ATHLETIC
INNOVATIONS

Sam Hafezi, CEO

April 10th 2015

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
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Re: RunWare by Athletic Innovations Post-mortem

Dear Dr.Rawicz,

The attached document, *RunWare by Athletic Innovations Post-Mortem* outlines the process our team endured to create and demonstrate our product, *RunWare. RunWare* is an athletic jacket with wearable tech, and combines the benefits of indoor ergometers with the freedoms of outdoor activity.

This document covers the end product we created, the deviation from what we intended to create, and our future plans for the product. We will also have individual reflections on our experiences during the last 4 months of work, both technically and socially.

Athletic Innovations is composed of a highly talented team of individuals. Our organization alongside myself includes senior engineering students Ricky Tran, Chelsea Huang, Michael Ng, and Neha Chhatre. If you have any questions or concerns about our proposal, please do not hesitate to contact me by phone at *(778) 885-0499* or by e-mail at *shafezi@sfu.ca*.

Sincerely,

Sam Hafezi
Chief Executive Officer

Enclosure: RunWare by Athletic Innovations Post-Mortem

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ATHLETIC**INNOVATIONS**

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RunWare

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Simon Fraser University
School of Engineering Science

April 10th, 2015

POST-MORTEM

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1. Introduction

Athletic Innovations was founded to create **RunWare**, a wearable technological running jacket to provide the tools available for indoor running to the outdoor runner. We enjoy living a healthy lifestyle, and wanted to be able to access biometric sensors like, heart rate and calorie burn rate, while enjoying the outdoors.

Currently the wearable technology market is expanding rapidly. There are many companies coming out with health monitoring systems [1]. However, one of the major issues we noticed was none of the products work together to provide an integrated running experience. A runner needs to grab a heartrate monitor, cellphone, and music player before leaving the house. **RunWare** will add to the growth of the wearable health technology market by integrating communication, health monitoring, entertainment, navigation and safety. With health and fitness awareness on the rise, there is a growing market for an all-inclusive product.

We were able to create two demonstrable proof-of-concept jackets that include a heartrate sensor, audio system, step counter and safety lighting. We also created an Android Application that is specifically designed to work with the jacket. The following report illustrates the realization of **RunWare**.

2. High Level Overview

When **RunWare** was conceived, it was decided that the product would achieve providing all necessities to the user through five categories: communication, health monitoring, entertainment, navigation, and safety. To address communication, the jacket needed to provide a channel to the user's mobile phone. Voice control through the jacket would also be ideal for user experience and ability to communicate with the device. The most important aspect of health monitoring in our opinion is the heart rate as it demonstrates the intensity of a run. Additionally, we wanted to provide users with calories burned and distance. Entertainment would be provided mainly through the use of music integrated into the jacket. To address safety, the jacket would need the ability to light up when low light settings were detected.

The **RunWare** system consists of both hardware and software components. Embedded into the jacket we wanted to build a heart rate monitor to go into the wrist of the sleeve or possibly on the palm of the hand through the use of thumbholes. An accelerometer would be used for step counting, and a phototransistor would be able to detect daylight and turn the jacket's LED's on and off. All data collected from the sensors embedded into the jacket would be processed and calculated using a waterproof microcontroller and sent to an application on

the user's mobile phone via Bluetooth. A microphone in the jacket would be able to send phone audio and voice commands to the application. The mobile phone would also be able to transmit phone audio, music, and audible running statistics to be output of the jacket's speakers via Bluetooth.

Heart Rate and Accelerometer

In the beginning, the hardware team tried to design a circuit that would use reflective photoplethysmography to measure the change in heart rate of the user. However, as more research and experimentation was carried out, we realized the required circuit was too complex for our current level of expertise.

As an alternative measure, we purchased a Pulse Sensor; an easy to use heart rate monitor for the Arduino. Pairing this with the Lilypad Arduino, we could measure and send heart rate data from the microcontroller to the phone via Bluetooth. The user can then read their heart rate with the **RunWare** app.

Some problems we ran into during the development of this subsystem was inaccuracies in measuring heart rate. The Pulse Sensor was not accurate enough for us to use reliably.

Microcontroller and Bluetooth Module

We often referred to our microcontroller as the "brains" of our product because it did most of our calculations for all of our hardware systems. The microcontroller handled three main components; the EL wire, heart rate sensor, and step counter. It controlled buttons to accept and end calls by sending commands to the Bluetooth control. **Figure 1** shows a summary of the microcontroller processes.

The Bluetooth module is able to handle advanced audio distribution profile (A2DP) and hands-free profile (HFP) [2]. So all the microphone and speakers are connected directly to the Bluetooth module. Any audio playing or phone calls are sent to the Bluetooth. To answer or end a call the user can use their phone, or press the buttons on the **RunWare** collar. **Figure 1** shows a summary of the microcontroller processes and Bluetooth functions.

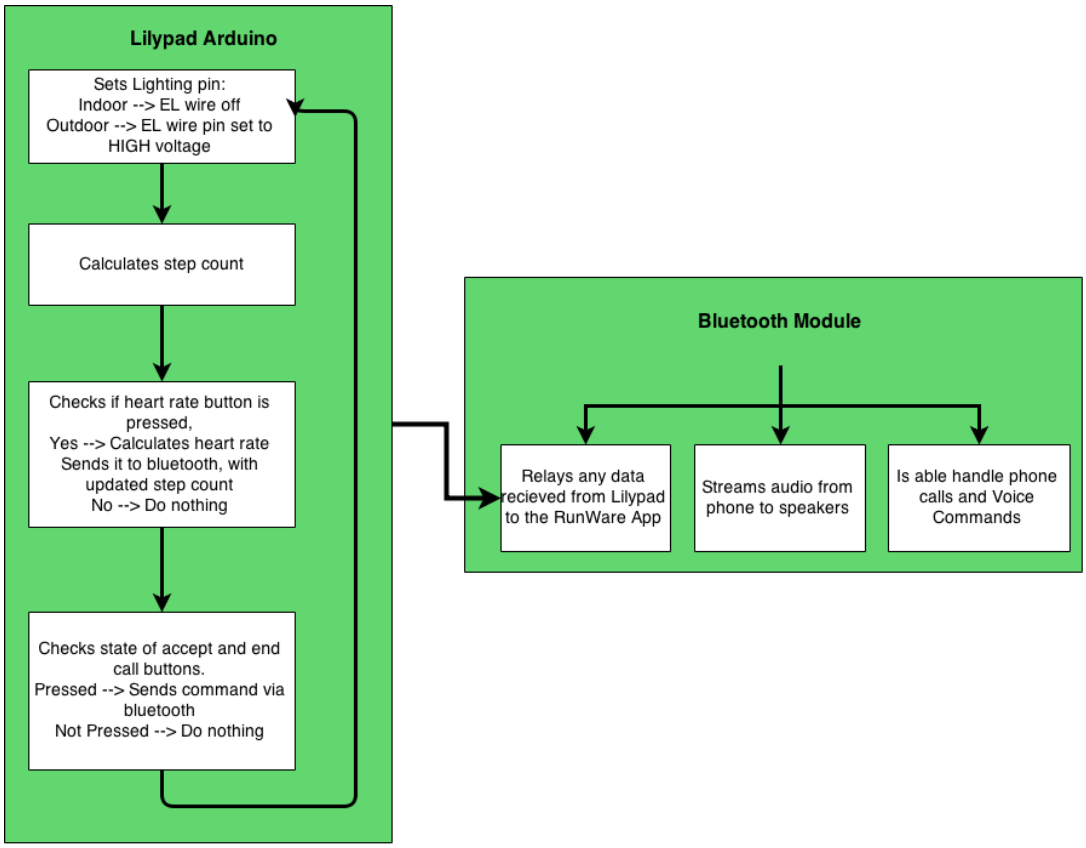

Figure 1 - Microcontroller and Bluetooth System Overview

When the idea of **RunWare** first started, it was clear that the system would consist of a microcontroller, Bluetooth module, and mobile phone. We instantly decided that the microcontroller would be the Arduino Lilypad because it is specifically designed for wearable technology. Since a member of the group had worked with HC-06 Bluetooth module before, we decided to use the same module. Without much research, we did not realize we had ordered the Arduino Lilypad Simple instead of the regular Arduino Lilypad, and we ended up not having enough pins or a Send/Receive port. The HC-06 was also inappropriate for **RunWare** because it did not have the ability to stream audio or have hands-free profile. We solved the Lilypad problem by ordering the proper Lilypad early on in the semester. To fix the Bluetooth module we ended researching and ordering a new Bluetooth module, however since we ordered this part end of March we did not have time to fully utilize all the features properly.

Lighting Subsystem

Electroluminescent wire (EL) wire is a thin copper coated in a phosphor layer, which glows when an AC current is run through it. This wire was wrapped around the jacket as a means of

illuminating the runner should they choose to run at night when it's dark out. EL wire allows us to illuminate the jacket quite well, while staying within the voltage and low current requirements of the system. The original plan was to use LED strips to cover the jacket, but the voltage requirement was 9V; much higher than our power source can provide.

A series of phototransistors was used to detect ambient light, which would control the brightness of the EL wire through the Lilypad Arduino. This allows the EL wire to glow bright during the night when there is no light out. However, when it is bright out, the phototransistors limit the amount of current being pushed through the EL wire, causing it to not glow.

Microphone and Speakers

The original plan was for the user to be able to answer calls via the microphone contained in the collar. We also wanted to control the application with voice commands through the microphone. Things controllable via voice commands would be fetching heart rate, calories burnt, time spent running and other features located within the app. The speakers were intended to stream music from the phone as well as project any calls the user made or received.

The biggest oversight in the audio subsystem is that we did not realize that the microphone part purchased required an amplifier to work. Significant research and experimentation was required to develop an accurate output signal from the microphone. The output signal to the Bluetooth module required experimentation in order to bias and filter the signal to the module requirements. We were able to create a functioning microphone circuit but during integration, the Bluetooth module intended for use failed.

Initially, we assumed the speakers required an amplifier due to the weak signal from the Bluetooth module. However, we realized the Bluetooth module supports built-in audio signal amplification so no additional circuitry was required. In the current prototype, we were able to stream music to the speakers but unable to output any audio from phone calls.

Mobile Application

As seen in **Figure 2** below, we initially intended for our mobile phone application to look like the image on the left, but in reality we implemented the display on the right.

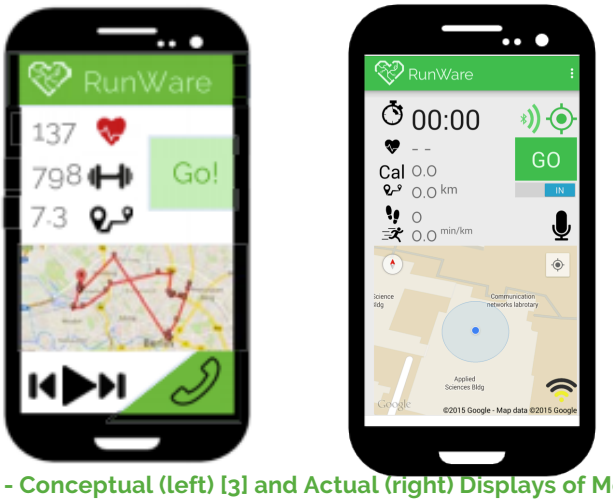

Figure 2 - Conceptual (left) [3] and Actual (right) Displays of Mobile Application

The software team was fairly new to the languages used for coding Android phone applications, and there was a much steeper learning curve than expected. Although there was steady work on the app throughout the semester, it was not fully completed until late March. Originally we thought there would be more built-in tools for creating a map image with an overlay image of the user`s path, but in the end implementing the map was one of the harder features to establish in the app. The app was supposed to include controls that would link to the phones music player or phone, but once we were able to get a connection established with the Bluetooth Hands Free Profile, we realized that this would be unnecessary. After we had completed the rest of the functions outlined in our original conceptual image, we realized that step count, pace, and time elapsed would also be useful to the user. Buttons were added to create an easier way for users to ensure Bluetooth and GPS connections. Through the use of various Google APIs, we were also able to implement voice commands even though it goes beyond what we expected for the prototype.

3. Future Plans

We believe that **RunWare** can expand to more markets than strictly running wear. A direct use-case that **RunWare** could fit into are snowboard and skiing gear. Many snowboarders carry around heavy backpacks with battery packs and a speaker, so that they can have entertainment with them as they ride without wearing headphones. However if they had a modified **RunWare** jacket, our built in speakers would not only provide that, but also with increased visibility and safety during night riding. The accelerometer could also be changed to function as a fall detector in the situation that the rider is in an accident. For example, if a fall was detected followed by no further movement, the user could be prompted to respond to a voice command. If no response is received, further steps could be taken to aid the user,

such as flashing the lighting in a S-O-S pattern, and in extreme situations initiating a call to emergency services. Another possibility would be a variable heating system to be included in the jacket, by having thermal wiring and a temperature sensor to regulate body temperature. Aside from the snowboard and skiing use-case, we believe **RunWare** can also be sold as a package to clothing manufacturers such as Nike and Adidas. By incorporating our technology into their current clothing lines, they can target a different user base with **RunWare** technology inside. This will allow us to not have to be concerned with jacket manufacturing and distribution, but only with licensing our product to various manufacturers.

4. Budget

In total, we spent $716.19 to create the two prototypes for **RunWare**. Our estimated budget was $762.63 including an added contingency of $69.33. In terms of funding we received $550 from the Engineering Science Student Endowment Fund, so we will apply for reimbursement of the remaining $166.19 from the Wighton Fund. A breakdown of the materials we purchased and their prices can be seen below.

Item	Quantity	Unit Cost	Projected Costs	Actual Costs
Arduino Lilypad Simple	2	$23.95	$67.24	$67.24
Arduino Lilypad	2	$22.90		$51.30

JY-MCU Bluetooth Wireless Serial Port Module	3	$6.43	$23.52	$23.52
EL Wire and Inverter	2	$9.95	$22.28	$35.84
Heart Rate Sensor related parts + Phototransistor				$41.06
FTDI Breakout + NPN Transistors				$25.31
Portable Wireless Bluetooth Stereo Speaker	2	$25.90	$68.02	0
Microphone (POW-1644L-B-R)	2	$6.33	$24.18	$24.18
Waterproof wiring tools (Heatshrink, ports, etc.)	--	$50.00	$66.00	0
Li-ion (VL-3032/GUFN) + Protoboard, Heat shrink, Battery Charger, 12 port connector	2	$9.00	$30.16	67.93
Solderable Board and Capacitors	1			16.35
3 Li-ion, 2 x 24 port connector				76.48
Accelerometer (KXCJ9-1008-FR)	2	$2.68	$6.00	0
Phototransistor (ALS-PT19-315C/L177/TR8)	2	$0.79	$11.77	0
Photocell/diode (SFH 2430-Z)	2	$2.37	$15.31	0
Green LED (MLEGRN-A1-0000-000001)	2	$1.58	$13.54	0
128 Mbit Memory (557-1562-ND)	2	$2.43	$5.44	$44.25
EL Inverter - 3v	1	$9.95		$12.11
EL Wire - White Retail	1	$10.95		$13.11
Pulse Sensor	2	$24.95		$53.82
SparkFun Audio Bluetooth Breakout - RN-52	2	$39.95		$84.22
Grove - 3 Axis Analog Accelerometer ADXL335	2	$15.80		$31.60
Running Jackets	2	$99.99	$223.98	0
Texsport 15615 - Waterproofer/Seam Sealer	1	$19.56	$21.91	0
Sewing Materials (Thread, Zippers, Buttons, etc.)	--	$25.00	$28.00	$15.50
Logo Design	2	$8.50	$17.00	$10.00
Security	1	$7.84	$8.91	0
Wet Look (High Gloss Polymer for Speakers)	1	$17.50	$29.60	0
Epoxy	1	$9.33	$10.45	0
Chest Heart Rate Monitor	1	--	--	0
Wiring/Electrical Tape	1	$22.37		22.37
Heat Shrink	1	$27.14		

Contingency (10%)			$69.33	
Total			**$762.63**	$716.19

Figure 3 – Budget including Final Costs

5. Schedule

In the very beginning, we all wanted to try and keep a month to do system integration and testing. However, we ran into problems with faulty parts and incorrectly ordered parts. We also underestimated the amount of time needed for documentation. The final integration and testing was completed in two weeks and testing wasn't as thorough as hoped. One thing that we did to keep on schedule in the beginning is use a team management software tool called Trello. We would list all the tasks and deadlines so we could see what everyone needed. If we had to do this again we would make sure we left more time for documentation and spend more time on researching parts.

6. Team Organization

Athletic Innovations consists of five engineering students with varying backgrounds. Its members have experience working with audio systems, electronic circuits, and programming. Sam Hafezi is the Chief Executive Officer (CEO), Neha Chatre is the Chief Marketing Officer (CMO), Chelsea Huang is the Chief Financial Officer (CFO), Ricky Tran is the Chief Technical Officer (CTO) and Michael Ng is the Chief Information Officer (CIO).

We separated the tasks based on each team member's strengths and experiences. Figure X shows a breakdown of each member's contributions. We had ten formal team meetings to discuss important issues, as well as several informal group meetings and work sessions. We encouraged creative ideas and helped each other during the final stages of system integration.

Work Breakdown

Figure 4 below demonstrates our work breakdown, where 'xx' represents primary responsibility and 'x' represents secondary responsibility.

High Level Task	Sam	Chelsea	Neha	Michael	Ricky
Documentation	xx	x	x	x	x
Budget		xx			
Administrative Tasks	xx	x	x		
Parts Sourcing		x		xx	xx
Heart Rate			xx	x	xx
Variable Lighting				xx	x
Arduino			xx		x
GPS Tracking	xx	x			
Bluetooth Connectivity	x	xx	xx		
Voice Recognition	xx		x		x
Microphone and Speakers	x	x	x	x	xx
User Interface	xx	xx			
Jacket	x	x	x	x	x
Funding	x	x	xx		
Jacket Sewing	x	xx	x		

Figure 4 – Budget including Final Costs

Sam Hafezi Reflection

These last 4 months have been an incredible journey. While incredibly taxing, and stressful, I can definitely say that I have learned a great amount. My relationship with the four other group members may have been strained during one of our many long nights at Lab 1, but thankfully all of us were able to distinguish the lines between personal and business conflicts. As CEO I learned how to motivate our team, and the necessity of one on one discussion when issues arise. There was a point in late March when a lot of hardware circuitry was failing, but by rearranging our priorities and relieving some stress and workload from Ricky and Mike, we were able to reinvigorate ourselves and push through.

My main technical challenge was to create the Android application, alongside with Chelsea. This posed a great challenge, as neither of us had much experience coding in Java or XML. The first 2 months of the semester were spent trying to read as much documentation on Google's developer webpage as possible. As we stated in our lessons learned page of our presentation, the learning curve for this was more like a learning cliff. At the beginning, the most simple of tasks, like placing a textbox were incredibly difficult to understand. However as we began to understand exactly how things work, we were able to come up with, what I believe to be, a beautiful user interface and mobile application. Once the main interface was completed, we began adding functionality to the application. I focused on implementing a Google Map window into the application, as well as using a combination of GPS, Wi-Fi, and cellphone signal to locate the user's position. From there, I had gained enough knowledge to be able to easily calculate and display their total distance, time, calories, average pace, and to plot their movements on the map.

Our next large hurdle was communicating via Bluetooth with the jacket. Thankfully I had Chelsea working on this concurrently while I researched GPS, and in the end we both brought our work together and helped each other finish the application side of our project well in advance. From then on, we aimed to do the manual work of creating our enclosures, wirings and connections, and helping out the hardware team when possible. Unfortunately this brings us to the most difficult aspect of our project overall, integration. We ran into hurdle after hurdle, from cross-talk and noise between our audio signals, to short-circuited Bluetooth modules and microcontrollers. Luckily we had purchased various components, so we had a plan to fall back on. In the end we were able to get two nearly fully functional prototypes working in time for our demonstration.

ENSC 440 is an incredible experience, and one that definitely lives up to the name capstone. Every aspect of what I have learned so far, from CMPT 225 and ENSC 325, 351 and 387 to name a few, have played a role in what we needed to know to create our project. However, it is important to note that designing and creating your own project is an entirely different problem in its own. If I would change one thing about the curriculum that we have had, it would be that more courses like capstone are offered throughout our degree, perhaps even yearly. Ideally these would be with a bit more aid from professors and TA's early on, but in the end culminating in a self ran project as it is now in 440.

Neha Chhatre Reflection

Athletic Innovations was a formed out of our common interest in sports and active living. In the beginning when coming up with a product it was important for me to find a concept that I was motivated and passionate about. Our final product idea RunWare matched that criterion perfectly. It uses new wearable technology and it also includes several different aspects so

everyone in our team was able to contribute some of their experiences, but learn something new at the same time.

Since I had experience using a microcontroller before, I decided to be in charge of the Lilypad Arduino. The Lilypad Arduino was an integral part of the RunWare system because it did all the calculations for the sensors and controlled the lighting subsystem. The first thing I did was research different techniques for calculating heart rate and step count. I was quite hesitant at this stage because I had never worked with analog sensors before. However I was able to find several resources and even some open source code that I was able to use a foundation for our Lilypad code. After troubleshooting different issues, it was brought to the group's attention that we needed to use a different Bluetooth module that had Hands-free profile enabled. I did the research required to figure out how it works and then added code to the Lilypad to send commands to the Bluetooth module. I really enjoyed programing the Lilypad and it gave me a better understanding of how to use interrupts and how to sample analog data. It was nice to be able to code and do hands-on work like bread boarding together.

I enjoyed working with the other members of the Athletic Innovations team because we kept all our working sessions upbeat and humorous. In my mind a good dynamics are more important that an individual's skill. Even when we were in the lab in the wee hours of the morning and tired the team still found ways to lighten the mood and rejuvenate the motivation.
During capstone, one of the main things I learnt was the time and effort it takes to turn a design into a tangible product. As a group we had tested each individual part successfully many times before starting to integrate the complete system. At that stage everything started going haywire. Many unexpected problems occurred and it was during this stage that the gap between theoretical knowledge and practical skills became apparent. When the entire system was created on the breadboard it worked perfectly. However, when we started adding longer leads and attaching it to the jacket it suddenly stopped working. I wish I had more project experiences so that I would have been able to foresee the hurdles we faced.

In the end, I had a positive capstone experience. I am glad we were able to produce two prototypes in the span of 3 months. I have a new respect for start-up companies and hope that Athletic Innovations will be able to turn into a successful consumer product.

Ricky Train Reflection

I was mainly tasked with implementing a heart rate sensor into our jacket as well as integrating a microphone and speakers into our system. Along with these as my main focus, I also was

responsible for overseeing the circuitry design of the overall jacket, debugging problems with connections and choosing the portable power supply. I believe our group dynamic and division of responsibilities allowed us to best utilize our different strengths in order to provide the maximum contributions. Even with the division of tasks, we were still flexible in shifting our focus to technical problems that required more brainpower. We were only able to complete a demonstrable prototype because our team had the motivation and drive to spend countless hours in the lab in order to iron out the problems.

Initially, we attempted to create our own heart rate sensor using an open source design but was met with difficulty. This involved not having the exact components and also having noise affecting our small ac signals. Since I was using a breadboard to prototype the circuit, I had to acquire through-hole mounted parts that would provide the same function as a surface mounted part. I believe this slight difference in selection of parts is why I was not able to have the heart rate sensor circuit working and had to order an off the shelf heart rate sensor. Thankfully, the off-the-shelf heart rate sensor had plug and play capabilities with the Arduino. Throughout this Capstone project I have picked up and improved on various technical knowledge and techniques. Within the heart rate sensor was a photodiode that outputted a signal based on the reflected light and amplification was required for this signal. I had to review my knowledge on operational amplifier circuits in order to understand this part. During this stage of the project, I refreshed my ability to discern information between electronic components through the use of their datasheets. This was especially useful when I was trying to decide between different components.

Due to being on co-op for one year and completing mainly physics courses recently, many of the knowledge learned in prior courses have been not utilized till now. I had to review much of the circuitry knowledge and filter knowledge before I was able to make progress with the microphone and speaker circuits. I tried to design an amplifier for the speakers but soon realized that there was a built-in amplifier within the Bluetooth module. Again, an amplifier was required for the microphone and I had to apply op amp knowledge to create a circuit that amplified the signal from the microphone. After which, filters were designed to remove the noise before sending to the Bluetooth module. I was able to have a functioning microphone circuit that was capable of making phone calls when connected to the module but once integration began problems occurred. Though in the end I was not able to integrate a working microphone circuit into the jacket, we were able to record a video of the functions before integration.

From this experience, I learned that the integration process requires much more time and effort and just because the feature works while isolated does not mean it will work once connected. If I was to undertake a similar project, I would set and maintain early deadlines so that significant time remains for the integration and testing process. The one thing I would

change with regards to ENSC 305 and 440 is to allow more than 4 months to work on a Capstone project. This would allow for more ambitious projects and also provide more leeway to each stage of the project

Michael Ng Reflection

It has been a pleasure working with this group because all of its members are dedicated, ambitious and kind. We have weekly in-person meetings for progress updates and often have group work sessions that function similarly. One improvement I would make to the team dynamic would be that we could improve our communication if there are problems between team members. Should conflicts arise, the issue should be addressed directly instead of being quiet or passive aggressive about the situation.

For written assignments, tasks were divided up and an internal deadline was set for each person to complete their portion. We would then have group editing sessions. An improvement for the group would be to shorten these editing sessions, as they could be quite time consuming. This is especially true for the Functional and Design Specification documents. The quality of the document was always quite high, but the length and efficiency of time spent was not quite where I wanted it to be.

This project has exposed me to working in the realm of wearable technology. So many compromises in our jacket design had to be made, due to considerations to the comfort or safety of the wearer. One of the biggest examples that comes to mind is the choice of using the Lilypad Arduino since it's more suited for wearable technology. Another good example is having to waterproof or contain all circuitry to ensure the users safety. While these restrictions were hindrances in some areas, it provided a rather fun and unique challenge to our design.

Another lesson learned from this project is the importance of allocating time for research purposes. Comparing the timeline we created at the outset of the project to how much time we actually spent researching, it wasn't nearly enough. There have been quite a few times where we have found a circuit design or a hardware part that seems great to use, but turned out to be the wrong choice after further research. I realize that part of design is trial and error, I now realize how important it is to allocate time for research.

That being said, I'm quite grateful for all the research that I've have to do because it taught me how to research in smart and efficient ways. The starting phases of research and design were quite slow and cumbersome for me, but it became quicker as time went on.

Some technical skills I've acquired throughout the project is a proficiency in circuit construction and design. The lessons from ENSC 220, 320 and 325 were definitely relevant for the portions of the project that I undertook. My hardware skills were pushed to the absolute limit with this project.

In conclusion, there were many lessons learned over the course of this project; much more than could be reasonably stated in a one page summary of the experience. That being said, I'm really grateful for the opportunity to work on this project.

Chelsea Huang Reflection

This experience has been incredibly hard but even more rewarding. From the beginning of the engineering science program at Simon Fraser University I had been looking forward to Capstone and I felt that it exceeded my expectations. I really enjoyed having a course where we were able to apply many and more of the skills we have learned in class to actually create a working prototype. I wish more classes would follow a structure like that because I believe I have learned more practical skills through this project. I think future offerings of this class will be even better now that the school is migrating to offering 8 month programs. This way teams won't have to focus so much on documentation throughout the semester, but I think it would be more important for teams to meet their targets. I think our team would have benefitted by setting harder deadlines for specific components of our product throughout the semester.

Our team dynamic was very well balanced. We had two people focussed on software, two people focussed on hardware, and one person focussed on firmware/Bluetooth. We were all also willing to help each other. In the end, hardware and firmware took longer to complete because of integration, and it would have been helpful to have an additional person on both of those teams. I think software finished earlier because we had worked very steadily throughout the semester since we were anticipating a larger learning curve than the rest of the teams. I think if we had interspersed more integration time throughout the semester, Sam and I would have been able to help hardware and firmware more. In the last couple weeks of the semester, all five members of Athletic Innovations focused on assembling and integrating the project together, and these weeks will be what we remember fondly.

I really love that we are able to choose boundless projects. Because of this, I not only learned to solder efficiently, research parts, and code in Java and XML, but I also learned how to sew, manage my time better, and think like a business owner. Treating our capstone project like a start-up company really added to the magic of this experience. As Chief Financial Officer of our company, I created a budget based on what we originally thought we needed and really learned how much can go wrong in the terms of purchasing parts. For the majority of the

semester, I had thought to myself that we were doing really well because we had not even spent more than the $550 we received from the Engineering Science Student Endowment Fund. But in the last 2 weeks of the project, we spent the remaining money in the budget because of unanticipated oversights.

Originally, I was wary about working with people that are very close to me socially. I was worried that through the stress of our project we would hold resentment towards each other. In reality, I found that this experience actually brought us closer together because we were able to celebrate our triumphs together.

7. Conclusion

This post mortem was written to highlight some of the trials and tribulations we faced as a team while creating a proof-of-concept for our RunWare product. We were able to create two prototypes, a male and a female version, of our RunWare product. Although, the design has changed during the course of the project, we are pleased with our current design concept. The budget and a work breakdown for each member was also included. We would like to take the experience we have gained during this project and implement our ideas for future RunWare designs.

References

[1] Wikipedia, 'Activity tracker', 2015. [Online]. Available: http://en.wikipedia.org/wiki/Activity_tracker. [Accessed: 10- Apr- 2015].

[2] Wikipedia, 'List of Bluetooth profiles', 2015. [Online]. Available: http://en.wikipedia.org/wiki/List_of_Bluetooth_profiles. [Accessed: 10- Apr- 2015].

[3] Athletic Innovations, 'RunWare Proposal', 2015.

Appendix

1. Meeting Minutes:

November 12, 2014:

Meeting Called to Order @ 4:30pm

Action Items:

Sam (CEO) Chief Executive Officer: *Product/Company Name, Research Display Screen for Jacket, Research Heart Rate Sensors, Research Heart Rate Sensors (Light vs. Pressure), Learn to code in LaTeX, Setup Hub thingy, Learn to code that arduino shit and that app shit, Buy Journal - document research*

Neha (CMO) Chief Marketing Officer: *Product/Company Name, Scheduling (app/gantt), Research Heart Rate Sensors (Light vs. Pressure), Market Research on Relevance of components, Learn to code in LaTeX, Buy Journal - document research*

Ricky (CTO) Chief Technology Officer: *Product/Company Name, Research Power Supply, Research Heart Rate Sensors (Light vs. Pressure), Learn to code in LaTeX, Buy Journal - document research, Start on Arduino Research*

Chelsea (CFO) Chief Financial Officer: *Product/Company Name, Bluetooth/Sensor App Communication Capabilities, App communication, Voice Recognition, Sound Reduction in Loud Environments, Research Heart Rate Sensors (Light vs. Pressure), Learn to code that arduino shit and that app shit , Compose Letters for Funding applications (Deadline: Dec. 7), Learn to code in LaTeX, Buy Journal - document research*

Mike (CIO) Chief Information Officer: *Product/Company Name, Research Power Supply, Research Heart Rate Sensors (Light vs. Pressure), Learn to code in LaTeX, Buy Journal - document research*

Agenda:

1. Roll Call
   Present: Sam, Neha, Ricky, Chelsea, Mike
   Absent: None
2. Assignment of Roles
   - CEO: Sam Hafezi
   - CTO: Ricky Tran
   - CMO: Neha Chhatre
   - CFO: Chelsea Huang
   - CIO: Mike Ng
3. Company/Product Name
   - More brainstorming (AI for everyone)
   - Product: Wearable Technology: High Performance All-Purpose Lightweight Running Jacket

4. Scheduling and Administrative Issues
   - Gantt Chart
   - App: Trello
   - Documentation: LaTeX for formal write-ups, Google Docs for collaborating data and meeting minutes → SVN for code?
   - AI for Everyone: Buy a Black Journal (for research, etc.) - make sure to label and date each page.
5. Funding and Sponsorship
   - Late Jan: ESSEF
   - Chips and such: http://www.microchip.com/
     - free samples per person per month or something like that
     - will not be looked into until schematics and tests are fully thought through and spiced etc.
   - Vancouver-based Activewear companies:
     - Lotus Activa Yoga Apparel: http://lotusactiva.com/
     - Karma: http://www.karmawear.com/pages/about
     - Tonic: http://mytonic.ca/
     - J76: http://www.j76cw.com/
     - The Bay: http://investor.hbc.com/contactus.cfm
     - Stormtech Performance Apparel: https://www.google.ca/maps/place/Stormtech+Performance+Apparel/@49.2612825,-123.0221036,3a,52.5y,52h,90t/data=!3m5!1e1!3m3!1so01wP_JLYNgAAAQIt-jogA!2e0!3e2!4m2!3m1!1s0x0000000000000000:0xdc873b51c7eaec49!6m1!1e1 No website…
     - Lululemon: http://shop.lululemon.com/home.jsp
     - ..Roots?: http://canada.roots.com/on/demandware.store/Sites-RootsCA-Site/default/CustomerService-ContactUs
     - LIJA: http://www.lijastyle.com/shop/outerwear/jackets.html
     - Snowboard jacket Companies
     - Sugoi: http://www.sugoi.com/en-CA/contact-us
     - Nike/Adidas/SuperDry/etc.
6. Product Breakdown and Parts

   Initial Component Notes:

   Features:

   - Bluetooth Speakers and Microphone
   - bluetooth profiles: https://developer.bluetooth.org/TechnologyOverview/Pages/Profiles.aspx
     - GATT = Generic Attribute Profile
     - iPhone: http://support.apple.com/en-ca/HT3647
   - Located in the hood/collar of the jacket
   - Music: for user's enjoyment without obstructing important environmental sounds (traffic, nature, helicopters, etc.) and annoying internal sounds associated with in-ear running headphones
   - Microphone for voice recognition, communication and vocal commands with mobile phone - allow for phone calls, gps, and running statistics (distance, step count, heart rate, etc.) - distance run.
     - Noise reduction feedback loop for phone calls

    - Low frequency noise reduction for less annoyance for other end of call
- GPS: verbal cues through speakers via google navigation, so user does not have to constantly look at phone
- Materials:
    - Flexible speakers:
        - https://www.sparkfun.com/products/12723
        - https://itp.nyu.edu/classes/cdni-spring2014/ble-speaker-diagram/
        - lilypad mp3: https://www.sparkfun.com/products/11013
            - maybe for recreating, not for purchase
    - bluetooth transmitter:
        - http://www.circuitsathome.com/tag/bluetooth
        - https://developer.android.com/guide/topics/connectivity/bluetooth-le.html
            - Bluetooth Low Energy (BLE) designed to provide lower energy consumption, allows apps to communicate with BLE devices that have lower power requirements (eg. proximity sensors, heart rate monitors, fitness devices)
            - Android 4.3
    - microphone
        - https://www.sparkfun.com/products/8635
    - Safety
- Weather-proofing
    - dependent on jacket material, waterproof fabric spray: http://www.amazon.com/Armor-Fabric-Waterproofing-Natural-Fabrics/dp/B002WLUYUG
    - All wiring will be done within the lining of the jacket
- Fibreoptic/LED visibility strips along sides, front, and back of jacket - light dependent - will be more effective than reflective strips, as they will be more visible from afar, also more aesthetically pleasing as they will not be visible during the day
    - ASK FAISAL FOR RGB LED
- If CPU is required in jacket, will be removable using 8 or 10-pin connectors for machine washing. All wire connections will be used with heat shrink to waterproof connections
    - Power Sources/Magnetic Induction Charger
- decrease weight, and increase safety by creating a jacket that can power itself through movement
- inductor with a loose magnet, so that up-down movements will trigger charging
- inductor with magnet located in the elbow position, so that arm swings will trigger charging
- to power bluetooth, heart-rate sensor, and stepcounter
- possible hybrid?
    - Heart-rate sensor
- with an e-ink or LED display on the lateral side of the forearm
- will be located on the cuff of the arm to measure pulse and wrist
- possible thumbhole add-on sleeve for more accurate results
- communicates with application, so pulse can be verbally communicated via speakers when prompted by user

- Wearable OLED Displays/ Flexible e-ink http://www.idtechex.com/research/articles/plastic-logic-shows-a-flexible-oled-display-for-wearable-devices-00006435.asp
    - BACKBURNER: Stepcounter
- will be able to communicate with phone applications (eg. S Health)
- counts both steps and distance
- uses an accelerometer to track up-down movements
- will be displayed with heart-rate
- communicates with application, so distance and stepcount can be verbally communicated via speakers when prompted by user
    - Mobile Phone Application
- to sync and display all functions and communicate with jacket via bluetooth
- Android for proof of concept
- apple, windows, blackberry moving forward?
- Google API for Maps, etc.
- C/C++/C#: QT, GTK+, Visual Studios
- Java: AWT, Swing
- Functionality:
    - GPS Distance
    - Voice Control: Phone Calls, Music Control, Running Stats
    - Music Control
    - Environmental-based Music Reduction
    - Arduino Lilypad
- for CPU processing in jacket? http://arduino.cc/en/Main/arduinoBoardLilyPad
- http://arduino.cc/en/uploads/Main/LilyPad_schematic_v18.pdf
- accessories (LEDS!): https://www.sparkfun.com/categories/135
- designed specifically for wearables and e-textiles
- lightweight, washable
- a circle, approximately 50mm (2") in diameter. The board itself is .8mm (1/32") thick (approximately 3mm (1/8") where electronics are attached).
    - Running Jacket Options (do last ~mid-Jan/early-Feb)
- Womens, Target < $40 (Champion): http://www.target.com/sb/activewear-women-s-clothing/activewear-pullovers/activewear-sweatshirt/-/N-5xtclZ55qvpZ55xhw#?lnk=Grid_WmActv_11_0_X0Y0W4_29_9_2014|X0Y0W4|T:Template_Grid1A|C:CMS&intc=2089582|null
- Mens, Target <$45 (Champion): http://www.target.com/sb/activewear-men-s-clothing/running/-/N-5xu2eZ5xwdh#?lnk=Grid_MenAct_1118_X0Y0W4|X0Y0W4|T:Template_Grid1A|C:CMS&intc=2070053|null
- Womens, Walmart $11 (Danskin): http://www.walmart.com/ip/FAST-TRACK-Danskin-Now-Womens-Dri-More-Zip-Up-Hoodie/29116342
- Mens, Walmart <$20 (Various): http://www.walmart.com/browse/clothing/men-s-activewear/5438_133197_592999?page=2&cat_id=5438_133197_592999

Meeting Adjourned @ 6:00pm

Next Meeting: Thursday, Dec. 18, 2014 - Downtown ~ 5:00pm

January 9, 2015:

Meeting called to order at 12:37PM

Action Items:

Research deadline: Jan. 18

Software Conceptual: Jan. 16

Logo Design:

Design Requests: Jan. 12

Designs Receival: Jan. 17

Goals for this week:

- **Hardware**: figure out what the arduino can take. Will have heartrate methodology completely done by the 18th.
- **Software**: UI Design for app. Use arduino to try bluetooth communication. Set up SVNs
- **Purchases**: Arduinos (2 lilypads (14 digital (6PWM out), 6 analog): $25), Bluetooth Module.

Personal descriptions should be done by next week. If we don't all have professional photos - photo shoot at next week.

CH: More sponsorship letters. Keep eye out for ESSEF email. Start Budget

Agenda:

1. Roll Call
   Meeting called to order: 12:11PM
   All members present
2. Formal Acceptance of Company and Product Name
   Company name: Athletic Innovations
   In Favour: 3
   Opposed: 2
   - Athletic could be considered restrictive to our growth
   - Move to change to Active Innovations
     - Rejected because sponsorship letters have been sent using the original name
     - Move to vote again for Athletic Innovations
       - Passes unanimously

   Product name: RunWare
   All in favour: Unanimous

a. Company and Product logo brainstorm

- outsource our design to either Oscar (neha's friend from high school) or Neha or Mike's graphic design friends (in black and white, we will color on our own) or Pouya
- we will give ideas to oscar and he will draw them out
- avoid a picture of a person running (too stereotypical)
- Focus on letters AI - but don't look like art institute or alan iverson (bball player)
- heart made out of circuits
- muscle and circuitry mix

- Look tech-y (circuitry) but minimalistic
- Colour scheme: Metallic to go with technology theme; Pastel/light green
- Deadlines: requesting people - Jan 12, designs in to us: Jan 17

3. Updates:

a. Funding and Scholarship

3 emails sent, more to come. will be sending follow up emails this week.

b. Research Progress

Ricky: Heart rate sensor: optical. Most wrist base - 2 LEDS, light up capillaries which expand and contract as blood pumps. Sensor will track the expansion and use data for algorithms (research pending) and give heart rate, blood pressure. Kick starter proejct - buy, open source, clip to finger or ear. National Instruments (chip creator company) - white paper (open research) on creating a heart rate sensor. Downsides: most wrist based are not very accurate (off by 40-30 bpm) CNET had an article comparing wristbased to ECG - article published last year, found not very accurate. Compared to Samsung S5 - very accurate b/c finger veins are better linked to heart - same method. MIO: wrist-based, fairly accurate on wrist - sensors and complete products - sell to addidas. We should find out if we need to build our own sensors. **Al ask Andrew about these sensors (will we build or buy) - we can email companies to ask if they will sponsor it to us.** Some sensors need you to stop for 30 seconds to figure out heart rate. Normal light effects sensibility, but within jacket should be fine. If we do end up doing our own algorithm - we will have to worry about sampling rate. Measure average? etc. Ability to function in high and low temperatures - will our sensor be able to hold up in that temperature for testing. In general this is not a common problem. We can ask restaurants for their big fridge for testing.
Generating energy while running - very very difficult - makes system a lot more complex. We already need a LiOn battery for circuitry. The one company that is doing electricity from motion - sold assets, physics does not work. Unanimous decision - idea is cut. Bluetooth adapters will be small. Has Arduino Uno for us to work with. To do some fundamental work. Will begin playing with it to gain some familiarity.

Mike: Heart rate sensor - studied touch base monitors (similar to ones in treadmills) and may be do-able but feasibility issues, but would have to go on palmside of thumbholes. down sides: inaccurate if hands are too dry or running too much, will not get a good reading; metal plate - maybe intrusive, maybe able to find a flexible sensor. More research pending. Hard to measure while running in general

Chelsea: Instructable - activity tracker with accelerometer: http://www.instructables.com/id/Make-your-own-activity-tracker/ Other possibly useful instructables: http://www.instructables.com/id/Voice-Activated-Arduino-Bluetooth-Android/ http://www.instructables.com/id/DIY-Tough-Bluetooth-Speaker/
Compiled list of popular applications for fitness tracking (pdf will be uploaded to google drive). Software needs to start this week. Conceptual design sketches will be done by Wednesday and coding will begin immediately after. SVN will be set up for collaborative

work. Detachable Music headphone stuffs - Collar preferred (sketches located page 10 of Chelsea's notebook)

Sam: heart rate - focus more on speed than accuracy in terms of monitoring heart rate during run. Team agrees. LATEX - started coding in it - good because dont get bogged up with how things look. Issues: comes with some default document types (book, journal article, letter, IEEE transactions, etc.) looks very professional but don't know how to customize yet. LATEX vs. Word? Would still be good to keep Latex because design doesnt matter as much as content. In the end if it does not work out it would not be hard to copy and paste into Word. Makes bib, ToC, LoF, etc. We will know if this is working for us by the proposal document. Set up a SVN for LATEX so at *least* one other person (Neha) will know it. And content can be uploaded to Google Drive and Sam and Neha will integrate into big project. Let's get 3 arduinos in case we blow them.

Neha: For testing can obtain a chest heart rate monitor to compare accuracy of our heart rate monitor. Will try to borrow from BPK department. We can get LED's from Grow-Op group from previous semester's project. We can buy a fitbit zipper for our product ($10) - calories burnt, etc, but not sleep. We can get LEDs from Grow-op group - so we will ask for 150.

c. Formal assignment of roles/focus

Software Leads: Sam, Chelsea

Hardware Leads: Ricky, Mike

Integration Lead / Arduino Specialist: Neha

Passes Unanimously

4. Timeline outline

We will have each element of the jacket complete concurrently so we will be able to test software and hardware integration as we go.

- A. Hardware (includes Arduino) Schematic and Theory Completion date order:
  - (1) Arduino purchase (this week)
  - (2) Heartrate Monitor
  - (3) Speakers/Mic/Headphone Collar
  - (4) LED's

ii) Hardware Completion date

iii) Software Conceptual completion date

b) Software application completion date

c) Bluetooth

d) Implementation and Testing

e) Deadlines:

Monday, January 26	Project Proposal
Monnday, February 16	Functional Specification
Late February	Oral Progress Reports
Monday, March 16	Design Specification
Monday, March 30	Written Progress Report
April (due at demo)	Group Presentation/Demo
April (due at demo)	Engineering Journals
April (due at demo)	Post-Mortem + Minutes

5) New Business
   a) How much are we all willing to contribute personally:
      - Mike: willing to give whatever it takes.
      - Ricky: $100 first, if need arises we will add more.

6) Personal descriptions should be done by next week. If we don't all have professional photos - photo shoot at next week.

7) Research deadline: Jan. 18

8) Software Conceptual: Jan. 16

Goals for this week:

Hardware: figure out what the arduino can take. Will have heartrate methodology completely done by the 18th.

Software: UI Design for app. Use arduino to try bluetooth communication.

Purchases: Arduinos (2 lilypads (14 digital (6PWM out), 6 analog): $25), Bluetooth Module.

Meeting adjourned at 1:25pm

January 16, 2015

Meeting called to order at 1:24pm

Action Items:

Sam: Begin App development of main page (Ongoing)
- Email the Profs re: Confidentiality
- Letter of Transmittal (Wednesday)
- System Overview (Wednesday)
- Possible Design Solutions (Wednesday)
- Sources of Information (Wednesday)
- Company Profile (Wednesday)
- LATEX (Saturday)

Neha: Investigate bluetooth modules for Android Apps and wakeup triggers with bluetooth
- Send us the pics
- Executive Summary (Wednesday)

- Introduction
- Conclusion (Wednesday)
- Possible Design Solutions (Wednesday)
- Sources of Information (Wednesday)
- Company Profile (Wednesday)
- Book study room for Saturday, Jan 24

Chelsea: App development of main page (ongoing)

- Market research - talk to mother/running coworkers re: design choices and what kind of needs/wants they have for running and running jackets
- Buy Starbucks gift card for designer (Friday)
- ESSEF Funding Questions (Friday)
- Possible Design Solutions (Wednesday)
- Proposed Design Solutions (Wednesday)
- Sources of Information (Wednesday)
- Budget (Wednesday)

Ricky: Hardware research completion (Sunday)

- Do an AskReddit on likes/dislikes/futurewants of wearable technologies
- System Overview (Wednesday)
- Possible Design Solutions (Wednesday)
- Sources of Information (Wednesday)
- Company Profile (Wednesday)

Mike: Possible Design Solutions (Wednesday)

- Proposed Design Solution (Wednesday)
- Sources of Information (Wednesday)
- Team Organization (Wednesday)
- Company Profile (Wednesday)

Meeting Minutes

1. Roll Call - Everybody Present
2. Last Week Updates:
    a. Software Conceptual

    Finished. Sam and Chelsea worked on it. Showed sketches of UI to everyone. Sam worked on graph demonstrating communication between app and hardware and jacket and (future) cloud. Login: Start with main page and check for credentials. Not essential, but nice to have. Android basic tutorials done for Sam. Waiting for Icon from Mike to put into design.

    Neha AI: Investigate bluetooth modules for Android apps. Wake up triggers with bluetooth.

    When app UI is done, Sam and Chelsea will join Bluetooth.

    b. Budget

    Done, on google docs. Need model number for heart monitor.

    c. Logo

    We received a design from Brendan Lane on Wednesday.

    We will give a $20 Starbucks Gift Card to him for his service. Will be added to budget

    d. Personal Descriptions

    We were supposed to do this last week. No one did.

    e. Further Research

Checking what sort of I/O pins all sensors need, then will go to work on Arduino. When Arduino starts, Neha will join to help (Bluetooth connectivity).
Will look for Canakit for buying wiring for Arduinos. Arduinos will be in locker.
Ricky will be looking into temperature sensors. By sunday, will compare other wearable technologies to see what is feasible and relevant for us to implement if it is good for our product.
MagLock - using a magnet to put our features in, so we can remove for washing.

3. This Week's Goals:
    a. ESSEF Funding

We want to keep our idea away from other students
Bring food and drink for people coming to watch our presentation.

    b. Proposal Delegation
        i. Round 1: Writing

Letter of transmittal - Sam
executive summary - Neha
Introduction: Neha
System Overview: Ricky (HW), Sam (SW)
Possible Design Solutions: Everybody come up with 1
Proposed Design Solution: Chelsea, Mike
Sources of Information: Everybody
Budget and Funding - Chelsea
Schedule - Neha
Team Organization (1 overall paragraph) - Mike
Company Profile - Everybody
Conclusion: Neha

        ii. Round 2: Upload through LATEX
        iii. Round 3: Edit

Get together and read outloud and edit each part together
We can book a study room
downtown:
http://roombookings.lib.sfu.ca/studyrooms/week.php?year=2015&month=01&day=23&area=3&room=18

Meeting Adjourned at 1:59pm

January 30, 2015

Meeting called to order at: **9:47 am**

Action Items:
Ricky:
- *Complete verification of parts and tell Chelsea (Sunday, Feb 1)*
- *Verify information from Neha's email (Sunday, Feb 1)*

Mike:
- *Verify Email and parts as well*

Neha:
- *Email Elastolite re: sponsorship (Draft to Mike and Ricky: Sunday, Email: Wed)*
- *Follow up with Lululemon*

Chelsea:
- *Contact Lilypad store to see if they will refund or exchange our item*
- *Begin ordering parts after Sunday*
- *Work on UI*

Sam:
- *Follow-up with ESSEF*
- *Work on UI*

Next Meeting: Tuesday, Feb 3 @ 8:30pm via Skype

All Members Present

Agenda:

1. **Post-Proposal Thoughts and Feelings**

- Good, let's keep it going
- The things talked about today in 305W should be used for our future documents as we probably used some of those things (7 deadly sins, nominal style, verb style, etc.)
- Really happy about sticking to internal deadlines. We likely need more internal deadlines to keep us on track.

2. **Progress Reports**

- Hardware:
    - Looked at all of parts and voltage requirements: There is a range of voltage we can function at; needed minimum 3.6-4V battery, *battery can be purchased last,* but we should look at getting parts
    - We will try to contact the N. Vancouver store to see if we can exchange or return the lilypads we already have so we can get the ones with 22 pins.
    - Heart rate: need memory, because its not instant, theres only flash memory on the arduino. 100KB. Looking into buying a DRAM for that.
    - Built in ALU?
    - Deadline: Sunday, Midnight - Parts verification and begin ordering.
    - LEDs - Mike Theim already thinks we have them due to miscommunication
    - Elastolite - Michael and Neha looked; does not know how it would be integrated into our jacket. Irons on. Lightweight. Waterproof. No Heat. Meant for wearable technology. More of a subtle glow. Dat "sexy".
        - Neha will draft email and get Ricky and Mike to make sure our technical information is correct and she will email them (draft Sunday, email Wednesday)
- Software
    - Started on app. Goal is to finish UI
    - Using our own font is a bitch.
- Sponsorship
    - ESSEF updates: No one knows yet, Daniel (VP Services, ESSS) is going to ask Nancy Bart how much money is available to be given out

- Lululemon Metrotown, Roxy, meeting later today; they said they want to help, even if store does not go trhough, Neha will contact head office again. Also emailed Coquitlam Center to see. If does not pan out, we will email all lower mainland stores.
- We really want Sugoi, they have been contacted. They are best fit because they are local, have a wider range (running jackets, high performance ski/snowboard jackets - which we want to expand into if we go to market).

3. **Overall Deadlines Discussion**

- FS barebones up on drive. Delegate parts?
    - 11th group editing
    - 9th parts done
    - Work together throughout reading break during the evenings, except 12th.
    - Parts will be assigned during the week via Skype or Text. 8:30pm on Tuesday.

4. **This Week's Goals**

- From Gantt:
    - Functional Specification 1-Feb-15
    - Bluetooth Connectivity (Software) 25-Jan-15
    - Heart Rate Sensor (Hardware) 25-Jan-15

Meeting Adjourned at 10:13am

February 3, 2015

Action Items:

Ricky:
- *Hardware System Overview*
- *Heartrate System Overview*
- *Power System Overview*
- *Reliability and Durability Standards*
- *Testing*
- *System Test Plan*

Michael:
- *LED & Visibility System Overview*
- *Power System Overview*
- *Safety and Charging/Power Standards*
- *User Documentation*

Neha:
- *Executive Summary*
- *Introduction*
- *Intended Audience*
- *Arduino System Overview*
- *Visibility and Usability Standards*
- *Conclusion*

Chelsea:

- *Audio Hardware Overview*
- *Software System Overview*
- *Waterproofing and Wearability Standards*

Sam:

- *Letter of Transmittal*
- *Title Page, Formatting*
- *System Requirments*
- *Software System Overview*
- *Android Design Standards*
- *Testing*
- *System Test Plan*

Content due Feb. 9
Group editing session on Feb. 11: Harbour Center Library 1047 @ 4:30pm
Bring Computer or something so we can group view via Google Hangout

Agenda:

1. **Assignment of parts for Func Spec:**
   letter of transmittal - *Sam*
   title page - *Sam*
   executive summary (non-tech) - *Neha*
   table of contents, list of figures and tables
   Introduction - super brief, about product ***-*** *Neha*
      Scope - what the document entails 2 sentences. -- *Group*
      Intended Audience - who will use the product and why therefore what kind of things to we need and why- *Neha*
      Classification - formatting -- *Group.*
   System Requirements -- *Sam (after content is written)*
      System Overview (*include General, Physical, and Electrical, and Environmental and Material Requirements as well)*
         Hardware (Electronics/Jacket) -- *Ricky*
            ****INCLUDE PICTURE HERE*****
            HeartRate -- *Ricky*
            Audio -- *Chelsea*
            Arduino -- *Neha*
            LED & Visibility -- *Mike*
            Power -- *Ricky and Mike*
         Software (App) -- *Sam and Chelsea*
            Minimum Required OS for App: APK 17 - Jelly Bean 4.2
   Standards
      Standards (waterproofing, durability, wearability, visibility, charging standards, etc.)

Android Design Standards: Sam
Waterproofing and Wearability (Strain Relief): Chelsea
Reliability and Durability: Ricky
Safety and Charging/Power Standards: Mike
Visibility(Brightness, placement of lighting strips) & Usability: Neha

Testing -- *Sam and Ricky → Individual component testing and Integrated testing*
User Documentation -- *Mike*
System Test Plan -- *Sam and Ricky*
Conclusion -- *Neha*
Glossary, and References -- *Group*

Content due Feb. 9
Group editing session on Feb. 11: Harbour Center Library 1047 @ 4:30pm
Bring Computer or something so we can group view via Google Hangout

Meeting Adjourned at 9:36PM

February 26, 2015

Meeting called to order at: 7:51 pm

Action Items:

Ricky:
- **Intro:Heart Rate Monitor**
- **Timelinme: All subsystems**
- **Problems & Tasks Left: Hardware w/Mike**
- **Plan B: Hardware w/Mike**

Michael:
- **Intro: EL Circuit**
- **Progress: Planning & Fabrication**
- **Problems Left: Hardware w/Ricky**
- **Plan B: Hardware w/Ricky**

Neha:
- **Intro: Team and Project Scope and Problem Statement**
- **Intro: Microcontroller**
- **Timeline: Acquisition**
- **Plan B: Other**

Chelsea:
- **Intro: Audio**
- **Budget**
- **Timeline: General**
- **Progress: User Meetings Experimentation**
- **Problems Left: Software w/ Sam**

Sam:

- **Intro : Software + GPS**
- **Progress: Test/Measurements :)**
- **Progress: Documentation**
- **Problems Left: Software w/Chelsea**
- **Plan B: Software**
- **Conclusion11**

Roll Call: Everybody present via Skype

Agenda

1. **Progress Reports**
    a. **Software**
        - Chelsea needs to learn to update through Git
        - UI is 80% done so we need to speed things up
    b. **Hardware**
        - Everything has been ordered or is there. More parts are on their way
        - Circuits are drafted up
        - No real progress on speakers or accelerometer yet
        - speakers and wiring have been thought of
    c. **Other**
        - Bluetooth works, currently looking at heart rate monitor code from Ricky's website for idea
        - Code for accelerometer is done - will need to be tweaked for our requirements first
2. **Assignment of Parts for Oral Presentation**
    - See Action Items

Meeting adjourned at 8:52pm

March 4, 2015

Meeting called to order at 9:34 PM

Action Items:

Ricky: Work on Heart Rate circuit on Friday 2:30-5:30

Michael: Work on Heart Rate circuit on Friday 2:30 - 5:30

Neha:Work on Heart Rate circuit on Friday 2:30-5:30

Chelsea:

Sam:

Roll Call: All Present

Agenda:

1. **Progress Reports**
    a. **Software**
    - Added Location Awareness to map in application
    - Currently trying to figure out how to use phone's GPS location and align map to phone's coordinates
    - Changed map to include terrain
    - Included Location API as it is separate from Google Maps API

    b. **Hardware**
    - Parts Arrived, and the EL wire circuit is complete
    - Circuit is operational, but not up to our standards yet
    - EL Wire is not as bright as we want it to be
        - Tradeoff between maximum brightness versus effectiveness of ambient light sensitivity
    - Most of Heart Rate circuit built, just require to connect surface mounted parts, and then commence testing
    - Work will continue on Friday, barring any unforeseen explosions
    - No progress on accelerometer

    c. **Other**
    - Analyzed accelerometer code for Arduino
        - Can't be tested until circuit is completed
    - Heart Rate monitor code is nearly complete, currently being worked on
    - Software team needs to talk to Neha to discuss requirements from heart rate code (Software only requires a number from the heart rate calculations, ie. the final BPM)
    - Drew schematic of arduino inputs/outputs

    d. **Reflections of Month of February**
- Neha : We've worked well as a team. Personally more involvement aside from documentation is needed. We seem to be doing relatively well in regards to other groups this semester
- Ricky: Agree's with Neha. More involvement on everyone's part is needed. We shouldn't be comfortable with our current pace.
- Mike: We should spend 3-4 times a week working exclusively on the project.

- Sam: We've done adequately so far. There's been good progress so far, but we've got a lot of ground to cover. However, I believe we can still easily hit our deadlines if we dedicate ourselves to the project
- Chelsea: Feeling overwhelmed with amount of work remaining on project. Worried about time commitment due to co-op. Even though other groups don't seem to be on the same pace as our group, we should not use them as our standard for ourselves.

2. Function Specifications Feedback

a. Do we think mark is deserved?

- Not particularly.
- We lost marks due to unmarked headings, even though we all chose as a group to leave them unmarked which was our mistake
- We also lost marks since Sam forgot to include the letter of transmittal in the final PDF even though it was completed
- We lost 0.5% for no reason regarding our Title Page, and got no feedback as to why
- ~~We lost marks since we didn't write ENSC 440W, even though that's not the name of the course~~
- We don't need contact person and email for title page, so why were we docked marks for it?
- We lost marks due to "difficult to locate" pages numbers, which were not an issue for the previous document we handed in. In fact we were given praise for the quality of the document
- How did we lose a mark for professionality?
    - There seems to be a mismatch between what the TA thinks the functional specification is, and what Professor Whitmore explained it as
    - Whitmore said functional spec should focus on "What, not how", where as the TA seems to disagree
    - It was our understanding that circuit diagrams are unnecessary for functional specs
    - We did not want to include repeated images from our proposal that would not add to what we aimed to portray to the reader in the functional specs
- We lost marks for CSA standards, even though we seemed to include the same amount as previous groups had

- As a whole, the marking seemed unnecessarily critical and unfair

To Discuss with TA:

- We were wondering about the format of the title page.

b. What will we do to address our issues?

- We have emailed Jamal to discuss how we can improve for next time

Meeting adjourned at 10:24 PM

March 11, 2015

Meeting called to order at 9:07 PM

Roll Call: All members present via Skype

Agenda:

1. Design Spec Layout and Assignments
    - See “DS Rubric/Layout” for assignments
    - Timeline
        - Content done by March 15 to Sam Hafezi
        - Group editing on March 17 @ SFU at 7:30pm
            - Neha is booking room
            - BRING YOUR LAPTOPS - AI for team to text mike to remind him
        - Meet with TA on March 18
        - Submit March 19
2. Meeting with T.A.
    a. Recap
        - Met with T.A. on March 6 to discuss our marks from the Func. Specs.
        - T.A. was very constructive but we believe his interpretation of the rubric differed from what we were taught in class
    b. Moving Forward
        - Meet with Whitmore before 2:30pm on Friday
        - CEO will email him to ask for a meeting.
        - contingency meet next week

Meeting Adjourned at 10:05pm

March 29, 2015

Athletic Innovations

Meeting called to order at 12:46 PM

Roll Call: All members present

Agenda:

1. Implementation progress

- Hardware:
    - EL wire is completely done
    - Should we scrap the idea of building our own heart rate monitor?
        - Ricky: we believe the reason it isn't working
    - Audio Subsystem needs to begin...like now..
    - MAJOR issues with Bluetooth
        - do we want to get a new bluetooth module or do minor interruptions in the music when sending step count and everything like that.
            - why would anyone want to buy the product if it wasn't continuous
        - ALSO: current bluetooth isn't able to stream music
            - does it have Hands-free Profile? no….. and that's probably why
        - Possible Solution: RN-52 - Sam and Neha will do more research and order if this is sufficient
            - Sam can pick up from Point Roberts
        - Neha: We should enable interrupts - Ricky agrees
- Software:
    - App is completely done. We will now try to implement voice control because we have some extra time
    - We believe bluetooth works fine since we are able to establish a connection with the current module, but if we get a new one this will have to be reworked (most likely) - Chelsea will do more research
- Jacket:
    - hole has been cut into jacket for pocket placement

2. Today's plans, Future plans:
    - AI Neha: Order the new bluetooth module and pulse sensor replacement for Ricky
    - AI Sam: Pick it up please

Meeting Adjourned at 1:11 PM

April 9, 2015

Athletic Innovations

Meeting called to order at 2:31 AM (*technically April 10th)*

Roll Call: All members present

Agenda:

1. Presentation Breakdown
    - Michael has already created barebones powerpoint and Sam has filled in more content and pictures
    - Sections Assignment:
        - Introduction
            - Sam
        - The Team
            - Sam
        - Market

        - Neha
    - Timeline
        - Neha
        - Moved up from near bottom to better compartmentalize parts
    - System Overview (General)
        - Mike
    - High Level Overview(s)
        - General: Mike
        - Variable Lighting: Mike
        - Heart Rate: Ricky
        - Audio: Ricky
        - Accelerometer: Neha
        - Microcontroller: Neha
        - Software: Sam and Chelsea
    - Budget
        - Chelsea
    - Lessons Learned
        - Chelsea
    - Conclusion
        - Sam
2. Post-Mortem Breakdown
    - Chelsea has started on a barebones sections and content
    - Assignment of remaining parts: (..we will all work on this tomorrow together after presentation)
        - Heart Rate and Accelerometer
        - Microcontroller and Bluetooth Module
        - Future Plans
        - Budget
        - Schedule
        - Team Organization
            - Reflections: Mike is done, rest of us still have to do it
        - Conclusion
3. Final Reflections
    - We want to go home and sleep, but good job everybody!

Meeting Adjourned at 3:05AM