April 7th, 2016

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

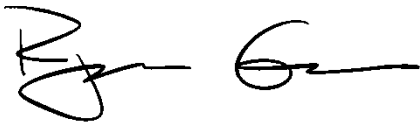**Re: ENSC 305W/ENSC 440W Post Mortem for CleanLift**

Dear Dr. Rawicz,

Attached is the Post Mortem for CleanLift, a touchless elevator panel system. CleanLift is the inaugural product developed by our company, Porcupine Solutions, and aims to reduce disease and germ transmission between elevator users in disease-sensitive environments such as hospitals and cruise ships.

A high-level project overview will be presented in this document, as well as financial and schedule summaries. Also discussed will be the challenges we faced and our group dynamics and workload distribution. Our future plans for CleanLift and for Porcupine Solutions will be discussed near the end of the document, which will conclude with appendices describing individual learning and containing meeting agendas and minutes.

The Porcupine Solutions team is comprised of four engineering students: Ryan Goldan, Elizabeth Durward, Lauren Jackson, and Simon Huang. We thank you for your consideration of our Post Mortem for CleanLift. If you have any questions, feel free to contact our Chief Communications Officer, Lauren Jackson, by email at lljackso@sfu.ca.
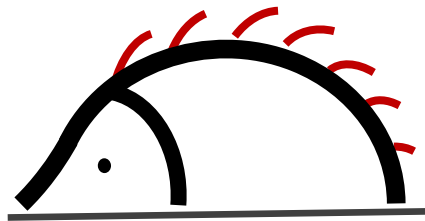
Sincerely

Ryan Goldan
CEO, Porcupine Solutions

Enclosed: Post Mortem for CleanLift: Touchless Elevator Panel

CleanLift

Touchless Elevator Panel

Porcupine Solutions

Post Mortem

Issue Date: March 10th 2016

Revision Number 1.0

Primary Contact: Lauren Jackson - lljackso@sfu.ca

Submitted By:

Ryan Goldan   Lauren Jackson

Elizabeth Durward   Simon Huang

Executive Summary

The spread of infectious disease has been a central concern in modern health care since its early days, and over time there have been numerous methods introduced to battle its spread in hospitals, airports, and numerous other public spaces. Technology in particular has played a very important role for the past decade in mitigating the presence and transmission of bacteria on common surfaces. Innovations such as motion sensor activated faucets, toilets, and paper towel dispensers have greatly reduced the risk of bacterial spread in public restrooms, which have been identified as a high-risk location for disease transmission. Other innovations such as motion sensor doors and light switches have also assisted in the battle against disease causing bacteria.

While there have been many great advances to minimize the presence of bacteria on various common surfaces, there is one very common surface which has yet to be addressed. That surface is the elevator button panel. Elevator panels are one of the most frequented surfaces in any building and are generally cleaned and disinfected less frequently than restroom surfaces. A recent study showed that elevator buttons in hospitals actually have a higher rate of bacterial colonization than toilet surfaces [1], which may come as quite a surprise to most people. With this fact in mind, it is hard to believe that there has not been a viable solution to this very real problem. Until now.

This post mortem by Porcupine Solutions will discuss CleanLift, a touchless elevator panel system. The system employs a laser grid consisting of horizontally and vertically oriented lasers projecting onto photocells on the opposing end of a panel. When a user crosses the intersection of two lasers and blocks the paths to their corresponding photocells, they have pressed a virtual button. The panel has been designed in such a way that the user will not need to touch any surfaces, thus eliminating the possibility of bacterial spread leading to illness. The panel also employs a voice recognition mode, for those who are visually impaired or are in need of a hands-free system.

We will discuss why this technology is needed and how our system will serve as a solution to the problem at hand, as well as explore the business case in which it can be applied. Also presented in this document is the final project budget and schedule, including discussion on the changes between projected and actual values. Lastly, we will discuss some challenges that occurred during the development of CleanLift, and expand upon team dynamics and the workload distribution of the project. Appendices include individual learning write-ups and meeting agendas and minutes.

Porcupine Solutions is composed of four 5th year engineering students with a range of skills including medical device development, systems engineering, software development, electro-mechanical system design, and product testing. We are very excited about the potential success of CleanLift, and we hope that you see this potential as well.

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1 Introduction

CleanLift is a revolutionary solution to reduce disease and bacteria transmission via elevator button surfaces. We have designed a simple, yet effective, touchless button panel system to greatly reduce bacterial spread in high-risk places such as hospitals, cruise ships, and residential buildings.
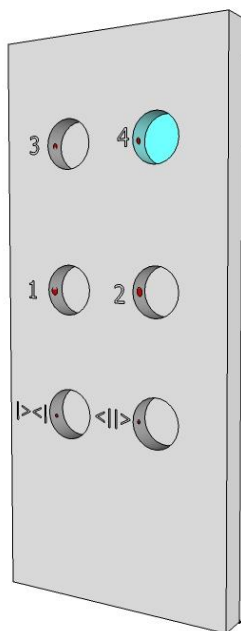

Figure 1: Outer panel of a 3x2 touchless panel

Several studies have shown that elevator buttons are subject to more bacteria colonization than any other surface in hospitals and other public spaces [1] [2]. Currently, there are only two implemented approaches to address this issue: encourage personal hygiene for users (washing hands, hand sanitizer, etc.), and regularly cleaning and disinfecting elevator surfaces. These approaches are dependant on the thoroughness of hospital administration and staff, and thus may lead to inconsistent effectiveness in reducing the risk of spreading infectious disease.

Over the past two decades, touchless technology has been effectively implemented in nearly all modern buildings. Toilets, faucets, and door handles have been replaced with touchless mechanisms in hopes of reducing the presence of bacteria and improving sanitation on common surfaces. Unfortunately, this trend has yet to transfer over into the realm of elevators, even with a growing demand for elevators [3]. CleanLift is a new technology presented by Porcupine Solutions that aims to introduce touchless technology to modern elevator systems. With nothing readily available on the commercial market, and with individuals and governments pending thousands on preventative medicine each year [4], the market is primed for a solution to this problem.

This document will give a general product overview and discuss the business case for CleanLift. It will also include financial and schedule summaries, and discuss project challenges, group dynamics, and workload distribution. Included in the appendices of this document are Appendix A: Individual Learning – a personal summary of individual learning from each group member – and Appendix B: Meeting Agendas and Minutes.

2 Project Overview

CleanLift is a touchless elevator panel system that consists of three main subsystems: the physical panel, the sensing grid, and the control system.

The physical panel is the part of CleanLift that interacts with the user. It has a clean aesthetic and has been user tested to be simple and intuitive to use, and is comparable in operation to mechanical button systems. The only difference between it and conventional panels is the use of CleanLift's touchless sensing recesses instead of mechanical buttons, as shown in Figure 2 below.

The sensing grid of CleanLift is what enables the change over from mechanical buttons to touchless sensing recesses. It is implemented by a grid of lasers that each have their own photoresistive sensor. These sensors send information to the control panel for analysis and to activate the LEDs and audio feedback measures.

The control system, implemented on an Arduino Uno board for prototyping, takes in information from the sensing grid and performs analysis to determine the proper feedback and results. In the case of a user using the system correctly, it turns on the corresponding LED and audio feedback. In the case of a user becoming frustrated or not understanding the system, it outputs simple instructions. These instructions and audio feedback are implemented via the control system's voice recognition module, implemented by an EasyVR Shield 3.0 - Voice Recognition Shield. This shield, while providing valuable audio feedback to users, also enables CleanLift to be used by the visually impaired or those with their hands full. It is controlled through the same Arduino Uno board as the rest of the control system.

Together, these subsystems interface to create a truly touchless system, clean and accessible to all users.
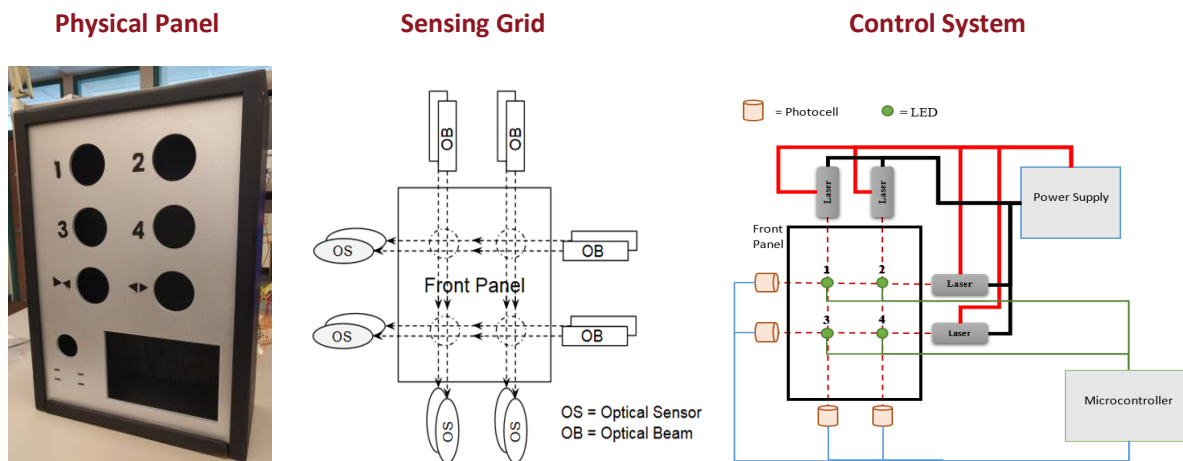
Physical Panel   **Sensing Grid**   **Control System**

Figure 2: The subsystems of CleanLift

3 Financial Summary

After the final purchases were made, CleanLift cost approximately $400 to design and prototype. This is under our original budget of closer to $570, and was nearly completely covered by our main source of funding, our ESSSEF grant of $399. Details can be found in Table 1 below.

Table 1: Estimated vs. Actual Costs

Item	Estimated Cost	Actual Cost
Physical Panel		
Plexiglass	$11.30	$45.54
Opaque Plastic	$79.10	$40.99
Plywood	$20.86	$0.00
3D Printing	$0.00	$63.13
Screws and Brackets	$20.00	$0.00
Paint	$20.00	$0.00
LEDs	$10.17	$12.60
Sensing Grid		
Lasers	$56.48	$44.58
Laser Holders	$46.99	$0.00
Photoresistors	$94.92	$14.56
Control System and Voice Recognition		
Arduino Mega	$72.69	$0.00
Microphone	$7.83	$0.00
Speaker	$3.08	$2.00
EasyVR module	$0.00	$80.31
Miscellaneous		
Assorted Electronics	$10.00	$61.45
Food for Demo	$0.00	$23.57
Totals		
Subtotal	**$453.42**	**$388.73**
Shipping	$30.00	$12.11
Contingency	$90.68	$0.00
Total	**$574.11**	**$400.84**

We had many non-monetary sources of funding and ways to cut our costs, not seen in the budget above. We managed to save a good portion of money on the physical panel by using scrap and donated materials from our family and friends. We were also forgiven the setup fee for our 3D printing by using the 3D printing service facilitated by Simon Fraser University's Engineering Lab Staff. In the sensing grid, we found that using a simpler hot-glue method for affixing our lasers would be easier and more customizable for our setup, and was coincidentally cheaper as well. Lastly, during our research phase we realized that we could use an Arduino Uno lent to us by one of our team members as our microcontroller, and were therefore able to reallocate those funds towards our voice recognition module.

Overall, we came in under budget and all but $1.84 of the costs were covered by our monetary grant and donated services and materials.

4 Schedule Summary

A comparison of our original estimated schedule and our actual schedule is seen below in Table 2, with green and blue bars indicating actual and estimated schedules, respectively.

Table 2: Estimated vs. Actual Schedule

Task Name	Jan					Feb				Mar				Apr		
	Jan 3	Jan 10	Jan 17	Jan 24	Jan 31	Feb 7	Feb 14	Feb 21	Feb 28	Mar 6	Mar 13	Mar 20	Mar 27	Apr 3	Apr 10	Apr 17
Research																
Purchasing/Returning Parts																
Project Proposal																
Single Button Prototype																
Functional Specification																
Design Review																
Design Specification																
Plywood Prototype																
Test Plan																
Progress Report																
Usability Testing/Debugging																
Plastic Prototype																
Voice Recognition																
Error Checking/Diagnostics																
Post Mortem																
Demo Preperation																

We had originally scheduled development to complete by April 1st, but after receiving our demo date of April 7th we extended a few items into the final week, such as the final demo/plastic prototype and its corresponding software. This allowed us to polish our final prototype and ensure a complete and professional looking demo. We also were able to add on additional features, such as the voice recognition, that we had originally not budgeted for.

A few things took longer than expected, most notably the plastic prototype. This was due mostly to the alignment of the lasers being a far trickier operation than originally thought. This will be discussed further in the next section of the document.

Overall, with a good split of workload amongst team members (described in section 8), we were able to complete most of what we wanted and fairly on schedule.

5 Project Challenges

One of the major challenges we encountered during the design and development of CleanLift was due to the optical method we chose: the precise alignment of the lasers onto the opposing photocells was a difficult task. In the initial prototype we had drilled wood blocks and affixed the lasers with some slight tolerance in order to provide the ability to make micro adjustments. This method was sufficient for an initial prototype but limited our control over the trajectory of the beams after the holes were drilled. In the final prototype we decided to first align the lasers in the desired trajectory, and then affix them using tape and VHB adhesive. This approach was not very stable, as the tape and adhesive had significant variability and were not very reliable in keeping the lasers in position. In the end we decided to hot glue the lasers in the desired position, and this proved to be the most effective way to fix the laser securely in the correct position. Of course this is not how the lasers would be secured and aligned in a production model, but it worked for our purposes. In a production model, the lasers would be fixed using fasteners on an adjustable track to allow for minute changes in position.

The second major challenge we faced, which was present throughout our development, was the presence of ambient light on the system. The photocells in the system vary in resistance based on the intensity of light projected on them. When observing the difference in light intensity with the laser projected and when the beam is blocked, the readings would have less of a difference if there were large amounts of ambient light. This smaller difference between the activated and deactivated states makes it difficult to actually determine if a button has been pressed. By limiting the ambient light, the contrast between the laser being blocked and projecting fully is much greater, and the control system can easily differentiate the states. The solution to this challenge was to build an enclosure for the panel to limit the light exposure; additionally, the box was painted black to avoid reflecting any minimal light which could enter the system through the holes of the front panel.

Lastly, the limitation of the number of analog pins on the Arduino Uno board provided some challenges when implementing the final prototype. In order to read in values of from the photoresistors we used the analog pins in the Uno, of which there are 6 in total. Since we decided to implement the redundancy feature for the final demo, which required 10 photocells, as opposed to 5 in the initial prototype, we were left with only 1 analog pin with which to do this. For this reason, we had to get creative in order to use the digital pins on the board to read the photocell state. To do this we designed a simple differencing circuit which essentially digitized our analog signal based on a predetermined threshold and some hysteresis. This allowed us to use the digital I/O pins which are much more abundant on the Uno board.

6 Group Dynamics

The Porcupine Solutions team worked well together. We are composed of three systems engineering and one biomedical engineering student, all in similar places in our degrees. This gave us all fairly similar backgrounds, but also helped us showcase our individual areas of knowledge and interest.

At the start of this project, we assigned fairly clear roles – Ryan as CEO, Liz as CTO, Lauren as CCO, and Simon as CFO. Throughout the development of our product and as a team, we changed and adapted these roles as necessary to complete the project and create our best work. Documentation stayed fairly consistent, with everyone contributing to the bulk of the writing, and then passing the data off to Liz and Lauren, who would format and combine the sections into a document with a clear voice and accurate data. As for creating the prototypes, Ryan and Liz worked on the hardware and custom circuitry of the project, while Lauren and Simon focused on the software, control, and voice recognition. Overall, the work was fairly evenly distributed and all members of Team Porcupine were happy with their contributions.

Group morale and dynamics stayed fairly upbeat throughout the whole process. There were a few times where heated arguments were had, but they were always worked out. Ryan was integral in the resolution of these issues, as part of his role of CEO was to have final say on contentious decisions. Giving him this role made it easier to avoid unnecessary conflict within the group and allowed everyone to have their say. This was very important for us, as most of our team members are used to being the natural leader in group projects, but having too many leaders on one project can just as easily cause conflict as having no clear leader. Compromise and clear discussion became keystones for our group meetings and discussions, and led us to create a great product. We all learned a great deal about working closely with other people under high-stress environments, especially towards the end. It became important to understand and be compassionate about each other's ways of dealing with stress, and as a team we pulled through and are better for the experience.

7 Workload Distribution

Workload was distributed among team members based on expertise and experiences, as seen and expanded upon below in Table 3. Each member contributed in the design and construction of the prototype, which gave us ideas for future improvement and additional features for our final product. In creating our final prototype, tasks were split into hardware and software. For the hardware sections, Ryan and Liz designed and constructed the physical panel – including 3D printing recesses, laser cutting of panel materials, and creating powering circuits – with Ryan focusing more on whole-system design and assembly and Liz focusing more on specific item design. Simon was also involved in this section, with a focus on parts sourcing and LED and panel design. Looking at software, Lauren worked on the main control logic, error detection, and system integration, while Simon worked on the voice recognition module. Further breakdowns can be seen below.

Table 3: Workload Distribution Table

	Ryan	Liz	Lauren	Simon
Documentation Writing	A	A	A	A
Documentation Editing		A	L	
Voice Recognition			A	L
Programming Integration			L	A
Error Detection			L	
General Case software	A		L	
Meeting Planning	L	A	A	
Electronics	A	L		
Wire Management	L	A		
Part Purchasing	A	L		A
CAD Designs	A	L		
Initial Prototype Assembly	A	L		A
Proof of Concept		L		
Demo Prototype Assembly	L	A		
Through Hole Boards	L	A		
Panel Aesthetics			A	L
LED selection	A			L
Final Demo Debugging	A	A	L	A
User Testing	A	A	L	A

L = Lead; A = Assist

8 Conclusion

Our group was able to accomplish most of what was proposed at the start of this project; we were able to complete multiple iterations of the proof of concept and our final demo included the major functionalities we had set out to implement either fully or partially. The final prototype included redundancy lasers and photocells to improve reliability as well as the likelihood of button triggering, voice recognition for added usability and convenience, visual and audio feedback, error checking for non-ideal usage, as well as an aesthetically pleasing front panel and enclosure. We learned a great deal about the technical, organizational, and documentation aspects that go into such projects, which will be valuable in our future endeavours as engineers in industry.

In the future, we would like to improve the design of CleanLift as well as experiment with alternative methods for creating touchless buttons. Introducing tactile feedback such as air puffs is of great interest in order to mimic the touch feedback present with mechanical buttons. Additionally, adding braille code to the front panel is necessary to keep with elevator standards and to improve the user experience for visually impaired users. We would like to experiment with other sensing methods such as infrared, ultraviolet, and capacitive to observe performance and feasibility. Introducing a power saving mode when elevators are not in use would be useful to save power consumption, and could be easily implemented.

CleanLift is a simple yet effective product which solves the very real problem of pathogen transmission on elevator button surfaces. Touchless technology is becoming increasingly used in modern buildings however it has yet to be implemented in elevators. Our product would be the first of its kind commercially and could potentially have a great impact on the modernization of hospital elevators. We believe that with further design refinement CleanLift could become a ground-breaking technology.

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Appendix A: Individual Learning

A.1 Ryan Goldan

When the Porcupine team met for the first time to discuss which project we would pursue for the semester, we all agreed that we wanted to solve a real world problem first and foremost. On a personal level I wanted a project that I truly thought could turn into a marketable product beyond the scope of the course, and I believe my colleagues shared this desire. I believe that CleanLift falls in both of those categories, and I am content with the way our final product turned out. The idea behind CleanLift stemmed from personal experience from countless hours spent in hospitals and health care institutions where there is a great deal of attention to mitigating the risk of disease transmission. The approach we took in our design was geared towards meeting the standards of hospitals, but now we see that this technology could be extended to elevators in any setting.

During the course of the project I learned a great deal about the technologies and methods we used to construct our system as well as team dynamics. This was the first time I had worked on a project which required the use of lasers and photocells, which was a good learning experience. While the technology is relatively simple, hands on experience has increased my comfort level when working with them. We used a laser cut piece of plexiglass as our front panel for the elevator system; designing and laser cutting the panel was a first time experience, and I was very surprised by the quality of the outcome. I had extensive experience working with Arduino, 3D printing, electrical and mechanical assembly, and documentation, all of which I believe were strengths that benefited the team and the project.

Acting as CEO of the group challenged me to take ownership of the project and effectively managing the work of the team, while still allowing others to lead in their respective areas of expertise. While my title was CEO, this group was comprised of multiple leaders, who all contributed in keeping the project on course. Over the course of my schooling I have always found myself in roles of leadership whether I chose to or not, but managing a project of this duration with the same group of people was a new challenge I had yet to face. Delegating tasks, making task deadlines, organizing regular meetings, supervising progress, and managing conflict were all part of the job. I learned that I struggle with keeping track of all of the details associated with the project sometimes, while certain team members were better in this area. I learned that my easy going attitude was good for fostering a good work environment and dealing with group conflict, but that I need to be more stern when keeping group members on schedule and making sure that everyone contributes their share to the project. Overall this group was great to work with, and I believe together we had the tools necessary to develop CleanLift to a high standard.

A.2 Elizabeth Durward

Developing a project from idea to prototype presented many new challenges despite previously having worked on prototyping new products during an 8-month co-op. Our team, myself included, feels that touchless elevators panel address a real world problem, and this led to a motivated team environment, which I believe was crucial to our successful completion of the project.

This project was full of learning moments for me during the various stages of development. During the initial idea selection and team formation I learned the importance of presenting ideas concisely yet completely for maximum impact when pitching. During the proposal stage the importance of bouncing ideas off team members to ensure a cohesive project scope between members between clear as we discovered our differing design ideas through dialogue. During the specifications I learned how challenging it can be to balance and optimize design elements. Throughout the documentation and initial implementation, it was interesting to work with a group of people all with differing work styles, personalities, and skills sets. Our group had several students, myself included, who are used to taking a leadership role, and we had to learn how to share responsibilities, compromise and work together to accomplish our team goals. During the implementation phase the need for planning, and thorough design was immediately highlighted as we found that due to insufficient planning with regards to integration we ended up compromising on some of our design elements (such as error notification, and team branding).

On a more personal level I learned that I work much better when close communication is maintained as I like to be able to see the big picture progress of the project regardless of whether I am involved in a specific task or not. While working as part of the Porcupine Solutions team I was able to learn new skills by watching other team members, which included conflict resolutions strategies, organizational tips, and technical knowledge. Being part of a close knit team that evolved as we designed and implemented our touchless elevator panel was a rewarding experience.

A.3 Lauren Jackson

It is easily and honestly said that I learned a great deal from this process. I came into it expecting to learn, but came away with knowledge and experience that I am grateful to have and take with me into future positions. Working on a project from idea conception to prototype realization was a new experience for me, and one that I am glad I got to participate in. Working in such a small group, I was able to look in and interact with everything that was going on with the project, which is something that I enjoyed and was another new thing for me. While I mainly focused on working on the documentation and the control system of the project, which is where my skills and interests lie, I also got to play a key role in the overall design and outcome of the project. This interwoven structure of contributions and decision making helped me learn quite a few things during the past four months.

On the technical side of things, I greatly expanded my knowledge of microcontroller coding and software development. I have worked on very small Arduino projects before (making LED's blink, using simple sensors), but I had not coded something for Arduino on this scale or with this much complexity. It was a very fun process, finding the correct implementations to work with our project, from analyzing the input for error cases to conditioning the signal for noise. I also had never worked with an Arduino shield before, or with any sort of voice recognition software. In integrating the voice recognition and control code of our system I ended up learning a good amount about the process, and about integrating code sections as well, which was something that I will definitely allot more time for in the future. I also learned about lasers, photocells, and circuitry during this project. I was not as involved with these sections, but I still was involved in the process and expanded my knowledge, especially of how these things all can be made to work well together in a system.

Nontechnical knowledge is just as important in the real world as technical know-how, and I found that accurate to our project as well. Our group was great, but it was also composed of natural leaders, and butting heads about the proper way to do things was something that definitely arose. I honed my compromise skills during this project, and really came to terms with the fact that my way is not always the correct way. I have a tendency to be loose with soft deadlines, moving them around to best fit the situation at hand, but that is not always a good experience for people with different personality or work styles than me. If I could something differently, I would definitely be stricter with myself in what deadlines I express to my group and what these deadlines actually mean, to avoid and unnecessary stress. Another thing I would change is that I would be more confident in myself and not back down so easily in an argument. This didn't cause any real issues for me in the project other than slight irritation, but it is something that irks me when looking back. In the end, it was a great experience of working with people who are similar to me, yet different in ways that helped me grow to be a better teammate and leader.

Overall, I am very happy with my contributions and the knowledge I gained from being a part of the Porcupine Solutions team. The experience of creating something start to finish is something that I'm excited to have, and am excited to utilize my new knowledge and skills in my next project.

A.4 Simon Huang

Never have we had a project with a duration of three months; never have we had the same group member to work with for three months; never have we had encountered technical challenges that were not provided a solution and to be completed in three months; experienced gained from this capstone project is definitely essential before heading out to the real world. This project allowed me to explore my imaginations and innovate but most importantly, experience a real world like scenario where technical uncertainties and budgeting play a heavy role in the process.

It was inspiring to experience the process from initial brainstorming of a concept to producing a prototype, and eventually a perfected demo prototype. The amount of thought and care this group put into perfecting a potentially commercializable product is unbelievable. After every documentation, a meeting will be held just to discuss any improvement required for the next upcoming document. The most valuable interpersonal experience that differs this from other shorter term projects is communication. Assumptions and misconceptions happen on a daily basis especially when a project this scale is involved. It is vital to keep everyone up to date or progress so people with availability may provide support, rather than have your section stalled and brings stress to deadlines for everyone even with valid reasons. Such mistakes happen often during the term but fortunately were all minor enough to be fixed.

I was mainly responsible for voice recognition, a feature that would definitely increase the complexity of the project. The initial challenge was deciding on what type of technology that would be best fit for our product in both power and functionality. We eventually decided to use EasyVR Shield that compiles with Arduino to conduct our voice recognition and audio feedback features. It was my first encounter with both hardware technologies, which brings a fair amount of time in researching and self-educate, and on top of that the amount of resources on the VR module was very limited so it became very time consuming and frustrating at points. Now looking back, overcoming such technology with so much unknown factors to it just brings me confidence in my ability to achieve or overcome any technological challenges in the future.

Overall, it was a pleasure to acquaint myself better to Liz, Ryan and Lauren throughout the semester. It was definitely eye opening to see each other's growth from beginning to end. They were all considerate, supportive and with each of their unique expertise and working habits, we were able to compensate each other's weaknesses and deliver a final product that defines the best out of us. It was a privilege to have them as my partners, I could not think of any better group to do this with in drawing down an ending to my bachelors.

Appendix B: Meeting Agendas and Minutes

Meeting dates noted in this section:

- November 22, 2015
- January 8, 2016
- January 11, 2016
- January 29, 2016
- February 10, 2016
- February 16, 2016
- February 23, 2016
- March 1, 2016
- March 8, 2016
- March 18, 2016
- April 1, 2016

Porcupine Solutions

AGENDA

November 22, 2015
7:30pm-8:30pm
Library Team Room

Purpose of Meeting: Pitching proposals

Items for Discussion:

- Introductions (exchange phone numbers)
- Present/ Debate potential ideas
- Pick a few ideas to talk to Andrew/TA about
- Discuss communication modes Drive/Dropbox/scheduling etc – Msreports, Whatsapp
- Schedule next Meeting or decide what tasks have to be completed by when

Porcupine Solutions

Meetings

November 22, 2015
7:30pm-8:30pm
Library Team Room

Present: Ryan Goldan, Simon Huang, Liz Durward and Lauren Jackson
Absent: none

Purpose of Meeting: Discuss all individuals proposals

Minutes:

Liz Durward called the meeting 7:30pm.

A. Debate potential Ideas

    Discussion: Each group member presents their proposal

      1. **Sanitary Elevator Buttons**
Problem: people touching elevator buttons is unsanitary (hospital etc)
Proposed Solutions: no touch button or UV sanitation
Main Technical Challenges: finding appropriate sensors/ UV and making sure the UI is intuitive and easy to use
Issues: making it just as easy for the user as regular buttons, ideally make it cost effective and be able to go on top of existing buttons
Discussion:
- ultrasonic distance sensor, Laser distance/LED distance sensors
- how to get users to understand
- possibly take out numbers
- how uniform are elevator panels
- Ryan might know someone who installs elevators

      2. **Wireless Blood Pressure Monitor Real Time Recorder**
Problem: cardiovascular diseases are hard to detect and are one of the leading factors of death, increase in accurate data monitoring will help decrease that problem for certain people
Proposed Solution: Every measurement is recorded real time into a personal account wirelessly and data can be extracted into a chart for medical purposes or doctor references.
Main Technical Challenges: implementing an account data based infrastructure and setting a touchscreen wireless internet search onto an existing heart monitor.
Issues: minimal hardware, mostly software. Don't know if they would accept the project due to our majors.
Discussion:
- Has this been done before?
- iHealthLabs similar product $100
- arm measurement cuff has pressure putter and its controlled wirelessly
- what does it it do? what does it not seem to do.
- Arduino module for wi-fi real-time programming→ lots of potential

3. Ski race timing
Problem: ski race timing
Proposed solution: Start Gate
Main technical Challenges: none
Issues: range of bluetooth?
Discussion:
- http://www.tagheuer-timing.com/en/tag-heuer-professional-hl640-chronosplit
- Race system ($500 dollars) Train system is a radio a stopwatch and a piece of paper.
- Liz to talk to a ski coach

4. Jump Analysis for High performance Springboard Divers
Problem: High performance divers often lose potential height due to timing or body position during takeoff
Proposed Solution: Attach an accelerometer to the bottom of a diving board. Analyze the data (in real time?) to give divers feedback on how timing or body position can improve dive height which is a crucial component of every dive
Main Technical Challenges: how to attach/ waterproof accelerometer, and Data analysis
Issues: Will the data actually be informative (would need to do initial test prior to choosing as project)?

5. Security Fence Monitoring system
Problem: At events where temporary fencing is used, fencing links can be opened if insufficient security personnel for the size of the perimeter
Proposed Solution: use some form of electrical sensing → inductive? to determine if the perimeter has been broken and sound an alarm
Main Technical Challenges: can this be done? and what if 1 opening is needed can it monitor between points and not just for closed/open
Issues: How to test! Would need a scaled down version as likely hard to get access to real fences

D. Voting on a project

Discussion: each group member chooses 2 projects he/she prefers

Action: the group has come to an agreement to do Sanitary Elevator Buttons

E. Next Meeting Date

The next meeting was arranged for January 8, 2016 at 10:30-12:30 in the Asb.

F. Other Business
None.

Meeting was adjourned at 8:30

Porcupine Solutions

AGENDA

January 8, 2016
10:30am-12:30pm
Applied Science Building

Purpose of Meeting: To discuss the design specs of the project and assigning individual responsibilities

Items for Discussion:

- Company and product name
- UI Design of the product
- What type of sensors do we use

Porcupine Solutions

MINUTES

January 8, 2016
10:30am-12:30pm
Applied Science Building

Present: Ryan Goldan, Simon Huang, Liz Durward and Lauren Jackson

Absent: none

Purpose of Meeting: To discuss the design specs and company name

Minutes:

Liz Durward called the meeting to order at 10:30am.

A. Company name and individual titles

Company name: Porcupine Solutions
Product: CleanLift
Titles:
- Ryan Golden: CEO
- Simon Huang: CFO
- Liz Durward: CTO
- Lauren Jackson: CCO

B. UI Design Factors

What is the design goal for our users?

Discussion: People will have the temptation to physically touch the buttons

Action: our LED response from the sensor has to respond fast enough for users acknowledge no more pushing button is necessary

Discussion: First time users will still assume it's a touchable button

Action: Our target is for hospitals and public office places where the most vulnerable subjects will be staff whom use it often should benefit from it the most.

C. Type of Detecting Device

What type of sensor method should we use?

Discussion:
1. Capacitors:
- not scalable and
- limited by sensitivity
- reliability: what if user has gloves

2. Laser:
- Reliable
- Cheaper
- Easy to troubleshoot

Action: Researching on the number of lasers and decide on using grid distance detection for our buttons.

D. Next Meeting Date

The next meeting was arranged for January 11, 2016 at 10:30am -12:30pm in the in lab 1.

E. Other Business
None.

Meeting was adjourned at 12:30pm.

Porcupine Solutions

AGENDA

January 11, 2016
10:30am-12:30pm
Lab 1

Purpose of Meeting: Plan for proposal and parts for prototype

Items for Discussion:

- Project Proposal
- Proposal Funding
- Parts for prototype

Porcupine Solutions

MINUTES

January 11, 2016
10:30am-12:30pm
Lab 1

Present: Ryan Goldan, Simon Huang, Liz Durward and Lauren Jackson

Absent: none

Purpose of Meeting: To discuss the design specs and company name

Minutes:

Liz Durward called the meeting to order at 10:30am.

A. Individual Tasks done before January 13, 2016

Budget for Funding - Liz
Logo - Simon
Read Proposal Rubric - All
Project proposal schedule - Lauren

B. UI Design Factors

What is the design goal for our users?

Discussion: People will have the temptation to physically touch the buttons

Action: our LED response from the sensor has to respond fast enough for users acknowledge no more pushing button is necessary

Discussion: First time users will still assume it's a touchable button

Action: Our target is for hospitals and public office places where the most vulnerable subjects will be staff whom use it often should benefit from it the most.

C. Prototype Required Parts

- Arduino
- Breadboard
- Photocell
- Laser
- LED Light

Action: construct prototype for next meeting.

D. Next Meeting Date

The next meeting was arranged for January 18, 2016 at 10:30am -12:30pm.

E. Other Business
None.

Meeting was adjourned at 12:30pm.

Porcupine Solutions

AGENDA

January 29, 2016
10:30am-12:30pm
Applied Science Building

Purpose of Meeting: Functional Specs

Items for Discussion:

- Project Proposal reflections
- Function Spec Documentation work distribution
- Product ordering
- Schedule for prototype production

Porcupine Solutions

Meetings

January 29, 2016, 2015
10:30am-12:30pm
Applied Science Building

Present: Ryan Goldan, Simon Huang, Liz Durward and Lauren Jackson
Absent: none

Purpose of Meeting: Discuss prototype and functional spec documentation

Minutes:

Liz Durward called the meeting 10:30am.

A. **Project Proposal Documentation Reflections**

   Discussion: Each individual discuss what needs improvement on proposal documentation

   6. Ryan: work wasn't divided in an efficient manner
   7. Lauren: editing was overwhelmed and last minute
   8. Liz: overlap on material
   9. Simon: material content was unorganized

   Action:
   - **Outline must be written together to avoid material overlapping**
   - **After first proposal, member's documentation style is pointed out and will determine that on what parts to assign**
   - **Strict timelines on accomplishing parts is in affect**

B. **Functional Spec Documentation**

   Discussion: reflecting on proposal documentation improvements

   Action:
   1. **Research on prototype**
   2. **A detailed Outline to be constructed on Feb 2**
   3. **All parts MUST BE DONE by Feb 9, for additional time for editing**
   4. **Ryan gone from February 12th to 16th 2016**

C. **Prototype**

   Discussion: Material selection and ordering

   Features and Materials discussion:
   1. **Transistors VS Resisters**

2. **Ambient Sensitivity**
3. **Air processing for UI purposes**

Action: buying Lasers at Lees electronics

D. **Conclusion:**

1. Research on specs in more detailed for **outline** – Everyone
2. Research LED options – Simon
3. New Bank Account for tracking funding – Simon
4. Semi Prototype on singular button – Liz

E. **Next Meeting Date**

The next meeting was arranged for February 2, 2016 at 10:30-12:30 in the Asb.

Meeting Adjured at 12:30 pm in ASB

Porcupine Solutions

AGENDA

February 10th, 2016
4:30am-6:30pm
Google Hangouts

Purpose of Meeting: Functional Specs Review

Items for Discussion:

- Review of Functional Spec sections
- Initial Prototype build schedule

Porcupine Solutions

Meeting Minutes

February 10th, 2016
4:30am-6:30pm
Google Hangouts

Present: Ryan Goldan, Simon Huang, Liz Durward and Lauren Jackson
Absent: none

Purpose of Meeting: Review functional specs

Minutes:

Lauren Jackson called the meeting 4:30pm.

A. **Functional Specifications**

 Discussion: Trade and review sections
 10. Liz: to review Simon's section
 11. Lauren: to review Ryan's section
 12. Ryan: to review Lauren's section
 13. Simon: to review Liz's section

 Action:
 - **Address comments made by reviewers**
 - **Finalize Figures by Friday February 12th**

B. **Initial Prototype build schedule**

 Discussion: Liz will be building initial prototype Friday
 Action:
 5. **Liz to send picture of prototype to group in case mods need to be made**

D. **Conclusion:**

 5. Final edit of sections by Friday – Everyone
 6. Build prototype – Liz

E. **Next Meeting Date**

 The next meeting was arranged for February 15th, 2016 at 4:30 remotely through google drive and hangouts 10:30 in the ASB

Meeting Adjured at 4:30 pm via google hangouts

Porcupine Solutions

AGENDA

February 16th, 2016
10:30pm-12:30pm
Applied Science Building

Purpose of Meeting: Review of Functional spec

Items for Discussion:

- Group Review of Functional spec
- Check cohesiveness of content

Porcupine Solutions

Meeting Minutes

February 15th, 2016
10:30am-12:30pm
Applied Science Building

Present: Simon Huang, Liz Durward and Lauren Jackson
Absent: Ryan absent due to a conference

Purpose of Meeting: Review functional specs

Minutes:

Elizabeth Durward called the meeting 4:30pm.

A. Functional Specifications

Review of FS
1. Liz noticed graph and table still needed
2. Lauren noticed incorrect number in section 5.2
3. Simon found several grammatical error and typos

Action:

- **Liz to make required format changes and add graph, lauren to do final proof read and send in**

B. Check cohesiveness of content

Discussion: check that requirements in different section complement each other and are complete
Checked: and sections were cohesive

D. Conclusion:

7. Functional spec is mostly complete just a few minor changes needed

E. Next Meeting Date

The next meeting was arranged for February 23th, 2016 at 12:30 in the ASB

Meeting Adjured at 12:30 pm in the ASB
Porcupine Solutions

AGENDA

February 23th, 2016
12:30am - 2:30pm
Applied Science Building

Purpose of Meeting: Review of Functional spec

Items for Discussion:

1. **Discussion of Functional Spec process**
2. **Start Assembling initial demo**

Porcupine Solutions

Meeting Minutes

February 16th, 2016
10:30am-12:30pm
Applied Science Building

Present: Ryan Goldan, Simon Huang, Liz Durward and Lauren Jackson
Absent: none

Purpose of Meeting: Start work on assembling plywood prototype

Minutes:

Elizabeth Durward called the meeting 10:30am.

A. Functional Specifications process review
Ryan: much better getting individual sections done early
Lauren: liked having more time to format
Simon: happy with how it went
Liz: would like discus big picture more before writing individual sections of the design review

Action:

1. **Similar organization for design review, do individual sections on drive then add together**

B. Assembling initial prototype

   Discussion: Divide up tasks and plan time to wire
   Action:
   6. Liz to buy from lees (9V battery, 6 lasers, 5 photoresistors, 4 LM311)
   7. Ryan and liz to meet this week start wiring led, lasers and photo resistors
   8. Lauren to write Arduino sketch
   9. Simon to do more research on methods to implement voice recognition

D. Conclusion:

   8. Functional spec went well
   9. Continue to work on wood prototype

E. Next Meeting Date

   The next meeting was arranged for March 1st, 2016 at 10:30 am in the ASB

Meeting Adjured at 2:30 pm

Porcupine Solutions

AGENDA

March 1, 2016
2:30am-4:30pm
Applied Science Building

Purpose of Meeting: Division of design spec sections

Items for Discussion:

- Division of design spec sections
- Update on initial prototype

Porcupine Solutions

Meetings

March 1, 2016
2:30am-4:30pm
Applied Science Building

Present: Ryan Goldan, Simon Huang, Liz Durward and Lauren Jackson
Absent: none

Purpose of Meeting: Divide Design spec sections

Minutes:

Lauren Jackson called the meeting 2:30pm

A. **Project Proposal Documentation Reflections**

   Sections divided and recorded on google drive
   Action:
   - **Have individual sections done by 7th**

B. **Initial prototype update**

   Discussion: Liz and ryan finished attached and doing wire management, works with srduino program, a bit sensitive to ambient light

   Action:
   10. **Decide on sequence for user testing**
   11. **Reposition grid**
   12. **Do user testing**

E. **Next Meeting Date**

   The next meeting was arranged for March 8, 2016 at 10:30-12:30 in the ASB.

Meeting Adjured at 4:30 pm in ASB

Porcupine Solutions

AGENDA

March 8, 2016
12:30am-2:30pm
Applied Science Building

Purpose of Meeting: Demo Prototype planning

Items for Discussion:

- Demo prototype division of tasks and planning
- Proofing of Design Spec

Porcupine Solutions

Meetings

March 8, 2016
12:30am-2:30pm
Applied Science Building

Present: Ryan Goldan, Simon Huang, Liz Durward and Lauren Jackson
Absent: none

Purpose of Meeting: Demo Prototype planning

Minutes:

Liz Durward called the meeting 10:30am.

A. Demo prototype planning

Discussion: what do we need to get started on

1. Need to get started on the physical panel
2. Plan to 3D print it
3. Based on options lets go with easy VR shield
Action:
  - Liz and ryan to work on CAD for lasers holders and recessed
  - Simon to order and work on VR
  - Lauren to start working on code

B. Proofing of design spec

Discussion: what still needs to be done on the design spec
Action:
1. Lauren not done sections, will finish her section and combine, then send out for final edit

C. Next Meeting Date

The next meeting was arranged for March 18, 2016 at 10:30-12:30 in the Asb.

Meeting Adjured at 2:30 pm in ASB

Porcupine Solutions

AGENDA

March 18, 2016
10:30am-12:30pm
Applied Science Building

Purpose of Meeting: Planning for plastic prototype

Items for Discussion:

- Reflections on design spec
- Updates on Prototype sections
- Plywood prototype user testing

Porcupine Solutions

Meetings

March 18, 2016
10:30am-12:30pm
Applied Science Building

Present: Ryan Goldan, Simon Huang, Liz Durward and Lauren Jackson
Absent: none

Purpose of Meeting: plastic prototype updates

Minutes:

Liz Durward called the meeting 10:30am.

A. **Design spec reflections**

   Discussion: Each individual discuss what experience during documentation

   14. Ryan: Need to stick to assigned deadlines
   15. Lauren: wanted everyone to do more proofing of their individual sections
   16. Liz: reiterated the need to communicate with group, so a plan can be developed
   17. Simon: happy overal

   Action:
   - **All members will try to communicate progress with rest of group**

B. **Update on plastic prototype**

   Discussion: roundtable updates
   Action:
   13. **Liz: will 3D print recesses only then laser but, will finalize design once plastic is bought, goal to be done the panel printed and cut by march 22nd**
   14. **Ryan: will buy panel and will be working with liz**
   15. **Lauren: code is going well working on error checking cases**
   16. **Simon: playing with VR, fairly easy to program, has tried initial messages**

C. **Prototype**

   Discussion: Plywood user testing

   Action: Ryan to write up questionnaire, lauren to try on orchestra people next week

D. **Conclusion:**

1. Work on individual sections or smaller group (Liz,Ryan) (Simon, Lauren) to get task accomplished by April 1st to be ready for integrations

E. Next Meeting Date

The next meeting was arranged for April 1, 2016 at 12:30-2:30 in the Asb.

Meeting Adjured at 12:30 pm in ASB

Porcupine Solutions

AGENDA

April 1st, 2016
12:30pm-2:30pm
Applied Science Building

Purpose of Meeting: Functional Specs

Items for Discussion:

- Prototype Updates
- Demo Powerpoint
- Post mortem

Porcupine Solutions

Meetings

April 1st, 2016
12:30pm-2:30pm
Applied Science Building

Present: Ryan Goldan, Simon Huang, Liz Durward
Absent: Lauren Jackson due to illness

Purpose of Meeting: Discuss prototype and functional spec documentation

Minutes:

Liz Durward called the meeting 10:30am.

A. **Prototype updates**
   Discussion: roundtable updates

   18. Ryan: plastic bought and everything printed
   19. Liz: recesses and wired and attached
   20. Liz and Ryan: preliminary alignment done but still more to do
   21. Simon: VR programmed and ready to be integrated

   Action:
   - **Liz and Ryan to finished building and circuits ASAP so integration and testing can start, Simon to check in with Lauren about integrating VR mod**

B. **Demo ppt**

   Discussion: split tasks etc
   Action:
   17. **Liz to write outline**
   18. **Everyone to do content of a few slides**
   19. **Ryan to proof read and finalize**

C. **Post Mortem**

   Discussion: Lauren divided tasks and the list is on drive

   Action: start section before demo will be compiled by lauren after demo

D. **Conclusion:**
Keep working on prototype and demo.

Meeting Adjured at 2:30 pm in ASB