Project Proposal for the Automatic Product Tracker

March 28, 2019

Dr. Craig Scratchley
School of Engineering
Science Simon Fraser University
8888 University Dr
Burnaby, BC, V5A 1S6

Re: ENSC 405W/440 Project Proposal for the **Automatic Product Tracker** by **Pondus Tech**

Dear Dr. Scratchley,

The attached document contains the project proposal for the Automatic Product Tracker. The goal is to reduce the amount of time spent doing inventory and accurately calculating how much ingredients to purchase for buffet or grab n' go style restaurants. This will be done by tracking product data and providing suggestions based on ingredient consumption.

This document will outline the market for the Automatic Product Tracker, as well as any risks involved with developing it. It will also provide information on major processes and milestones, company details, and cost considerations.

The group consists of five engineering students from various branches of engineering: Justin Aoki, Tahsin Alam, Paul Bologea, Kevin Corbett, and Mauricio Veloz. We believe the group as a whole has both the hardware and software experience to successfully implement the product.

Thank you for taking the time to review the project proposal. If you have any questions please contact our Chief Communications Officer, Mauricio Veloz, by email at mveloz@sfu.ca.

Regards,
Kevin Corbett

Chief Executive Officer
Pondus Tech

Enclosed: Project Proposal for Automatic Product Tracker

PONDUS TECH

Project Proposal

Automatic Product Tracker

Team 10

Tahsin Alam - Chief Technical Officer
Justin Aoki - Chief Financial Officer
Paul Bologea - Chief Operating Officer
Kevin Corbett - Chief Executive Officer
Mauricio Veloz - Chief Communications Officer

Submitted to:

Dr. Craig Scratchley (ENSC 405W)
Dr. Andrew Rawicz (ENSC 440)
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Abstract

The Automatic Product Tracker is a scale intended for use in keeping track of inventory in fast paced environments and restaurant in order to facilitate real-time inventory monitoring as well as using product usage statistics in order to formulate efficient and effective ordering schemes.

The Automatic Product Tracker can be broken down into its 3 main systems: the scale, which measures the weight of items in real time; the processor, which reads the weight information and packages it into readable information which is also capable of sending the information out via wi-fi; and the server, which receives the incoming product data and allows users to monitor their items over days, months, and years.

This project proposal document will outline the scope of the project, potential risks and benefits of implementing the product, any market research that was conducted, company details, the major processes and milestones, and cost considerations for the Automatic Product Tracker.

Table of Contents

List of Figures

List of Tables

Glossary

These are a list of acronyms that will be used throughout the specification:

APT: Automatic Product Tracker
PoC: Proof of Concept (the product shown at the end of ENSC 405W)
WP: Working Prototype (the product shown at the end of ENSC 440)
FP: Finished Product (the commercial, ready-for-market product)

Scope

The APT is a product tracking system that integrates the use of a scale with an onboard Wi-Fi chip with a website and server that allows the user to maintain real-time statistics on product usage. The scale will register the weight of the product at specific time intervals and then process the information using the Arduino. The Arduino will then send this data packet to a server, where the information will be stored in a database, and can be easily accessible using the product website. This product allows consumers to keep track of products that can not normally be tracked using other automated systems. The system can be used as a single standalone scale, as in our proof of concept prototype, or can be used with multiple different scales, in order to track the weights of multiple different products at the same time.

The hardware component of the APT uses load cells, accompanied by load cell amplifiers, in order to obtain a weight reading that is usable by an Arduino. The Arduino will be collecting multiple samples over a period of time and should be able to detect when improper or invalid signals are read. Using the integrated Wi-Fi chip, an averaged data point for the given time slot will be delivered to the server. The scale unit will also have an LCD display, in order to visually show the weight to the user, as well as a tare button for the scale. The hardware will all be powered from a 9V wall mount transformer.

For the purposes of the project, the server will be set up locally to run on a single laptop, but will still support multiple APT scales. The server will be a database containing all (unique) data values collected by the various APT scales, along with a website front-end that the user can interact with. The website will display any and all relevant data in a user-friendly and visually aesthetic way for the consumer to view. The APT website will also provide usage statistics on each product in a report next to the corresponding product graph. The goal of having these graphs and reports is to simplify tracking for the user and provide a guide as to how much product they should buy.

Risks and Benefits

Risks

Several risk factors were taken into account during the design of the APT, some with the physical product itself, and some with the market share and with similar products. These concerns were brought forward during meetings about the product and were factored in upon the decision making process of what product to use for our final project.

The hardware components of the product come with a risk factor of being powered by electricity. Safety measures must be put into place so that the end user has a minimized risk of electrocution when handling or using the product. Mechanisms such as a plastic/non-conductive enclosure that can contain all of the electrical components have been designed in order to lower this risk. Many of the components being used are also run on low voltage, which would dramatically reduce the severity of any electrical injury that could occur. The scale will also need to not contain any sharp edges, as it will be often handled with bare hands. Another risk associated with the physical scale is breaking due to drops or falls. The scale is not designed to be repeatedly dropped or shaken, as its main purpose is to stay dormant on a countertop, however design parameters such as a durable material for the outer enclosure, as well as fastening the interior parts to the base, have been accounted for. As the main demographic for the APT is in a kitchen environment, the scale must be designed such that it conforms to the FOODSAFE BC guidelines on food-safe materials. This applies to all surfaces that the food may interface with, including the enclosure and the measuring platform. These physical risks have been identified and have contributed to the design of the APT.

Another risk of the APT pertains to the existing market and competition that the product may have if brought to the public. When discussing the functionality of the product, we wanted the product to have a unique niche while also having similar characteristics to certain products that were already on the market. Therefore we take a risk with how we market our product, as other products, or technologies, such as the Amazon Go store that have weighted shelves and sensors, provide a similar functionality. We also take a risk in attempting to design a cost-efficient system without a large amount of money to test multiple different designs or prototypes. Digital scales already exist with extreme accuracy and low cost, and as a group we are aware that we are not attempting to reinvent or improve upon the scale. Therefore there is risk in not being able to make a cost-efficient product, as we don’t have the infrastructure of a large company to test multiple different parts of the system.

Benefits

The APT system provides users with a simple interface to obtain real-time product usage statistics that would normally be unavailable. By simply maintaining a record of a product or containers mass, the APT can track the displacement and display the product usage down to the minute. The information can be used by business owners and managers to optimize an ordering scheme in order to minimize waste, which in turn will also save money. The APT is easily installable and configurable, and provides informative graphs and reports that can be customized to display information on an hourly, daily, weekly and monthly basis. The APT can be used to track how efficiently employees are using a product, identify any discrepancies with lost or excess product, as well as save time when counting inventory. The APT is usable in kitchen and buffet settings, but can easily be applied to other environments such as in machine shops, where different sized nuts, bolts and other mechanical parts are constantly being used, or in an electronics company, where different electrical components such as resistors and capacitors are constantly being taken. The APT provides assurance to the user that they are using their products in the most efficient way possible.

Market/Competition

While discussing the designs of our next product, Pondus Tech wanted to create something innovative and unique. We wanted to have a product that solved one issue well, in an area that wasn't oversaturated or highly competitive. With this vision in mind we made the APT.

Smart appliances in kitchen environments have been on the rise in recent years. As mentioned earlier, Amazon has brought high tech product tracking to market with their autonomous store Amazon Go. Using a combination of machine learning, computer vision and AI, Amazon has been able to make a store that can processes transactions without having to checkout at a register. Simply grab an item from the shelf and it will be added to your cart; when you leave the store, your Amazon account will be charged accordingly. In case someone has second thoughts about an item, returning the item to its shelf will also remove the item from your cart [1]. This type of product tracking begins to overlap with that of the APT, but on a much larger scale and would not easily integrate into existing kitchen infrastructures.

Similarly, LeanPath has developed a waste tracking system for use in the food service sector. The LeanPath 360 and LeanPath 360FS are "robust, state-of-the-art food waste tracking terminal(s)" that collect data on food waste for analysis [2]. The LeanPath 360 is a countertop scale device that weights items that have been designated as waste food. Certain models also photograph food waste so that waste material can be seen. The data collected from this then goes through LeanPath analytics algorithms to visually display what food is wasted and for what reasons. This system functions similarly to the APT but only tracks waste, and not food that will be served or stored. Additionally, the LeanPath system costs around $1200 a month as of early 2018, which is quite costly compared to the intended price point of the APT, which is under $100 [3].

Figure 1: LeanPath 360 (Left) and LeanPath 360FS (Right) [2]

On a smaller scale, SKE Labs created a smart scale technology called the Neo Smart Jar. The Neo was made to create a smart home kitchen environment, where the consumption of different foods and ingredients can be tracked. Scanning the barcode of whatever ingredient you want to track will update the Neo phone application with its nutrition facts. Stats on things such as grams of protein, carbohydrates, and fat as well as expiration dates are monitored and can be viewed by the user on their mobile device. SKE Labs also claims that the app will also be able to keep track of recipe proportions and add ingredients to your shopping list if supplies are running low. The Toronto-based Indiegogo crowd-funding campaign generated $70,000 in early 2015, and will ship the two Neo smart jars for $133 [4].

Figure 2: SKE Labs Neo Smart Jar [4]

Much like Pondus Tech and the APT, other companies have clearly seen the importance of product tracking in the foodservice industry. Certain products, like the Amazon Go, cater to a very large scale operation that is built from the ground up. This would be great for a new, high-tech kitchen environment, but is not as practical for most restaurants. Something like the Neo Smart Jar would work well in a household kitchen, but isn't as practical in a grab-and-go kitchen. At Pondus Tech, we want to target the middle ground between these two technologies. We want to attract businesses from the foodservice industry with an easy-to-use, low cost, low maintenance device. The APT is a simple to use, efficient and effective solution that can integrate into existing restaurants with ease. We strongly believe that this compact, flexible design will set us apart of the other product in our market.

Company Details

The team chose the company name Pondus Tech as a result of the product that was chosen, since pondus is the Latin word for weight. Pondus Tech consists of five undergraduate students from various branches of engineering. Each team member brings valuable skills and ideas to the table that will be used to develop the APT.

Tahsin Alam
Chief Technical Officer
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Tahsin is a systems engineering student in his final year at Simon Fraser University. Tahsin has built a broad area of expertise from hardware oriented co-ops and personal projects. He works with a systematic approach by looking at the bigger picture and is able to work down to the lower layers to ensure a finely tuned end product is achieved. With his passion for all levels of engineering from sketches to product development, Tahsin wishes to one day have his own start-up company.

Justin Aoki
Chief Financial Officer
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Justin is a systems engineering student in his final year at Simon Fraser University. Justin has gained experience in controls systems engineering through multiple co-ops, where he has worked with PLCs and HMIs in industrial settings. Throughout his schooling, he has worked with electronics and software to design technical systems. After graduation, Justin is hoping to continue working in the field of controls systems engineering.

Paul Bologea
Chief Operating Officer
pbologea@sfu.ca

Paul is a biomedical engineering student in his fifth year at Simon Fraser University. Paul has a wide range of skills in both software and hardware, with his co-op experiences giving him a unique set of skills in product and web development. Paul hopes to work with various technologies related to medical image processing, such as MRI.

Kevin Corbett
Chief Executive Officer
kcorbett@sfu.ca

Kevin is an electronics engineering student in his final year at Simon Fraser University. Over the course of his program at SFU, Kevin has honed his skills in both software and hardware development. With co-op experience in the research field, he provides a unique insight into creating working prototypes from scratch. In the future Kevin hopes to seek new and exciting challenges in the field of electronics engineering.

Mauricio Veloz
Chief Communications Officer
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Mauricio is a fifth year computer engineering student at Simon Fraser University. His past co-op experiences have given him a deep understanding of software testing, as well as chances to work with various different products in a professional environment. Mauricio hopes to work with various technologies and people in the years to come.

Project Planning

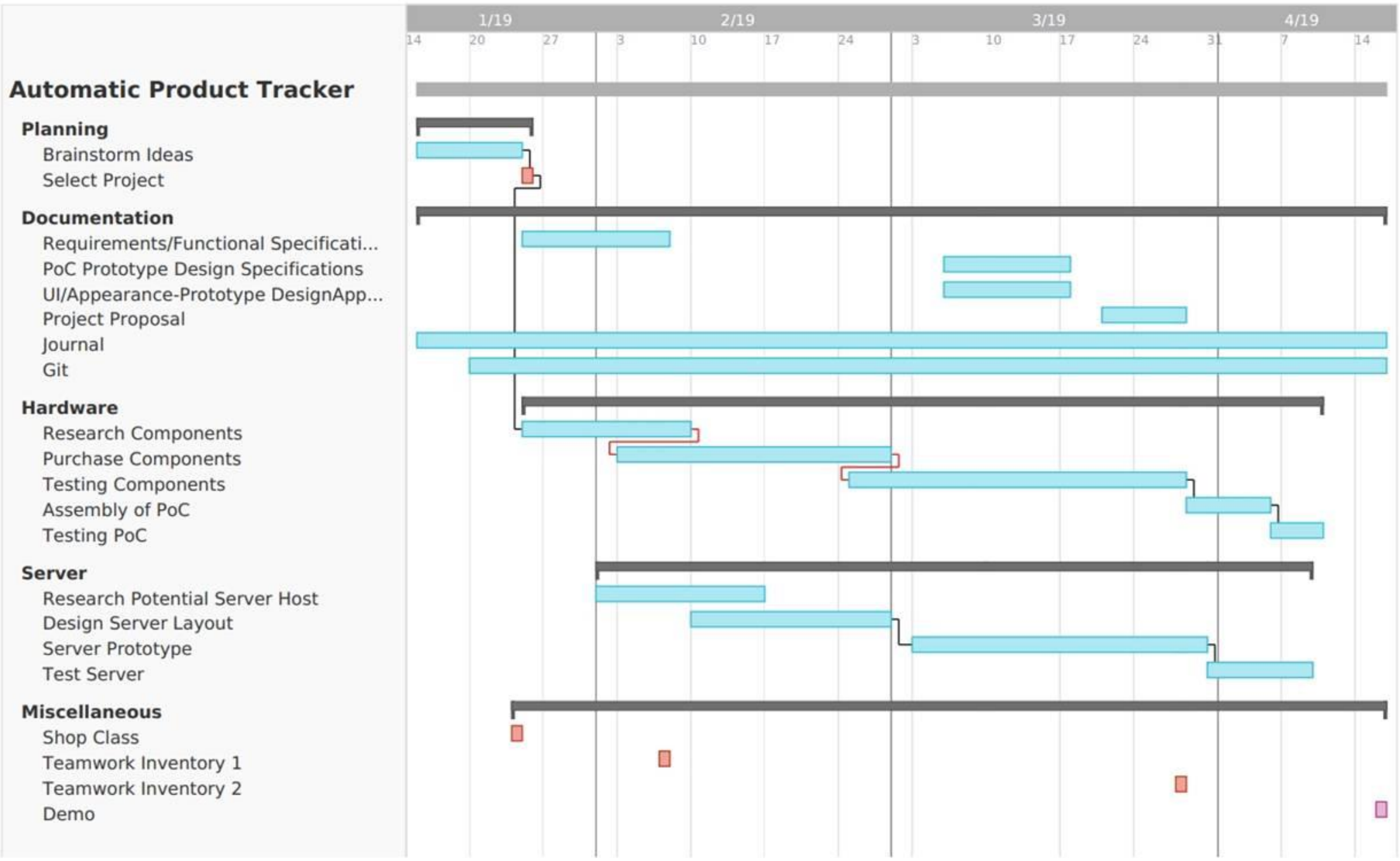

Figure 3: Gantt Chart for APT Development.

Timeline

At the beginning of the semester, we here at Pondus Tech knew the importance of planning and regulating the progression of our project. From the start of the term we had an outline defining the dates for the various course deliverables. To meet these deliverables, we created a series of internal deadlines that would guide our PoC prototype design.

To keep track of our weekly progress and ensure we kept our project on track, we held weekly meetings. These meetings were held at the same time every week when each group member could attend. Meeting minutes were kept, and allowed us to discuss the past weeks work, and what we had ahead of us in the week to come. This ensured that we stayed on track and would not waiver too far from our timetable.

The first major undertaking was deciding on green lighting the APT. We had a plethora of ideas, but at the end of our brainstorming phase it became apparent that the APT was the best suiting project for our team. Next up was defining a series of functional requirements that gave the scope of what the APT needed to accomplish. The first half of the semester focused mostly on this type of design work. Some of our preliminary designs went under many alterations, and multiple different design ideas were discarded. After completing the first teamwork inventory session, we became more confident in our design aspirations of the APT, and finished ordering all of the parts we needed to create the first working APT prototype.

The second half of the semester focused on physically building the APT from the ground up. As parts arrived they underwent testing and analysis to ensure that they could satisfy the specifications they were needed for. Currently we are in the process of assembling the final PoC prototype to meet the end of year demo deadline as outlined in the Gantt chart. As we progress forward to the end of the semester, Pondus Tech will look to get a head start on the ENSC 440 prototype, adding in new dates and deadlines for the deliverables to come.

Cost Considerations

Type of Cost	Component	Price
Hardware Cost	Arduino Uno Wi-Fi Rev2	$83.48
	LCD Screen	$13.99
	Uxcell Aluminum Alloy Load Cell (x2)	$31.60
	HX711 Load Cell Amplifier	$13.95
MSC Hardware	Tact Switches	$7.00
	Wood Enclosure	$40.00
	Aluminum Pressure Plate	$22.93
	Mounting Hardware	$10.00
	Wires	~$0.00
Server	Server Maintenance	~$0.00
Total		$222.95

Table 1: Proof of Concept Cost Breakdown

Type of Cost	Component	Price
Hardware Cost	Atmel Atmega328P	$5.00
	Printed PCB	$70.00
	Uxcell Aluminum Alloy Load Cell (x2)	$31.60
	HX711 Load Cell Amplifier	$13.95
	LCD Screen	$13.99
MSC Hardware	Tact Switches	$7.00
	Wood Enclosure	$40.00
	Aluminum Pressure Plate	$22.93
	Mounting Hardware	$10.00
	Wires	~$0.00
Server	Server Maintenance	TBD
Total		$214.47

Table 2: Prototype Cost Breakdown (estimates)

There are a few considerations here to keep in mind regarding the cost. The printed PCB cost $70 because for the prototype, only one PCB is needed. PCBs are expensive in small quantities, but very cheap for large scale, so for the final product, that component would be much cheaper. In fact, many of the component's unit prices could be reduced significantly by buying in bulk, but these are not being considered for the purpose of the working prototype. Finally, the PoC costs reflect actual purchases, as all of the parts mentioned above have actually been bought; the prototype costs are estimates (as it has not been built yet), and are thus subject to change.

For funding, during the ENSC 440 semester, the team will reach out to the student endowment fund from the Engineering Science Student Society and consider an application to the Wighton fund. With regards to the student endowment fund, the APT fits Category B - Entrepreneurial. If no external funding is provided, the team will fund the project by splitting the costs evenly amongst team members.

Executive Summary and Conclusion

No longer will there be concerns in storage tracking with the Automatic Product Tracker. With users in mind, the APT provides a simple and easy to use solution, for proper product tracking and for the over-ordering of certain products. This product will allow users to easily keep an updated and accurate inventory count of product, and see exactly how much product is used by the hour, day, week, month and year, in order to calculate product trends and create precise order spreadsheets.

To accomplish this, the APT will employ a “scalable” scale system able to be retrofit into existing shelving/storage units, with an easy to use server that will display all relevant information from an off-site server.

The founders of Pondus Tech are excited to bring this idea into fruition and have it deployed into commercial kitchens and storage rooms, and eventually to other industries as well. We know that this product will prove to be very useful, as current solutions to storage tracking is done manually, by hand, which inevitably has errors. By having a centralized location for tracking, the cost of shipping and wasted food will decrease as the owner will be able to make more precise orders of products by following trends in the data.

Pondus Tech would like to thank Dr. Craig Scratchley and Dr. Andrew Rawicz for overseeing our Capstone Project for ENSC 405W at Simon Fraser University, and for the overseeing they will do for ENSC 440.

References

[1] Amazon.com. (2019). *Amazon.com: : Amazon Go*. [online] Available at: https://www.amazon.com/b?ie=UTF8&node=16008589011 [Accessed 20 Mar. 2019].

[2] Prevent Food Waste with Leanpath Technology. (2019). *Solutions » Prevent Food Waste with Leanpath Technology*. [online] Available at: https://www.leanpath.com/solutions/ [Accessed 20 Mar. 2019].

[3] Schneider, S. (2019). *Pittsburgh Institutions Are Trying To Reduce Food Waste, But At What Cost?*. [online] Wesa.fm. Available at: https://www.wesa.fm/post/pittsburgh-institutions-are-trying-reduce-food-waste-what-cost [Accessed 20 Mar. 2019].

[4] Indiegogo. (2019). *Neo - Smart Jar*. [online] Available at: https://www.indiegogo.com/projects/neo-smart-jar#/updates/all [Accessed 20 Mar. 2019].