September 22, 2014

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, BC, V5A 1S6

Re: ENSC 440 Project Proposal for Secure On-Site wireless package storage solution (SOSbox)

Dear Dr. Rawicz:

Please accept the following document as a *Proposal for a remotely managed Secure On-Site Box (SOSbox)*. The purpose of the project is to address the real world frustration many people living in areas of low population density experience when receiving parcels through couriers at their residence. With the SOSbox system, we intend to address this issue by designing and implementing a system that allows the recipient to remotely receive parcels securely through couriers to one's home.

This proposal provides an overview of our SOSbox system, a strategic business case, an outline of design considerations, project scheduling, the company's organizational structure and a tentative projected budget.

SOS Technologies consists of five creative, innovative and constructive engineering students driven to solve real world problems through Internet enabled technologies. Our group members are Sutharsan Rajaratnam (Chief Executive Officer and President), Dan Kikuchi (Chief Finance Officer), Brett Hannigan (Chief Technology Officer), Herman Sagoo (Chief Operating Officer) and Jackson Connolly (Chief Information Officer).

Sincerely,

Sutharsan Rajaratnam
President and CEO
Secure On-Site (SOS) Technologies

Enclosure: Proposal for a Secure On-Site box

PROPOSAL FOR A SECURE ON-SITE BOX

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1. Executive Summary

Without a doubt, business-to-consumer e-commerce has boomed in popularity. In 2012, Canadians placed over $18.9 billion worth of orders over the Internet, increasing by nearly one quarter in only two years [1]. Worldwide, this figure is over $1 trillion [2]. Online shopping allows consumers to avoid many of the inconveniences associated with brick-and-mortar stores. However, there are still obstacles to seamless online shopping, mostly relating to the delivery of products and consumer goods.

First, consumer orders are usually delivered during regular business hours to a residential location. When the resident is away, the driver can elect to leave the package outside in a location presumed safe or return the package to the parcel depot (distribution branch). The immediate problem with this is balancing security with convenience. If a safe area is chosen at the driver's discretion, the package could still be stolen. On the other hand, if the package is returned to the depot, the advantage of convenience gained ordering products online is negated by the requirement to travel to the depot. For many, this means travelling across town during the depot's restrictive hours of operation.

What if these problems could be resolved with a device that separates the entire online shopping experience from the buyer's availability? Browsing, ordering, and delivering could be done on the buyer's own schedule. The Secure On-Site Box System does exactly that while also incorporating other features to streamline package delivery.

In essence, the SOSbox is a secure and automated parcel collection system. Consider a package arriving at a doorstep or community mailbox while the resident is away. With the SOSbox, the resident is notified via a mobile device application with a video stream and duplex audio communication. They can then remotely grant access to the SOSbox for use by a courier. The box has security features such as a tamper alarm, security camera, and microphone. It also has a QR code reader to notify the user of the package's origin. Furthermore, a user may even pay import duties and taxes on international or collect shipments remotely using the SOSbox.

It is estimated that this project will take approximately three months to complete. This encompasses time dedicated to planning, researching the market demand, designing the associated hardware and software system, and testing the result. The proposal contains the associated cost with the SOSbox, approximately $950, for which the team has applied to the ESSEF and the Wighton Fund to offset.

SECURE ON-SITE TECHNOLOGIES

Table of Contents

List of Figures and Tables

2. Introduction

In today's rapidly changing world economy, the way consumers interact with merchants is evolving. The emergence of online shopping in Canada and globally has led to a substantial rise in the number of parcels delivered by courier services. This exponential growth in parcel delivery is in stark contrast to the decline in letter-mail delivery. Thus, organizations such as Canada Post that relied heavily on mail services have been forced to reinvent themselves. The old business model is broken and no longer viable in the digital age. Canada Post employees delivered five million more parcels in 2013 than in 2012. The parcel business is growing by more than five percent annually and is expected to be a major source of revenue for Canada Post going forward [3].

To address this, Canada Post has embarked on a scheme to eliminate all door-to-door mail delivery services by 2019 and replace them with community mailboxes [4]. Unfortunately, these community mailboxes are exclusively for use by Canada Post. This leaves independent couriers with no secure, on-site storage system close to the recipient's home. The result is inefficiencies that cause frustration for the customer and unnecessary courier delivery delays, fuel, and labour costs. Thus, the opportunity exists for our product to provide value-added services and take advantage of "Internet of Things" (IoT) solutions.

Figure 1: Graphic taken from Canada Post's 2013 Annual Report.

The goal of our project is to address a real world problem that many of us on extended co-op have experienced personally. In cities with low population density, parcel items are often taken back to retail locations or even distribution centres more than five kilometres away from the recipient's home when attempts of in person parcel delivery are unsuccessful. Our project intends to address this issue by designing and building a secure outdoor storage system that is IoT-enabled, allowing for mobile platforms to securely access the SOSbox system remotely. Furthermore, the system would incorporate package recognition technologies and security features such as remotely controllable audio and video surveillance and theft deterrence capabilities.

3. Solution Overview

SOSbox System Diagram

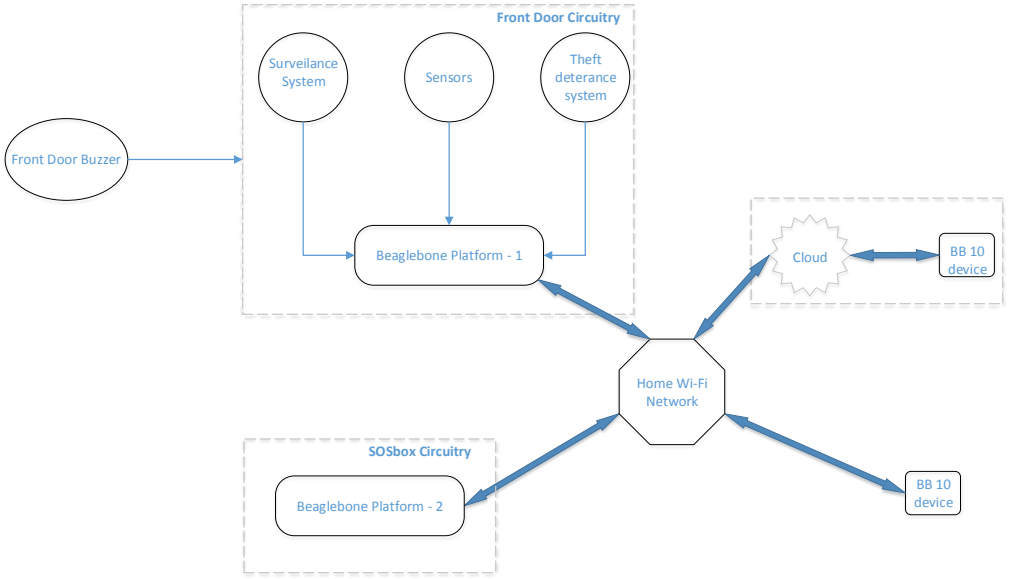


Figure 2: Secure On-Site Box system diagram.

Our proof of concept SOSbox design will incorporate the Front Door Circuitry seen in Figure 2 as well as the circuitry on the system itself to facilitate portability for testing and demonstration purposes. We will be using a standard home Wi-Fi router to demonstrate the initial wireless communication and control of the SOSbox system by a mobile platform. Time permitting, we intend to implement this capability over the internet with the SOSbox connected to the Wi-Fi network at SFU. We will be using an ARM-based development platform called Beaglebone to handle the processing needs of the SOSbox circuitry and wireless communication. Furthermore, surveillance and pattern recognition capabilities will be implemented to enhance security of the system.

4. Business Case

The "Internet of Things" is the next frontier in achieving greater control of everyday things around us. Such systems offer real time information to users about their environment and can drive greater efficiency and lower cost of performing everyday tasks. As introduced above, our area of interest is in the delivery and retrieval of parcels. Modern wireless communication technologies and processing capabilities can be used to substantially enhance current delivery methods if courier service providers use a common IoT-enabled community parcel solution.

The business model for monetizing the SOSbox solution is very simple. We partner with large retail outlets and home security companies to the sell the standalone system to consumers directly. At the same time, we could partner with courier companies. Possible expansion opportunities include offering a shared community SOSbox parcel solution owned and managed by us. We intend to charge a monthly service subscription fee ($20 to $30) per

Community SOSbox system installed to each of the courier service providers. For example, if 100 000 community SOSbox systems were installed across Canada we can expect to receive approximately a monthly reoccurring payment of $2 to $3 million from each of the respective courier service providers for our services. By expanding our services to the United States and other major markets around the world, we can expect substantial growth in our monthly revenue.

5. Risks and Benefits

Like all great ventures, this project has risks.

It is common knowledge that the postal service has been experiencing a downturn in both volume of use and financial viability. While physical letters are becoming a thing of the past, parcel delivery and online shopping is on the rise, Amazon alone has grown exponentially (Figure 3) since its inception and this trend is not limited to them.

Many more specialized online stores are experiencing similar growth as consumer confidence in online vendors grows and more people opt to purchase their goods online at competitive rates. Online purchasing is poised to eclipse the conventional store model as the dominant consumer-vendor interaction, resulting in growth in the parcel delivery sector.

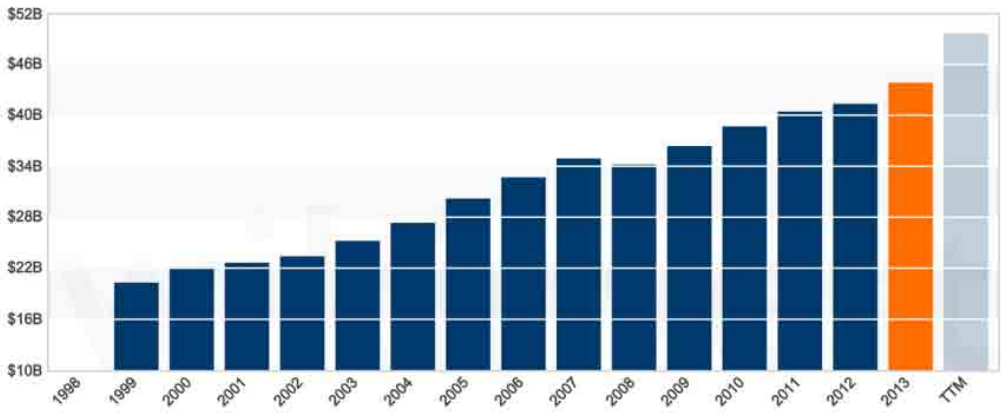


Figure 3: United Parcel Service revenue, 1998 to present [6].

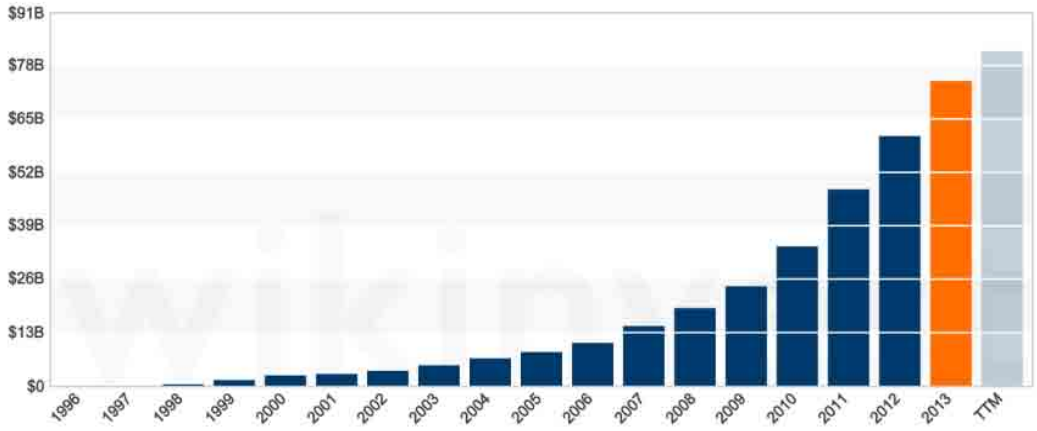


Figure 4: Amazon.com revenue, 1995 to present.

The risk of parcel delivery going the way of letter-mail is one to be considered. The obvious difference between letters and parcel mail is the inherent physicality of the goods. While data can be transmitted cheaper, faster, and more securely by email the same cannot be said of larger parcels and packages. Even the best current 3D printing technology will likely not be able to be deployed on a consumer level for decades, and even then it will be unable to replace many items, such as those that require rare elements, items that are prohibitively large or complex, et cetera.

Another key risk factor affecting parcel mail is that it is much more difficult logistically to deliver items securely from point to point without direct oversight from both parties. While the potential security risk of a mail slot in your door is negligible, leaving ones door unlocked or leaving the parcel outside both drastically increase susceptibility to foul play.

A further risk is that a major courier refuses to integrate with the system. This would be extremely unlikely, as the courier services arguably benefit the most from the higher successful delivery rate. There are a few possible circumstances where this may occur. The most likely of which would be either one or more courier services already working on a competing platform, or having already partnered with a firm that is. This would be unfortunate, although being beaten to market is always a possibility with any venture and can be mitigated with research and targeting a larger pool of consumers. With adequate market pressure, most delivery services will be willing to provide at least partial support for our system.

Despite these risks, the SOSbox satisfies a real need in the marketplace to have secure deliveries be made without direct supervision by the receiving party.

Like many good economic ideas, the SOSbox system eliminates inefficiencies in the marketplace. Productivity is lost due to missed and repeat deliveries. While the effects of these incidents are quite small individually, they add up to a significant loss of manpower, capital, and consumer satisfaction. Reducing end-point inefficiencies is quickly becoming more important as other areas become more streamlined. Better route-planning and logistics algorithms are reducing the inefficiencies at the delivery and long distance transportation levels, but due to the nature of the end-point interaction between courier and user, there have not been many improvements made.

The SOSbox system has benefits for all parties involved in the transaction process. The vendor is able to get their product where it needs to be with higher reliability and without undue effort by the consumer. The distributor can significantly decrease the average cost of parcel delivery. Finally, the end user no longer has to worry about being present for the package hand-off process, removing some barriers to purchase.

The real question is this: who pays for the box? The immediate solution is to sell it to the consumer as a convenience. This would appeal to a rather small minority of individuals who receive a very high volume of packages. To broaden appeal, the courier service could provide incentives to high-volume users to purchase the box like offering priority shipping, discounted rates, or direct subsidies to users.

6. Schedule

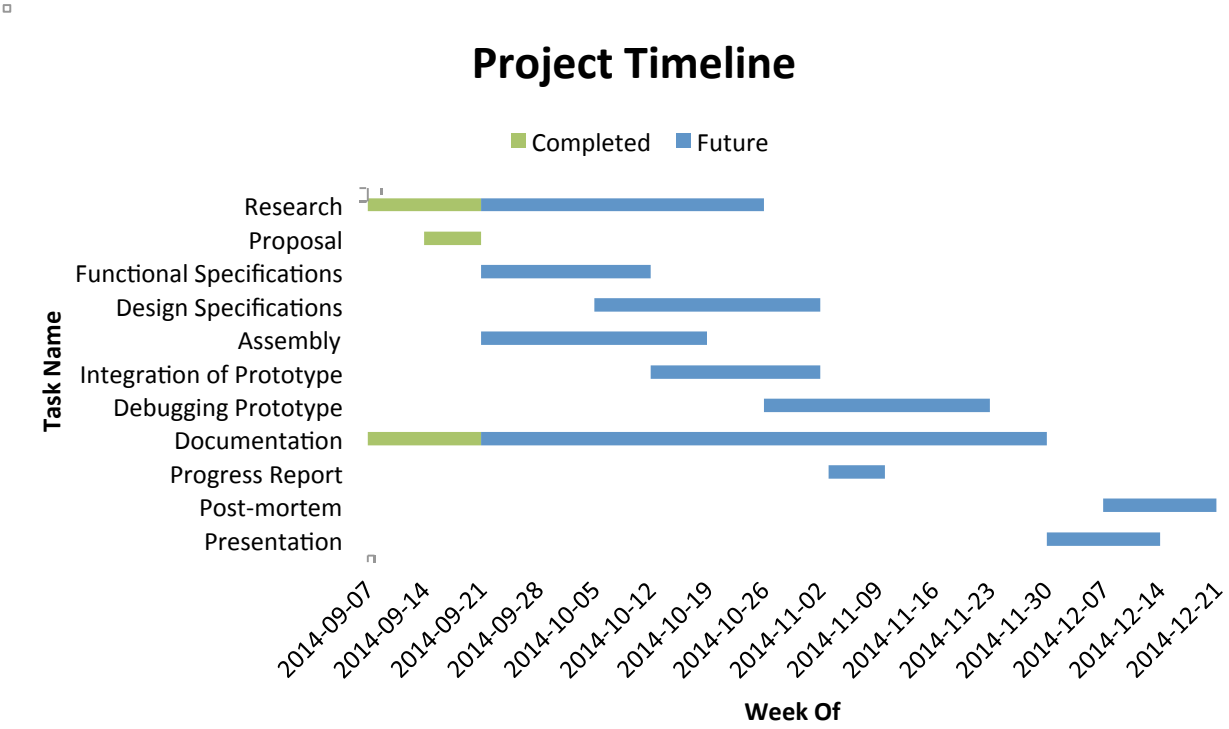


Figure 5: The Gantt chart depicting the approximate schedule for each task in the project.

7. Budget and Funding

The table below lists the components we will need to complete this project and accomplish our goal of a revolutionizing the postal and delivery industry. The two Beaglebone Black systems are for development purposes. A time may arise when during the development phase when some group members may not have access to all the parts due to the actual product being placed somewhere else. Debugging can be done on these SoC (System on a chip) devices. The Beaglebone Black Kits come with their own breakout boards, along with different capes to allow for further hardware development. An LCD Display may also be required for the box to allow for some user interaction and verification. The accessories include any power adaptors and miscellaneous replacements of hardware components. Box construction is dependent on what material we decide to use. For proof of concept, we could essentially just make it out of wood, which is easy to work with and quite forgiving.

Table 1: Breakdown of budget distribution.

Component	Cost ($)	Quantity	Total Cost
Beaglebone Black	$55	2	$110
Beagle Bone Black Kit	$90	2	$180

4.3" LCD Cape	$49	1	$49
Accessories	$150	-	$150
Box Construction	$100	-	$100
Hardware Components	$200	-	$200
Contingency	$150	-	$150
		Total Cost (rounded)	$950

A funding application has been filed to the ESSEF outlining Table 1 and we are awaiting a date when we can present our idea. An application to the Wighton Fund will be made in the coming week. Other sources of funding are being identified in case our application is rejected or partially approved. Should the need arise, our team members have decided to fund the project equally.

8. Company Profile

At first inception, the team members knew SOS Technologies as Smartbox. The company's main goal was to create a mail system combining elements of efficiency, security, and mobile communication. It would cater to niche markets that highly value the ability to accept incoming packages anywhere in the world securely using their smartphone. These elements all point at creating a secure mail receptor that is modifiable into a community, enterprise, or a personal mailbox. The company seeks to make a name for itself by creating a unique and reliable solution for many of the problems with the current mailing system. Ideally, SOS Technology seeks to create an infrastructure with the SOSbox and its related technologies. The product must appeal to a very broad audience of professionals, officials, and independent consumers.

Successful companies with strong branding inspired our logo. The company brand, SOS Technologies, denotes urgency and has a deeper meaning of "Secure On-Site" that defines key aspects of the systems worked on by the company.

9. People

Sutharsan Rajaratnam
Chief Executive Officer
President

Sutharsan is in his final year of the Engineering Science (Electronics option) program. His interests lie in the meticulous fields of physics and computer science. Mr. Rajaratnam has 2 years of industry experience, one at ACSI Inc and another at BlackBerry Ltd. He has significant experience in RF systems and components used in Smartphone's and PLC based control systems. Additionally, he has special interest in various wireless technologies and emerging M2M/IoT enabled solutions. His completed projects include significant software development in both Python and C/C++.

Dan Kikuchi
Chief Financial Officer

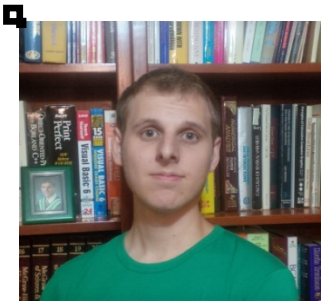
Dan is undertaking the Capstone Project as one of his final milestones of his undergraduate degree in Systems Engineering. Dan is the team's flex member with hands on experience in both hardware and software and brings a skill set that includes experience in embedded system programming, wireless communication, and leadership and organization. These are skills that he will apply when helping move SOS Technologies forward as the team's chief financial officer.

Herman Sagoo
Chief Operating Officer

Herman, in his final year in the Electronics program, is looking forward to providing his valuable expertise to this incredibly revolutionizing product. His experience includes a stint with the federal government of Canada, specifically Industry Canada, in the spectrum allocation and re-allocation, research and licensing department. His past 4 months are associated with Lungpacer Medical, where he was tasked with designing an airflow and pressure sensor calibration system along with fixing faulty accelerometers. He looks to bring his knowledge of circuit design and debugging along with experience with SolidWorks to the SOS Technologies team.

Brett Hannigan
Chief Technology Officer

Brett Hannigan is in his final year of biomedical engineering at Simon Fraser University. He brings to the team strengths in circuit design, microcontroller programming, and digital signal processing. He has obtained many of these abilities from coursework and applied them in co-op placements in the telecommunications, research, and biomedical realms. His multidisciplinary skill-set, adaptability, and knowledge will play a vital role in working with the other Secure On-Site Technologies team members to deliver a creative and effective solution.



Jackson Connolly
Chief Information Officer

Jackson Connolly is in his final year of undergraduate studies in Systems Engineering. An excellent communicator and critic, Jackson works tirelessly with the team to create innovative solutions. His skill-set encompasses many areas critical to this project, including knowledge of embedded systems, electronics, and numerous programming languages. His unique blend of telecommunication experience, customized application development and his ability to quickly grasp new technologies make him an indispensable asset to the Secure On-Site Technologies team.

10. Conclusion

SOS Technologies aims to move forward with its cornerstone product the SOSbox. The system will provide a secure and efficient method of receiving and verifying packages remotely via an IoT-enabled system and will be the foundation upon which future projects are based. The broad market for this product is appealing. Growing bodies of consumers use courier systems monthly and this number will continue to increase as online shopping becomes more prevalent. Enterprise users will benefit from the security and the organization provided by knowing exactly when something has arrived and being able to accept it and the incurred costs immediately. Postal services will be the primary partners of the company, integrating the SOSbox and related products into their distribution network.

A small subscription fee and other commissions would be used as sustainable revenue for the company allowing saved profits to be invested in areas such as research and development. As an entirely new area of mail delivery infrastructure, the product will have a strong brand presence to end consumers. Careful considerations have been made to leave a lasting impression on consumers and clients such as an impactful logo.

The prototype development plan will take just over 3 months. The company will allocate team members based on comparative advantages of their skill-sets. As the project is mostly software based, it is prudent to assign some of the hardware engineers to software related tasks as well due to time constraints. Hardware drivers will be the first things considered for the project, and will be followed by other software such as the implementation of the server client model and hardware components.

11. Moving Forward

The product put forward in this proposal is not the end goal of SOS Technologies. The SOSbox is simply a foundation for greater ideas that may stem and grow from this project. Once enough interest in the prototype has been achieved, the next step is to create a larger infrastructure with the SOSbox at its centre. The camera initially used to monitor the incoming packages can be used for a multitude of other purposes. The box itself may be altered to have things such as sorting ability and additional security. The network can also be upgraded to have stronger security protocols over the Internet to continually emphasize the strong security of the product.

The box may be improved with various features to further upgrade the utility of the box itself. The physical side of the system must also be secure to truly emphasize that the company is security oriented. The lock may be upgraded to have components such as an actuator for opening the door or other methods of controlling the input of the box.

Finally, the security of network must be considered. With the recent increase in security breaches such as the “heartbleed” bug exploitation, it is imperative that the private mail of the customers is not compromised. To do this requires all of the most recent security implementations such as hashing practices and the likes.

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