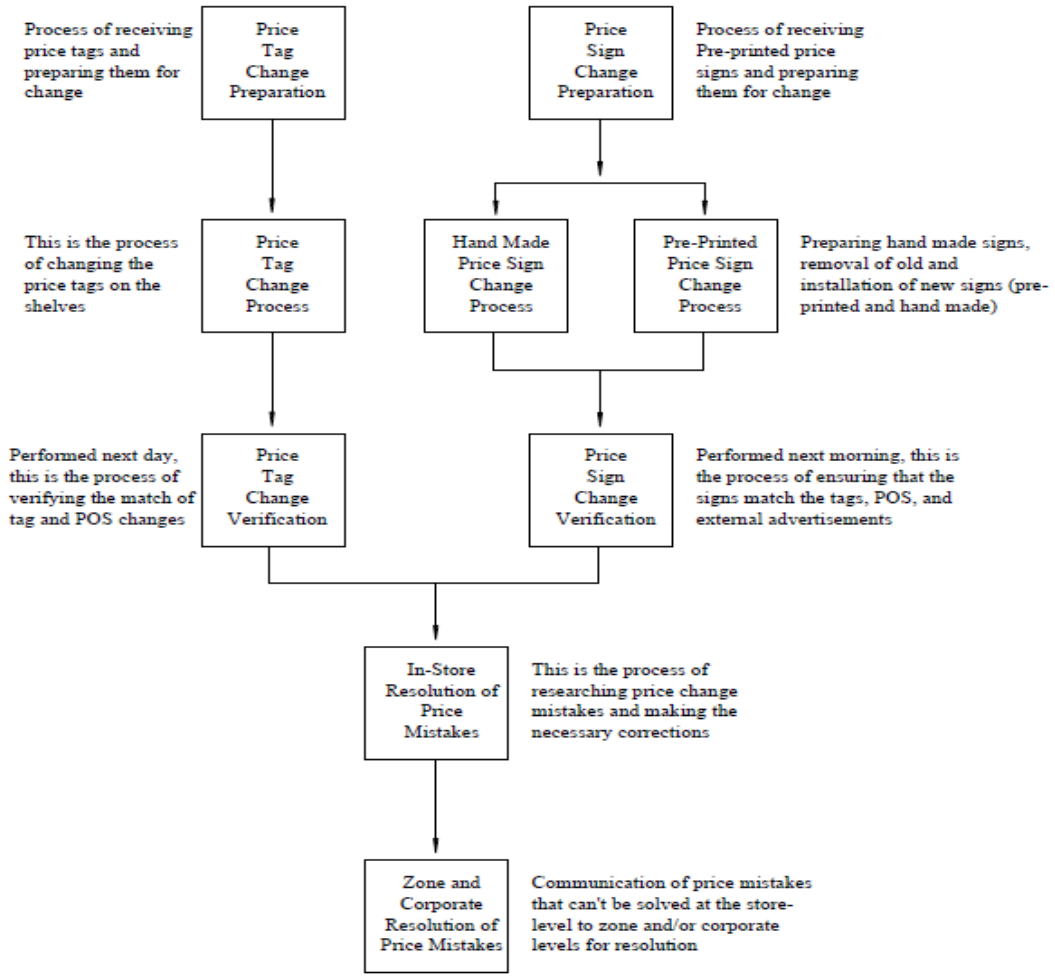

Figure 5.1: Overview of Price Change Process[5]

Cost/Benefit Analysis

Besides efficiency and convenience for both the store and consumer, we also base our project justification highly on the financial gain that our product will provide. Not only for the stores itself but also consumers. With a reduction in costs regarding paper price tags, stores will be more inclined to market their goods at a much lower price since they will be saving an abundance of money as shown in the analysis below. This ensures that everyone gets the full benefit from the use of the AccuTag system.

The correct terminology for the costs of a firm to change their prices is known in economics as menu costs. During extensive cost breakdown research of the current paper tags implementation, we found a research document[5] that summarized the labour costs and price tag maintenance costs of four different supermarket chains as shown below in figure 5.2. We referred to the lowest total annual menu cost per store value, **$91,416** (Chain C), in our cost/benefit analysis and expect that extrapolating this data would result in a much higher cost in the present year. However due to the uncertainty of this extrapolation we have deemed this data the most accurate that we could acquire and have used this number in our calculations.

Estimates of the Annual Menu Costs Per Store for Each Chain (in 1991–92 dollars)

Menu cost component	Chain A	Chain B	Chain C	Chain D	Average of chains A–D	Chain E (item pricing law)
Labor cost of price changes	61,414	53,149	40,027	53,748	52,084 (49.2%)	52,944
Labor cost of sign changes[a]	16,411	22,183	22,183	27,955	22,183 (20.9%)	22,183
Costs of printing and delivering price tags	4,110	10,018	3,048	6,879	6,014 (5.7%)	7,644
Mistake costs[b]	19,135	20,593	20,692	20,140	20,140 (19.0%)	20,799
In-store supervision costs[c]	4,241	6,692	5,466	5,466	5,466 (5.2%)	5,466
Total annual menu cost per store	**105,311**	**112,635**	**91,416**	**114,188**	**105,887 (100%)**	**109,036**

a. The labor costs of sign changes were not reported for Chains B, C, and E and so we use instead the average of Chains A and D.
b. The mistake costs were not reported for Chain D and so we use instead the average mistake costs of Chains A, B, and C.
c. The in-store supervision costs were not reported for Chains C, D, and E and so we use instead the average of Chains A and B.

Figure 5.2: Estimates of Annual Menu Costs Per Store [5]

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In the following table, Precision Wireless has completed a full financial analysis of the initial start-up costs of installing 1,000 AccuTag price tags to a large supermarket chain. In this analysis, we have looked at individual prices of the components in each price tag along with assembly and maintenance costs. In terms of the components, we are assuming that they will be bought in surplus, hence reducing costs substantially. We also take into account the necessity of at least one Information Technology (IT) professional dedicated to keeping track and updating the software that will be used to transmit these prices. We do not believe that he will be a full time employee as specific employees in the store will be equipped with the knowledge and skills to operate the software and make changes to the price tags when required. As with any start-up project, we can expect to have initial capital allocated to setup and training along with possible changes to infrastructure and store layout (i.e. shelves).

One Time Costs	
Components	Price (CAN)
E-INK Display	$3.83
Cost of LCD Controller	$3.00
Atmega 256RFR2	$7.00
Assembly/Marketing	
Marketing	$2.00
Fabrication & Assembly	$10.00
Cost of Each Tag	$25.83
Cost of 1,000 Tags	***$25,830***
Initial Capital	$1000
Yearly Costs	
Labor Costs Software Maintenance (IT Service)	$10,920
Battery Replacement (per 5 years) (Duracell 395/399 & 5V Watch Battery per price tag)	$1000
Miscellaneous (per 5 years)	$3000

Total Initial Cost for Buying 1000 AccuTags
$37,350

Figure 5.3: AccuTag Product Cost Breakdown per 1000 Digital Price Tags

As proved in the cost analysis, our digital price tag solution is already viable after one year even if the store decided to purchase 2,000 AccuTags. This financial justification is our main reason for implementing our project as we believe it will be worthwhile for any supermarket, large or small, to invest in this technology.

6. Scheduling

The Gantt chart shown below demonstrates our company's 4-month development period as well as our resource allocation for the AccuTag project. Our team of students will ensure that the desired product is ready to be implemented within the next 2.5 months. We have allocated one month to implementation and testing so that our team can ensure that the user is fully familiar and satisfied with the final product. We will delegate after each milestone of the project to ensure that we are meeting the needs and expectations as described in this proposal. Although the functional and design specifications are not completed yet, our executive team has begun their research and proper training to guarantee that all phases are completed on time for the deadlines.

Phase 1 of this project will begin by developing a "rat's nest" prototype using the Atmega256RFR2 Starter kit. This is an essential step in product design, since it provides us with the opportunity to develop a unique interface that is suitable for the user's needs and expectations. This interface will be customized based on the objectives set to improve customer service, organization, and efficiency.

Furthermore, based on the results of the preliminary prototype (rat's nest), second phase of the project will begin by designing the hardware architecture and schematic layout, which involves researching the necessary parts and components for both units (transmitter and tags). Ultimately, various simulations will be conducted on the final schematic through SPICE to ensure all functions are running smoothly.

	Task Name	Duration	Start	End	Completion	Resources
1	**Capstone**	**63 days**	**09/09/2013**	**04/12/2013**	**9%**	
2	**Documentation/Presentations**	**58 days**	**16/09/2013**	**04/12/2013**	**9%**	
3	Project Proposal	6 days	16/09/2013	23/09/2013	80%	Dave;Joe;Tauseef;Steven;Mahyar
4	Functional Specifications	11 days	01/10/2013	15/10/2013	0%	Joe;Tauseef;Steven;Dave;Mahyar
5	Milestone: Functional Specifications Report Due	0 days	16/10/2013	16/10/2013	35%	
6	Design Specifications	12 days	21/10/2013	05/11/2013	0%	Dave;Joe;Tauseef;Steven;Mahyar
7	Milestone: Design Specifications Report Due	0 days	06/11/2013	06/11/2013	0%	
8	Progress Presentation/Demo - part 1	4 days	14/10/2013	17/10/2013	0%	Dave;Joe;Tauseef;Steven;Mahyar
9	Presentation/Demo - part 2	4 days	04/11/2013	07/11/2013	0%	Joe;Tauseef;Steven;Dave;Mahyar
10	Written Progress Report Preparation	10 days	18/11/2013	29/11/2013	0%	
11	Milestone: Written Progress Report Due	0 days	02/12/2013	02/12/2013	0%	
12	Milestone: Final Presentation/Demo - part 3	0 days	03/12/2013	03/12/2013	0%	Joe;Tauseef;Steven;Dave;Mahyar
13	Post-Mortem	9 days	22/11/2013	04/12/2013	0%	Dave;Tauseef;Joe;Steven;Mahyar
14	**Research**	**54 days**	**09/09/2013**	**21/11/2013**	**51%**	
15	Project Selection	6 days	09/09/2013	16/09/2013	100%	Joe;Tauseef;Steven;Dave;Mahyar
16	Cost Benefit Analysis - part 1	4 days	09/09/2013	12/09/2013	100%	Tauseef;Joe;Dave;Steven;Mahyar
17	Environmental Risk Assessment - Part 1	5 days	11/09/2013	17/09/2013	100%	Joe;Tauseef;Steven;Dave;Mahyar
18	Modulation and Demodulation Schemes (WiFi, Bluetooth, RF ...	6 days	12/09/2013	19/09/2013	100%	Dave;Steven;Tauseef;Mahyar;Joe
19	Cost Benefit Analysis - part 2	10 days	21/10/2013	01/11/2013	0%	Mahyar
20	Environmental Risk Assessment - Part 2	10 days	08/11/2013	21/11/2013	0%	Joe
21	**Hardware**	**53 days**	**12/09/2013**	**25/11/2013**	**6%**	
22	Initial Component search (Transceiver and Display)	5 days	12/09/2013	18/09/2013	100%	Joe;Mahyar;Tauseef;Steven
23	Component compatibility check	4 days	16/09/2013	19/09/2013	100%	Mahyar;Joe
24	Hardware Integration	26 days	21/10/2013	25/11/2013	0%	Joe;Steven;Tauseef;Mahyar
25	Phase I completed	0 days	28/10/2013	28/10/2013	0%	
26	Phase II Completed	0 days	18/11/2013	18/11/2013	0%	
27	**Transmitter (Main Controller) Prototype**	**41 days**	**27/09/2013**	**22/11/2013**	**0%**	
28	Rat's Nest Prototype #1 (using DEV board)	20 days	27/09/2013	24/10/2013	0%	Mahyar;Dave
29	Architecture Design Prototype #2	14 days	14/10/2013	31/10/2013	0%	Mahyar
30	Simulations/debugging	14 days	28/10/2013	14/11/2013	0%	Mahyar;Joe
31	PCB Layout Design Final Prototype	10 days	11/11/2013	22/11/2013	0%	Mahyar;Joe
32	**Price Tag (Display) Prototype**	**41 days**	**27/09/2013**	**22/11/2013**	**0%**	
33	Rat's Nest Prototype #1 (using DEV board)	20 days	27/09/2013	24/10/2013	0%	Tauseef;Dave
34	Architecture Design Prototype #2	14 days	14/10/2013	31/10/2013	0%	Steven
35	Simulations/Debugging	14 days	28/10/2013	14/11/2013	0%	Steven;Tauseef
36	PCB Layout Design Final Prototype	10 days	11/11/2013	22/11/2013	0%	Steven;Tauseef
37	**Software**	**48 days**	**23/09/2013**	**27/11/2013**	**0%**	
38	Programing the Controller and Display Prototypes #1	30 days	23/09/2013	01/11/2013	0%	Dave;Mahyar;Tauseef
39	Building the computer Interface	30 days	01/10/2013	11/11/2013	0%	Dave
40	Firmware Implementation & Integration	33 days	14/10/2013	27/11/2013	0%	Joe;Steven;Dave
41	Firmware Debugging	28 days	21/10/2013	27/11/2013	0%	Tauseef;Mahyar
42	**Testing**	**3 days**	**28/11/2013**	**02/12/2013**	**0%**	
43	Final Prototype Testing	3 days	28/11/2013	02/12/2013	0%	Joe;Tauseef;Steven;Dave;Mahyar

Figure 6.1: Gantt Chart & Table (Numbers Correlate with Time Line Below)

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7. Finance

Budget

Figure 7.1 below shows various components and equipment that we are going to utilize for the completion of this project, and their associated costs. We have ensured to account for all the possible costs required for the price tags, and we are confident that we will stay within this budget for the duration of this project. The costs tabulated below are an average estimate and are obtained from various resources.

Funding

Item #	Equipment and Components	Estimated Price
1	E-Ink Display	2 × $ 60 = 120
2	RF-Transceiver and Processing Unit (Development Boards-Starter Kit) Atmega256RFR2	$ 180
3	Arduino Mega for Computer Interface	$ 60
4	Circuit components such as, LEDs, Transistors, etc.	$ 40
5	Miscellaneous Costs	$ 100
		Total: $ 500

Figure 7.1: Summary of Project Budget

We hope to acquire this investment from various sources such as the Engineering Science Endowment Fund (ESSEF), SFU Applied Science Dean's Office Fund, and the Wighton Development Fund. The project budget information has been presented to the ESSEF committee and we are currently awaiting a reply from them to confirm the amount of funding that we are eligible for. Also the Wighton Funding application is being prepared by the CFO to be submitted to Dr. Andrew Rawicz for further consideration. As described in the Project Design Section, our Electronic Price tags are designed to be compact with low power consumption. Unfortunately compactness of tags will require us to outsource the fabrication stage of the project, which will be expensive, laborious and time consuming. As a compromise we have decided to provide a full set of hardware design plans (e.g. SPICE files, gerber files); we will essentially stop right before the stage where these plans are sent out to fabricators and built for us to assemble. The most important of steps will still be carried out by our team.

8. Team Organization

Precision Wireless is an innovative company comprised of five Engineering students specializing in various engineering fields. Our vision is to develop stupendous business solutions utilizing cutting edge technologies and specialized resources, while promoting growth, enhancement, and sustainability of the community and the environment. Our main product, the AccuTag system offers customized and novel solution for organizing super marker floors, while improving efficiency.

The role and expertise of each team member can be further described as follows. Mahyar Mehran, the company's Chief Executive Officer (CEO) is responsible for ensuring that all the milestones and phases of the project are met within the expectations and deadlines. As a co-founder of the company he stated that our team is dedicated and committed to providing their services with honesty, excellence, and accountability. As well as scheduling and planning, due to his hands-on experience in hardware development and fabrication he is responsible for the design, simulation and integration of the transmitter unit throughout this project.

Joemini Poudel is our Chief Operations Officer (COO) and has expertise in various specialties such as embedded software development, signal processing and microcontroller interfacing. His expertise in an integrative view of engineering design process and product development makes him an ideal choice for the COO of the company. Joemini is committed to working with honesty and accountability to the formation of the product. Along with being in charge of the integration process he will be overseeing the firmware development for the tags.

Tauseef Alwaris who is the Chief Financial Officer (CFO) is specializing in Electronics Engineering. Tauseef's leading role is to make sure that our complete AccuTag system, ready for marketing is developed within the estimated budget. He is responsible to acquire various sponsorship and investment and allocate resources for various stages of the project.

Steven Hoang, our company's Chief Marketing Officer (CMO), has worked in many fields of customer service from the Real Canadian Superstore to IT Help Desk at Husky Energy. From these previous work experiences, he has learned the critical role of providing customer satisfaction in terms of technical and non-technical aspects. He has keen eyes for market opportunities and excels at communication in the most professional of settings making him the go-to personnel for our company's marketing division.

David Negrabee, our Chief Technical Officer (CTO) is mainly responsible for driving the software and firmware development of our prototypes. He will also be the principle programmer of the control software (e.g. API library, GUI program etc.). It is also worth mentioning that David was the member who initially came up with the idea for wireless price tags and our team agreed to select it as our capstone project for ENSC 440.

Our team plans to meet twice a week in order to ensure the smooth progression of various phases of the project. Scheduling has been specially designed and modified to utilize unique expertise of our members to ensure the satisfactory completion of all relevant tasks and ultimately the final product.

9. Company Profile

Mahyar Mehran - Chief Executive Officer (CEO)

As a fourth year Biomedical Engineering student at Simon Fraser University, Mahyar Mehran has spent majority of his time on the design and development of advanced electronic devices and state-of-the-art medical instruments. He has acquired valuable micro-fabrication skills through working at the Micro Instrumentation Lab as the R&D Engineer. He has considerable experience in digital communication, signal processing, and hardware architecture design and simulation, which makes him a strong member of the Precision Wireless team.

Joemini Poudel - Chief Operations Officer (COO)

Joemini is a fourth year Biomedical Engineering Student at Simon Fraser University. He has completed two coop work terms at Broadcom and one coop work term at MNERVA labs. He specializes in Digital System Design, Digital Signal Processing, Digital Communications as well as Medical Image Processing. His communication background and his integrative view of the Engineering Process in product development make him the ideal choice for COO.

Tauseef Alwaris - Chief Finance Officer (CFO)

Tauseef is a 4th year Electronics Engineering student, specializing in power systems design. He has always aspired to become a leading electrical hardware engineer. His main areas of expertise and experience include power systems' control and protection, electronic circuit design and testing, and RF design. He has 8 months experience as an Electrical Engineer at NAV Canada's Engineering planning and design department. He has worked on a variety of projects ranging from RF designs to electronic installation activities such as cable routing, site surveys and project management.

David Negrabee - Chief Technical Officer (CTO)

David is a 5th year Computer Engineer enrolled at Simon Fraser University. He has completed three coop terms, one at NetApp and two at Microsoft. In addition to his major in Engineering he is also pursuing a minor in Computing Science. He has a strong background in software engineering and specializes in software centered around computer networks. He has a great deal of interest in digital and embedded programming as well. This background makes him the ideal candidate for our Chief Technical Officer.

Steven Hoang - Chief Marketing Officer (CMO)

Steven is a fourth year Biomedical Engineering student at Simon Fraser University with corporate co-op experience stemming from one of Canada's largest fully integrated oil companies, Husky Energy. He has many skill sets ranging from computer and electric circuit design to programming and software integration. In terms of in-depth hardware experience; general microelectronics (BJT and MOSFET) along with amplifier and filter design are his key areas of expertise. For software, he has an adept understanding in the following programming languages: C++, VHDL, Matlab and low level machine coding on processors such as the HC12. He is also skilled in the development of medical equipment such as ECG and Pulse Oximeters as this is his main area of interest. Above all, he favours collaborative activities, technical and nontechnical, in which he can share his similar interests with others.

10. Conclusion

AccuTag by Precision Wireless aims to be a full-fledged replacement to the traditional paper tag system. Our system makes it easier to manage price displays around the store by essentially making it unnecessary for workers to ever have to check the correctness of the prices. Stores no longer have to pay employees to change prices en masse as prices are updated as soon as changes are detected in the databases whether it is a single price tag or the entire store's inventory.

In addition to the cost savings, our solution is also more eco-friendly than using paper and ink. Neither of them will ever need to be used again once a store adopts the AccuTag system. There is also the added convenience of having a database with fine grained product details which retailers can use to further benefit their customers with apps and such.

The Precision Wireless team strongly believes that our product will be the perfect alternative to paper price tags. It will be an easy-to-adopt and easy-to-use solution by retailers as well as their customers. We have put great effort into planning our schedules and milestones for the next three months and believe that we can provide a fully functional prototype as well as a hardware design of the production prototype by mid-November 2013.

11. Sources and References

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