Post Mortem Analysis for an Assistive Rehabilitation Device Named:

Team Members: Zachary Nunn
Alexandra Talpalaru
Ashley Lesperance
Shaquile Nijjer
Karsten Harder

Contact Person: Alexandra Talpalaru
atalpala@sfu.ca

Submitted to: Dr. Andrew Rawicz
Steve Whitmore
School of Engineering Science
Simon Fraser University

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Solegait

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1. Introduction/Background

Over the course of the semester we have put together a company and implemented the steps of product design, from concept to prototype. Our group consists of 5 engineers from different specialities: Ashley Lesperance, Zachary Nunn, Karsten Harder, Shaquile Nijjer, and Alexandra Talpalaru. Together we came up with the idea and design of our product, Pods. The following document summarizes the purpose, main functionality, components, cost, timeline and challenges of taking Pods from inception to prototype.

We have developed a device that helps in rehabilitation of gait related pathologies, including, but not limited to, athletic injuries, over pronation, over supination, flat foot and plantar fasciitis. The current techniques used by medical professionals for evaluation walking mechanics include: an assessment of symptoms, localization of the pain, and visually determining gait patterns using treadmills, force plates, and sensor detecting cameras. These methods are lengthy, expensive, and can only be found in a laboratory setting. In order to rival current technologies, we decided to build a device, named Pods, that allows the user to quantify pressure distribution during gait through a mobile application. This application would also provide suggestions for improvement of gait patterns. This information, being much more accurate and reliable compared to the human eye, can be used to provide a thorough injury analysis, and a more effective rehabilitation program.

2. Project

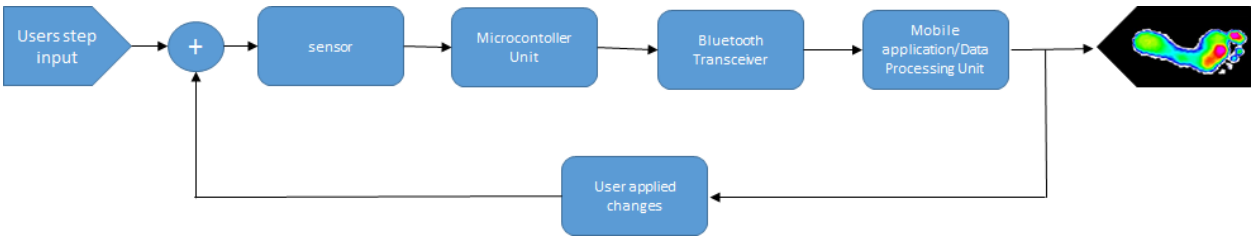

Figure 1: Pods flowchart

2.1 Main functions

Our device was intended to provide the user with accurate data, quantifying their gait. More specifically, to provide a depiction of the pressure distribution on their sole – a pedobarograph. The mobile application displays the data in real-time, and the plot is simple and intuitive. We decided to implement the app using one insole, however, the next step of this device, is to implement the second insole.

2.2 Project modules

This section includes the insole, electronics, data processing and application modules for the project.

2.2.1 Insole

As described in the design specification document, the insole uses force sensitive resistors implementing an 8 by 8 matrix giving 64 sensors. Figure 2 below shows the sensor placement of all 64 sensors mapped out to illustrate the insole design.

Figure 2: Mapped out Sensors on Insole

Sensor positions are spread or condensed in regions which are of higher important to understand the user's gait, such as condensed in the heel and ball of the foot and more spread in the large region of the arch.

2.2.2 Electronics

The Arduino Nano was the microcontroller platform used to collect the data from the insole. We chose the Arduino because of the number of input and output pins, SPI connection for Bluetooth communication, and the ability to create an internal multiplexer within the code. In order to send data from the Arduino to the mobile application, we decided to use a Bluetooth breakout called Bluefruit. This was chosen because of its wireless connectivity with a range of 10 meters, as well as the reliability of the connection. These devices are soldered and wired together inside a black box with a width of 15cm, height of 10cm, and depth of 10cm. Figure 3 below shows the connection between the Arduino and Bluefruit, along with the output connections.

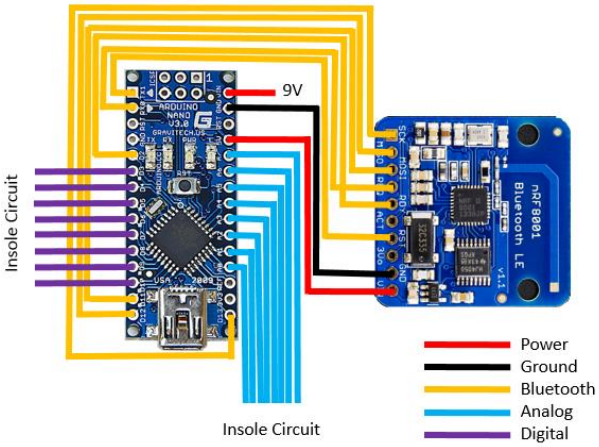

Figure 3: Black Box Design

2.2.3 Data processing

Figure 4 illustrates the typical data acquired over one normal walking step. This data contains information about the force at each sensor during the length of time that the individual takes a step. In order to extract patterns about gait from such data we have used various data processing methods

including filtering, averaging, and large slope detection to determine if the individual is over supinating, over pronating, or is affected by flat foot.

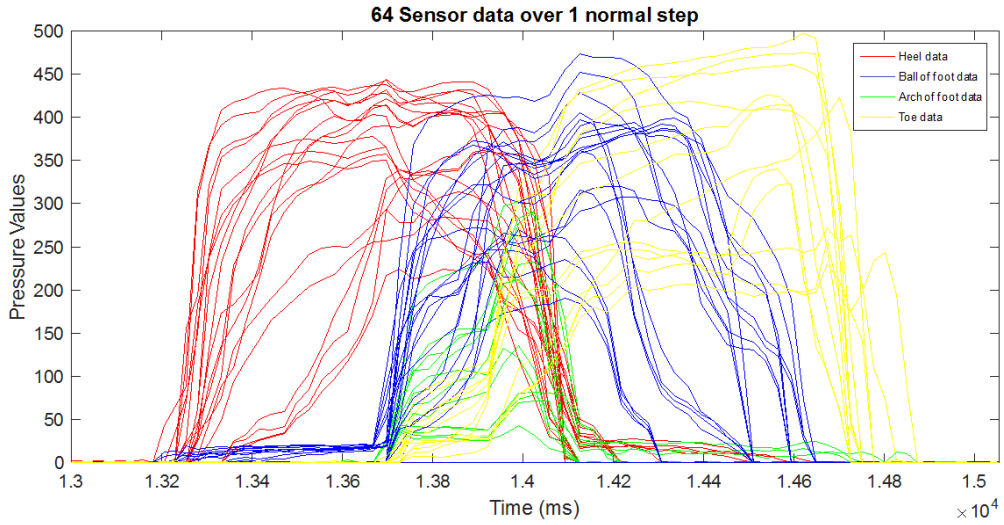

Figure 4: Typical data acquired for one step using 64 pressure sensors

Figure 5 represents eight instances of the processed real-time pressure data generated over one normal step using Pods. This is an average of the pressure data over six individual steps acquired while the individual walked normally. The colors on this image represent intensity values; zero symbolizes minimum pressure and one denotes maximum pressure. The first insole image in Figure 5 represents the initial heel strike and the last insole image is the final toe off. These types of images represent the feedback given to the user through the mobile application.

Figure 5: Real-time pressure data generated from the average of six normal steps

2.2.4 Application

The application was developed using an Android platform and was coded and debugged using Java and XML. The app got all the data from the Pods and process it so that it would be displayed in real time. Figure 6 shows the data flow diagram for the application.

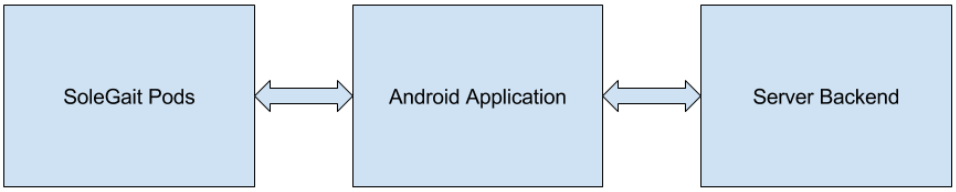

Figure 6: Dataflow Diagram

On the device side, the data store was SQLite, the most reliable way to store large amounts of data for the Android Runtime (ART). On the server backend, SQLite was used to prevent any incompatibilities that may arise between different database implementations.

The mobile application also has various screens each with its own purpose and functionality. These screens include: splash screen, status screen, tracking screen, mygait screen, profile screen, and app menu drawer.

3. Materials

3.1 Costs

Table 1: Expenditures

Item	Estimated Price ($CAD)	Actual Price ($CAD)
Bluetooth Breakout	19.95	19.95
Arduino	70.00	43.98
Force Sensitive Resistors	100.00	0
Force Sensitive Resistor Sheet	59.50	35.60
Wire/Conductive Thread	6.95	25.95
Fabric	10.00	N/A*
Shoe Insoles	20.00	7.00
Batteries	20.00	13.99
Additional Items		
Laminate Material	0.00	22.00
Enclosure	0.00	5.13
Prototyping Board	0.00	3.61
Miscellaneous	90.00	79.44
Shipping and import fees	60.00	46.78
Total	456.40	284.43

*A future purchase for the final stage of the project.

4. Execution timeline

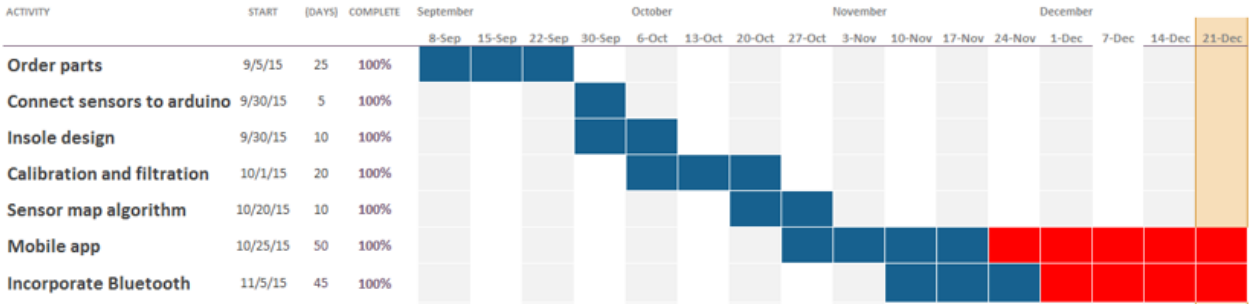

Figure 7: Execution Timeline

5. Project Challenges

The first challenge that we encountered was integrating the FSR-sheet into our circuit. Our original configuration introduced a large amount of noise, and leakage current. This issue was corrected by more thoroughly insulating the wires, updating the circuit, and reducing the length of wires.

Shortly after, we encountered problems when trying to incorporate Bluetooth communication. The communication protocol was severely delayed, affecting our mobile output. After long discussion and debugging, we managed to achieve effective communication between the Bluetooth module and our mobile device by modifying our data packets and communication code.

Lastly, we encountered complications when trying to process and output the data in real-time. Our processor consistently lagged behind our data stream and created a sequence of complications. This issue was corrected by modifying the processor to become more efficient in its functions.

6. Group dynamics

Solegait is composed of 5 engineering students in various fields of study, including systems, physics, software and biomedical. We had roughly 3 meetings every week throughout the semester, where ideas and further discussions were made. The project was split into three main sections: hardware, software and application development.

The hardware section was worked on by Karsten and Zach, both having strong backgrounds and experience in hardware development and hardware design. The insole was designed and built by both members, integrating 64 sensors and connecting it to the Arduino. Zach soldered and wired all the parts, including all resistors, diodes, Bluetooth and Arduino into a black box, while Karsten was in charge of the PCB design.

The software and algorithm implementation was worked on by Alex and Shaquile, both having previous co-op experience in coding and software development. They were both in charge of taking the pressure values taken from the insole, converting it, and sending it to the mobile application via Bluetooth. Finally Ashley, having strong knowledge in making mobile applications, was in charge of retrieving the data from the Pods and processing so that it can be displayed to the user in real time.

Solegait

Good communication, work ethics, and equal distribution of workload was enforced in order to minimize conflicts. There was a regular attendance in group meetings for all group members, and other communication methods were used such as google docs and one drive for document sharing and project files.

7. Workload Distribution

The table below shows a distribution chart where various tasks were assigned to each person. An "x" represents the individual contributed and provided input, "xx" means the individual assisted and had significant work, and "xxx" means the individual was fully in charge.

Table 2: Workload Distribution Chart

Task	Karsten	Shaquile	Alex	Zachary	Ashley
Hardware – Insole Design	xx	-	xx	xxx	-
Hardware – PCB Design	xxx	-	-	-	-
Hardware – Black Box Design	-	-	-	xxx	-
Soldering/Wiring	x	-	-	xxx	-
Software – Development	-	x	xxx	x	xxx
Arduino Integration	-	-	xx	xxx	xxx
Application – Development	-	-	xx	x	xxx
System Integration	x	x	xxx	xx	xxx
General Testing	-	-	xxx	xxx	xxx
Documentation	xx	xx	xx	xx	xx
Minutes/Management	-	-	xxx	-	x

8. Individual Learning

Shaquile:

I feel that this semester has proven to be very beneficial in honing my technical skills with respect to software and data processing. Moreover, working consistently in a team dynamic, hearing differing opinions, and working together through problems has effectively enabled me to be a very efficient and reliable team member.

Previously, I had no experience building apps within the Android SDK environment. But this project has enabled me to work directly with the front and back ends of the android app, play around with different layouts, and test and debug code within the SDK. I am glad to have had this opportunity as I have now broadened my software skills.

Watching our product come to fruition, I now have a much better understanding of the product development life-cycle. I understand that schedules are a dynamic timeline and may be modified along the development cycle for valid reasons.

In short, this course has enabled me to apply most of my previous knowledge gained from past engineering courses. If I had a chance to do this course/project over one more time, the only thing that I would change would be to allot more time at the beginning of the semester towards this project so as to avoid any possible last minute, or end of semester stress.

Karsten:

There are so many different things I have learned from this project, both technical and intrapersonal. Over the past four months I have learned what it is like to work closely in a team while overcoming technical and design problems. Having a team consisting of two students experience in hardware and electronics, and the other three having strong computer and software skills, we were able to divide the tasks evenly given our strengths and prior experience. Without having proper communication and planning, we would not have been able to finish this project in the recommended timeframe of four months.

Through my prior co-op experience and previous courses taken at SFU, I have not come across many projects or labs that require this much commitment and have pushed me to learn as many new skills as I have learned doing this project. Having a group where we have all know each other, from taking one or more courses together, gave us a huge advantage in terms of teamwork and communication. Having prior course experience in electronics and hardware design, I was in charge of building the insole, soldering, wiring, and making a printed circuit board.

Building the insole from scratch was a big challenge, because we didn't really know where to start and how to begin. I have never worked with FSR's, and didn't have much experience integrating with Arduino's. However, over the past 12 weeks, I now have a much stronger understanding of how Arduino's work, as well as building a device from scratch and learning to integrate it with an MCU. Another main component I was in charge with was to make a printed circuit board. Having never used eagle before, I have learned how to make a schematic and board with various layers all compiled into one PCB.

I have learned that teamwork is very important with this project, and having an amazing partners to work with I have really learned a lot from them. Any conflicts that arose, we were able to get together and talk through them in a positive manner. I also have learned various intrapersonal skills including team management, problem solving, communication, and time management. In the end we have developed a product that is beneficial to society and can be used everyone on a daily basis. Overall I would consider this project to be a great success and greatly beneficial to my engineering career at SFU.

Alexandra:

From the course outline point of view, ENSC305W/440W is intended to teach us the necessary steps of product development and documentation writing. In reality, this course has not only taught me the flow of product development, but also invaluable technical, problem solving, time management, and interpersonal skills. Being one of the only courses that is completely self-directed, I take great pride in the part I played in seeing this product to completion. Being a group that comes from different engineering backgrounds, it was fortunate that we were able to come up with a product idea that combines our individual passions. This project has allowed me to further develop not only the skills that I was already comfortable with, like medical research, and signal and image processing, but also hardware, wireless communication and application software.

The most obvious outcome of the capstone project was the development of technical skills. However, I was not expecting to work on parts of the project that are outside of my comfort zone. From the first week of this project we split up the work such that each person exclusively works on portions that they

have experience with. However, as the weeks went on, we came to realize that we needed in depth knowledge of all of the components of our project to complete our parts. We also realized that brainstorming ideas and being there for one another, even though we were not directly involved in that portion of the project, greatly increased team morale and progress. Lastly, combining different thought processes to a problem allowed us to uncover more creative solutions and debug issues. Prior to this course I had no technical knowledge of Bluetooth communication protocol or application development. This project has challenged me to explore these hardware and software components, which I expect will be vital in my future career.

I think that problem solving was one of the hardest but most rewarding portion of the capstone project. Unlike other Engineering courses, in 305/440 you are faced with an assignment that has no previously worked out solution and no steps to guide you in reaching that solution. The hardest part is knowing what you want our end product to look like, and trying to figure out all of the steps to get there. We ran into problems at every step, from the initial wiring of our circuit, to the development of our application. We all greatly underestimated the time required for testing and debugging, especially as a group. I am most proud of the team members that spent countless nights with me discussing ideas, testing hypotheses, and implementing solutions. Overall, I am extremely proud of the product that we have created and this course has been a great introduction to my engineering career.

Ashley:

The past four months has really been four months of constant learning for me. Coming into the project with programming experience, I did not believe how much more I would learn, especially when designing the software end and end for the system. Software skills were not the only skill that got refined, strong interpersonal skills were developed, something that will be useful for future projects.

Working at a lower level with the Arduino, a device with very little processing power and memory, I was forced to develop good optimization skills that can both maximize the memory and the processing power of the device while still meeting the requirements of the project.

Having never developed an Android application, a lot had to be learned in terms of the Android development process, asynchronous processing of tasks and optimizing database calls. Asynchronous processing was very important in order to prevent the application from crashing when doing complex computations, to communicate over Bluetooth and generating the Pedobarograph in real-time. Database calls for data storage were taking too long and optimization schemes had to be developed for that also.

Bluetooth Low Energy(LE) turned out to be a real challenge to work with. Such a new technology doesn't have as much documentation as more mature Bluetooth technologies. But having an understanding of communication systems helped in setting up a simple UART abstraction which made working with Bluetooth much easier.

Therefore, my greatest takeaway from the course is in technical skills and understanding, making use of knowledge learned from other courses. However, team dynamics that were developed will be useful in future teamwork.

Zachary:

Our group was devised from all of the engineering concentrations at SFU, which was the key component in taking on a project that had complex hardware, graduate level data analysis, and advanced software components. Members of the team were able to break off into these three sections of the project and attack them head on which was vital in completing the project in the small window of four months. Impeccable planning and completion of separate components allowed each member to work from sections completed by another allowing a smooth flow in our project timeline.

Having a large background of hardware experience working as an electrical apprentice, test station operator, as well completing countless independent projects my work in the group was focused on electrical design, and sensor implementation. Overcoming the device communication was the biggest challenge for me due to my lack of software experience; however other group members who had more knowledge in the field came together to debug and implement the device for wireless communication. For me this was the highlight moment of this project, members of the group spent countless days working to solve this problem allowing already formed friendships to grow into something very special to me.

A great challenge of this project was the separation of doers and non-doers within the group. Some members were interested and committed to the project while others fell more than short in the commitment to a group project, creating a much heavier load as well as responsibility for three of the group members. It was quite disappointing to see this and to be taken advantage of in a course which has the possibility to create something great. Despite these issues Ashley, Alex and I excelled under the pressure and together created something that was beyond the initial projects goal. I am quite proud of the creativity and hard work of these individuals as the burden of work left on their shoulders was much beyond an average ENSC 440 project.

Overall, this class has taught me many lessons in life such as the importance of group team work as well as splitting up large tasks into smaller ones which could be solved independently. I would like to conclude with giving further recognition to Ashley for his time and effort which was put into the app, as well as Alex's advanced data analysis, the project wouldn't have happened without them.

9. Conclusion

Solegait is a team of engineers who are highly dedicated to the development of an assistive device to aid a patient's rehabilitation process and correct their foot dynamics. The Solegait Pods is a low cost solution to more accurately define imbalances in the user's walking patterns, and as a result, inhibit any chronic injuries in athletes, or bone and muscle degradation of older adults. Furthermore, Solegait is a company that supports the advancement of medical research; therefore, with the added benefit of a cloud server, researchers have the opportunity to gather open source data for their own benefits.

For future improvements of the product, we would order a PCB with all resistors, diodes, Arduino and Bluetooth built onto one board to make it smaller and lighter when strapped to the users' ankle. We would also use fabric and a different insole to make it more aesthetically pleasing and comfortable to walk on. Additionally, adding more features on the app for the patient to use, as well as posting it on the app store upon completion for the community to download. These features along with further accuracy debugging improvements will be addressed before a future product launch.

Appendix

Meeting Minutes

September 14, 2015
13:30-14:30
Applied Science Building

Purpose of Meeting: To discuss the initial steps of product development

Items for Discussion:

- Company name
- Need for funding?
- What are some applications of the device?
- What are areas of pressure areas of the foot that indicate good/bad gait?

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Alex called the meeting to order at 13:30.

A. Approval of the agenda

B. Business Arising

Should we begin ordering materials?

Discussion: Pressure sensor matrix, neoprene fabric and conductive thread are being ordered from Adafruit that only delivers to the states which might take additional time.

Action: Zachary to order a small amount of these materials for initial testing in the next couple of days.

C. Company Name

Discussion: Need a company name.

Action: Solegait agreed upon as the company name and logo to be created and presented for the next group meeting.

D. Funding

Discussion: For the ESSEF application, a soft copy is to be completed by this Sunday September 20, presentation to be completed by Tuesday September 22.

Action: Figure out total cost of parts and begin putting together funding application next meeting.

E. Applications of the device

Discussion: Applications and benefits of our device.

Action: Focus on athletes and injuries and, if there is more time, look into musculoskeletal, developmental and neurological diseases that affect gait.

F. Pressure areas of the foot

Discussion: How many pressure areas of the foot we need to investigate and how many sensors do we need.

Action: From literature and past studies ~10.

G. Next Meeting Date

The next meeting was arranged for September 16, 2015 at 13:30-14:30 in ASB.

H. Other Business
None.

September 16, 2015
13:30-14:30
Applied Science Building

Purpose of Meeting: Complete funding applications

Items for Discussion:
- Company logo colors
- ESSEF & Wighton fund application

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Alex called the meeting to order at 13:30.

A. Approval of the agenda

B. Business Arising

Discussion: Did we like the black and green or the blue and green foot logo better?

Action: Blue and green for now; try black and red and gradient colors.

C. Funding

Discussion: For the ESSEF application, a soft copy is to be completed by this Sunday September 20, presentation to be completed by Tuesday September 22.

Action: Figured out total cost of parts and put together funding application to be sent in on Sunday.

D. Next Meeting Date

The next meeting was arranged for September 21, 2015 at 13:30-14:30 in ASB.

E. Other Business
None.

September 21, 2015
13:30-14:30
Applied Science Building

Purpose of Meeting: Complete funding applications

Items for Discussion:

- New Logo and ideas, talk about color variation and different designs
- ESSEF presentation preparation
- Order parts

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Karsten called the meeting to order at 13:30.

A. Approval of the agenda

B. Business Arising

Discussion: All 6 logos have been attached, which one looks the best?

Action: The black and red logo looks the best

C. Funding

Discussion: For the ESSEF application, a soft copy is completed, prepare for presentation for Tuesday September 22.

Action: Figured out total cost of parts and put together funding application to be sent in on Sunday.

D. Next Meeting Date

The next meeting was arranged for September 28, 2015 at 13:30-14:30 in ASB.

E. Other Business
None.

September 28, 2015
13:30-14:30
Applied Science Building

Purpose of Meeting: Finish up project proposal

Items for Discussion:
- Company logo: add inc. or corp.
- Add schematics that represent text
- Look over minor detail (page number, TOC, LOF, LOT)

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Ashley called the meeting to order at 13:30.

A. Approval of the agenda

B. Adding inc. or corp. to company name

Discussion: Illegal to do so.

Action: Keep Solegait as company name.

C. Proposal review

Discussion: No tabs should be used at the beginning of paragraphs. Should table of contents be automatically generated?

Action: Updates to be applied, Shaquille and Alex to finalize formatting.

D. Next meeting

A two-day development session has been planned for the weekend of 2nd October.
Meeting on 29th September cancelled.

E. Other Business
None.

October 3, 2015
13:30-21:30
Zach's House

Purpose of Meeting: Build first model of device

Items for Discussion:
- Cut insole and put materials together
- Figure out where sensors should be optimally placed and stitch on the insole
- Wire up circuit and connect to the Arduino
- Perform preliminary testing

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Ashley called the meeting to order at 13:30.

A. Approval of the agenda

B. Cut insole and put materials together

Discussion: Who's foot to be used for modeling?

Action: Use Zach's foot for analysis.

C. Figure out where sensors should be optimally placed and stitch on the insole

Discussion: Should we follow set up from http://www.biomedcentral.com/1471-2318/5/8 for now?

Action: 2 sensors on the toes, 3 sensors on the ball of the foot, 2 sensors on the arch, and 3 sensors on the heel of the foot.

D. Wire up circuit and connect to the Arduino

Discussion: How should we wire up the circuit to get the most sensors out of a matrix?

Action: For now use 10 analog sensors.

E. Figure out where sensors should be optimally placed and stitch on the insole

Discussion: Should we follow set up from http://www.biomedcentral.com/1471-2318/5/8 for now?

Action: 2 sensors on the toes, 3 sensors on the ball of the foot, 2 sensors on the arch, and 3 sensors on the heel of the foot.

F. Perform preliminary testing

Discussion: What tests should we run to test the device for different conditions?

Action: Test normal walking, pronation & supination.

G. Next meeting

Scheduled for Wednesday October 7 at 4:30PM.

H. Other business

None.

October 7, 2015
16:30-18:30
Zach's House

Purpose of Meeting: Test different resistors

Items for Discussion:

- Test resistors 10k, 5520, 1k, 220 ohms

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Ashley called the meeting to order at 16:30.

A. Approval of the agenda

B. Test resistors 10k, 5520, 1k, 220 ohms

Discussion: Which resistors produce the best graphical results?

Action: Use 1k.

C. Next meeting

Scheduled for Sunday October 11 at 10:00AM.

D. Other business

None.

October 11, 2015
10:30-17:30
SFU Library

Purpose of Meeting: Build testing model for the device.

Items for Discussion:

- Build a 4 sensor by 4 sensor array on the insole
- Acquire data for known weights applied to individual sensors
- Establish Bluetooth communication

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Zach called the meeting to order at 13:30.

A. Approval of the agenda

B. Build a 4 sensor by 4 sensor array on the insole

Discussion: At what distance apart should the sensors be spaced?

Action: 4x4 sensor array built on the insole with sensors 1.1 cm apart.

C. Acquire data for known weights applied to individual sensors

Discussion: How should the weight be distributed on the pressure block for testing? At what weights should we apply pressure?

Action: Distribute the weight evenly on the whole block and test 10-100 lbs in increments of 10. Place the weights on a single sensor and test 10, 20, and 30 lbs.

D. Establish Bluetooth communication

Discussion: How do we build a connection?

Action: Bluetooth connection created and tested.

E. Next meeting

Scheduled for Friday Oct. 19th.

F. Other business

None.

October 19, 2015
13:30-14:30
Applied Science Building

Purpose of Meeting: Finish up Functional Specifications document.

Items for Discussion:

- Put together everyone's portion from One Drive
- Read over everyone's section
- Fix formatting, spelling, grammar, etc.

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Shaq called the meeting to order at 13:30.

A. Approval of the agenda

B. Put together everyone's portion from One Drive

Discussion: Anything left to be completed?

Action: Karsten to finish up executive summary.

C. Read over everyone's section

Discussion: Assign an editor to make sure the document has a nice flow from writer to writer.

Action: Karsten to complete first run of editing followed by a run-through by Shaq & Alex.

D. Fix formatting, spelling, grammar, etc.

Discussion: Check 'vague this subject'.

Action: Fix all sentences beginning with 'This'.

E. Next meeting
Scheduled for Thursday Oct. 22nd.

F. Other business
None.

October 22, 2015

15:00-15:30
Applied Science Building

Purpose of Meeting: Prepare for meeting with Lukas.

Items for Discussion:

- Who should present what topics of the project

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Ashley called the meeting to order at 15:00.

A. Approval of the agenda

B. Who should present what topics of the project?

Discussion: Assign experts to discuss concept, hardware, and software portion of project during the meeting.

Action: Karsten & Zach to discuss hardware, Shaq & Alex to discuss signal processing and concept, Ashley to discuss app and Bluetooth communication.

C. Next meeting
Scheduled for Saturday Oct. 24th.

D. Other business
None.

October 24, 2015
18:00-23:30
Applied Science Building

Purpose of Meeting: Collaborate on project design ideas.

Items for Discussion:

- Design 64 sensor insole
- Convert data processing algorithm to Java
- Design initial UI for app

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Zach called the meeting to order at 18:00.

A. Approval of the agenda

B. Design 64 sensor insole system.

Discussion: How to align electrical wires such that there is no shorting and it is still comfortable for the subject to use?

Action: Stick wires on to the fabric by heating up laminate sheets and cut out in areas where they should connect.

C. Convert data processing algorithm to Java

Discussion: Easier and more efficient if data processing was done on the smart phone.

Action: Shaq & Alex to convert Matlab code to Java processing.

D. Design initial UI for app

Discussion: Best layout for data output in the application?

Action: Ashley to put together initial mock-up of UI of app.

E. Next meeting
Scheduled for Nov 2nd

F. Other business
None.

November 2, 2015
13:30-14:30
Applied Science Building

Purpose of Meeting: Go over Matlab code and discuss how to turn it into Java.

Items for Discussion:

- Evaluate display of sensor results
- Debug Matlab code
- Discuss changing to Java code for app

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Solegait

Shaq called the meeting to order at 13:30.

A. Approval of the agenda

B. Evaluate display of sensor results

Discussion: How should the results appear on the insole? Which color scheme should be used?

Action: Divide insole into 64 sections and display pressure data from low (blue) to high (red).

C. Debug Matlab code

Discussion: Is there anything else that the output should display?

Action: Also display an average over 6 step data.

D. Discuss changing to Java code for app

Discussion: Who should work on converting the Matlab code to Java for the app?

Action: Shaq, Alex and Ashley to get together on Friday and Sunday to work on it.

E. Next meeting
Wednesday, Nov 4 at 4:30PM.

F. Other business
None.

November 4, 2015
17:30-19:30
Applied Science Building

Purpose of Meeting: Discuss Design Specifications document.

Items for Discussion:

- What still needs to be done
- Who should do which part of the write-up

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Alex called the meeting to order at 13:30.

A. Approval of the agenda

B. What still needs to be done

Discussion: What still needs to be done before write up of document can be completed?

Action: Eagle schematic of Arduino. Figure out relationship between sensor value and pressure.

C. Who should do which part of the write-up?

Discussion: How should the write-up be divided?

Action: Zach and Karsten to do the hardware part, Shaq and Alex to do software part, Ashley to do app part. To be completed by Sunday night.

D. Next meeting

Thursday, Nov 12 at 12:30PM.

E. Other business

None.

November 12, 2015
13:30-14:30
Applied Science Building

Purpose of Meeting: Finish up Design Specifications document.

Items for Discussion:

- Items to be added to background
- App screen details to be kept in body or moved to appendix
- Pseudocode for Arduino, Matlab and app to be added to appendix

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Karsten called the meeting to order at 13:30.

A. Approval of the agenda

B. Items to be added to background

Discussion: Should we remove information already presented in Proposal & Functional Specs?

Action: Shaq to add information about current methods for measuring plantar pressure and how our device differs.

C. App screen details to be kept in body or moved to appendix

Discussion: Too many app screens in body of Design Specs?

Action: Ashley to make current images smaller and include any further images in the Appendix section.

D. Pseudocode for Arduino, Matlab and app to be added to appendix

Discussion: Which codes should be added and where should it be included in the document?

Action: Zach to include short snippet of Arduino code in body of document, Alex to add pseudocode of Matlab in Appendix and Java code completed by Ashley to be excluded from the Design specs as per software engineering document write-up guidelines.

E. Next meeting
Sunday, Nov 18 at 1:30PM.

F. Other business
None.

November 18, 2015
10:30-11:30
Applied Science Building

Purpose of Meeting: Discuss steps of integrating hardware and software.

Items for Discussion:

- Convert Matlab to Java code
- Fix Bluetooth connection
- Complete insole design and input into shoe
- Test subjects

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Ashley called the meeting to order at 10:30.

A. Approval of the agenda

B. Convert Matlab to Java code

Discussion: Current status of app development and code integration.

Action: Ashley to send current Java code and Shaq and Alex to continue working through tutorials. Alex, Shaq and Ashley to get together on Sunday and provide help for converting code to app.

C. Fix Bluetooth connection

Discussion: Test Bluetooth with finished hardware black box.

Action: Ashley and Zach to get together this week and solve.

D. Complete insole design and input into shoe

Discussion: Make insole more comfortable and put in shoe. Complete Eagle file.

Action: Zach to purchase fabric and integrate into shoe. Karsten to complete Eagle file for possible fabrication.

E. Test subjects

Discussion: Size 10 test subjects for current insole design.

Action: Everyone find friends with 10 shoe size.

F. Next meeting
Sunday, Nov 29 at 1:30PM.

G. Other business
None.

November 29, 2015
13:30-17:30
Applied Science Building

Purpose of Meeting: Finish up Written Progress Report and Test Plan

Items for Discussion:

- Finish up writing the progress report
- Items to be changed and added to the system test plan

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Zach called the meeting to order at 13:30.

A. Approval of the agenda

B. Finish up writing the progress report

Discussion: Who wants to write what part for the progress report?

Action: All sections including introduction, schedule, finance, progress and conclusion were distributed evenly for everyone to work on

C. Items to be changed and added in the test plan

Discussion: Should we convert the ideas from the design spec test plan into tables to make it clearer

Action: Everyone work on the test plan including the unit testing parts and system testing

D. Next meeting

To be scheduled after final exams

E. Other business

None.

December 19, 2015
13:30-17:30
SFU Library

Purpose of Meeting: Finish up Post Mortem and Java/application code

Items for Discussion:

- Finish up writing the post mortem
- Continue working on the Java code

Present: Alexandra Talpalaru, Zachary Nunn, Shaquile Nijjer, Karsten Harder, Ashley Lesperance
Absent: N/A

Minutes:

Shaq called the meeting to order at 13:30.

A. Approval of the agenda

B. Finish up writing the post mortem

Discussion: Who wants to write what part for the post mortem?

Action: All sections including introduction, functions, project modules, materials, problems, group dynamics, individual learning and distribution chart were distributed for everyone to work on

C. Continue Working on the Java code

Discussion: How to shorten the time it takes to send the data via Bluetooth?

Action: Working on the Java code to shorten the time, as well as further integration for the application

D. Next meeting

Tomorrow Dec 20th at 1:30PM.

E. Other business

None.