Lightweight Enterprises 

April 22, 2016

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

RE: ENSC 440W Post-Mortem for **Bartini Drink Dispensing System**

Dear Dr. Rawicz,

The attached document, *Post-Mortem for Bartini Drink Dispensing System*, provides an summary of our capstone project. Our goal was to design a software controlled drink dispensing system using electronic control, mechanical design, and software design techniques.

The post-mortem will outline the results of our capstone project. High-level descriptions, business models, budget, finances, and reflections will be included in this document.

Lightweight Enterprises consists of 3 talented senior design students: Noel Barron, Luke Mulder, and Ben Hieltjes. If you have any concerns or inquiries related to our functional specifications, please do not hesitate to contact our Head of Communications, Noel Barron, by email at nbarron@sfu.ca.

Sincerely,

Luke Mulder
CEO
Lightweight Enterprises

Enclosure: Post-Mortem for Bartini Drink Dispensing System

Bartini Drink Dispensing System

by

Lightweight Enterprises

Project Team: Noel Barron
Luke Mulder
Ben Hieltjes

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Submitted to: Dr. Andrew Rawicz - ENSC 440W
Mr. Steve Whitmore - ENSC 305W
School of Engineering Science
Simon Fraser University

Issue Date: April 22, 2016
Revision 1.0

Executive Summary

According to IBISWorld's market research report, Canada's bars and nightclub industry has annual revenue of three billion dollars. IBISWorld also estimates that for every $1.00 the industry spends on wages, $0.09 is required for capital equipment, including the use and replacement of buildings and fittings [1]. With our product *Bartini*, any business can redistribute these funds and greatly increase their net profits. Bartending is well suited to automation because of its variable levels of complexity and high markup.

Lightweight Enterprises has designed our product *Bartini* to deliver delicious, enjoyable cocktails tailored to the needs of the consumer. The *Bartini* is an autonomous machine which can perform the majority of a bartender's duties. Given a user-friendly interface, making the perfect, drink has never been easier. The graphic user interface (GUI) is run on a Raspberry Pi and brought to life using Python. With a press of a button, the user can choose and customize a drink from a pre-set menu. Once selected, *Bartini* will dispense the necessary ingredients into a mixing mechanism visible to the consumer. Base liquids are dispensed from an enclosure and brought through a series of tubes, while the spirits are displayed in the front in a carousel and dispensed directly into the mixing chamber. The transfer of liquids is regulated by servo-controlled valves. All this combines to create a unique experience and a consistent and professionally made cocktail.

The *Bartini* is targeted towards various venues such as bars, clubs, restaurants, casinos, and hotels. Currently, there are similar products in production and in the market but they tend to be large, obtrusive, and more importantly, expensive machines. We differentiate ourselves from the competition with our relatively inexpensive, modular, and scalable design. In addition to selling units to these markets there is possibility for renting them out to events that need to serve a large number of people for short periods of time such as temporary sporting events, conventions and conferences.

Lightweight Enterprises consists of three fourth year Simon Fraser University engineering students whose mission is to a deliver reliable, low cost and innovative bartending machine with the *Bartini*. Every member possesses a varying set of skills necessary for the production of our prototype, including circuit design and analysis, software programming, and mechanical design. This automated bartender seeks to provide a consistent, entertaining experience to its end users while reducing operating costs and increasing efficiency for its clients.

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Glossary

CES	Consumer Electronics Show.
DC	Direct current.
GPIO	General purpose input and output. Refers to configurable general use ports used to send or receive electrical signals.
GUI	Graphical user interface. A means of interaction with electronic devices through graphical icons and other visual indicators.
Raspberry Pi	A small computer containing a low-power microprocessor, various inputs/output devices, expandable memory, and capabilities of running an operating system.
Servo	A miniature rotary actuator consisting of a motor driving a train of reduction gears.
Solenoid Valve	A mechanical value used to control fluid flow. Operated by electrical signals.

1.0 Introduction

The *Bartini* automated drink dispensing system (Figure 1) is an entertaining solution in the amenities industry that will automatically pour a mixed beverage based on input from a user. By use of a graphic user interface (GUI) a user can request any number of predefined drink recipes or create their own based upon the liquids available in the machine. Valves, motors, and the software-based GUI work together to produce the end product. This project will provide a consistent, entertaining experience to its end users while reducing operating costs and increasing efficiency for its clients. This port-mortem document details the high level functionality of the *Bartini* system and describes the software, mechanical, and electrical design process. Comparisons between the projected and actual financial plans and timelines will be provided in this report. In addition, encountered challenges, group dynamics, and task distribution will be discussed. Individual reflections on the project and capstone experience as a whole are also provided.

Figure 1: Bartini System

2.0 System Overview

The *Bartini* has been designed to perform functions a bartender would typically be tasked with. A user will select from a list of possible drinks displayed on a graphical user interface (GUI). The *Bartini* will then dispense the appropriate amount of each ingredient into a mixing chamber. The mixing chamber mixes drink and the finished drink is dispensed into a glass. Finally, the chamber is rinsed remaining ingredients are updated. A block-level overview of the *Bartini* system is shown in Figure 2. Figure 3 gives an overview of the control process and the various signals used in the *Bartini*.

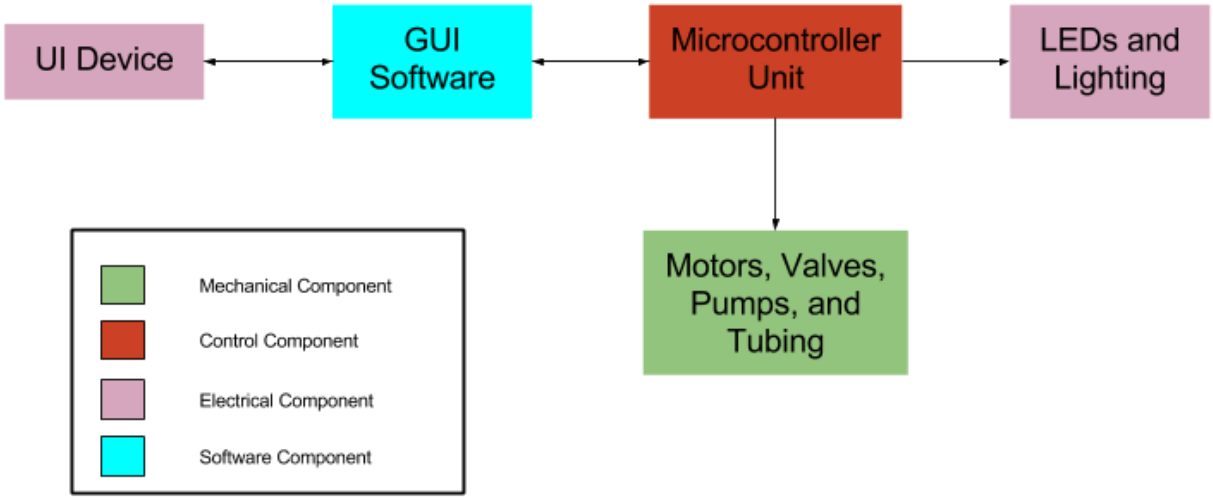

Figure 2: Block Diagram Overview

Drink selection is done through a GUI. A list of drinks composed of the available ingredients is displayed for selection. In addition, the software supports the ability to make a custom drink. The user places their order, places an appropriate glass into the dispensing chamber and the *Bartini* system will begin to dispense.

Pouring is performed in two different ways depending on whether a base liquid or an alcohol is needed. A base liquid is any liquid that does not typically have a brand attached to it such as water, tonic, lemon juice, lime juice. These are stored in reservoirs and dispensed into the mixing chamber through a network of valves and tubing. Alcohols are external to the device so that they can be seen when poured. A carousel will rotate a selection of alcohols so that the required alcohol can be released by a valve directly into the mixing chamber from above.

Mixing is done inside of an aluminum chamber. Contained within the mixing chamber is a paddle-wheel driven by a DC motor. The DC motor is outside of the mixing chamber to prevent electrical problems and connected to the paddle-wheel by an axle.

Rinsing must be done after the drink has been dispensed so that there is no contamination between orders. After the drink has been poured the mixing chamber is rinsed with clean water. The water is agitated briefly by the mixer and then dispensed into the waste chamber.

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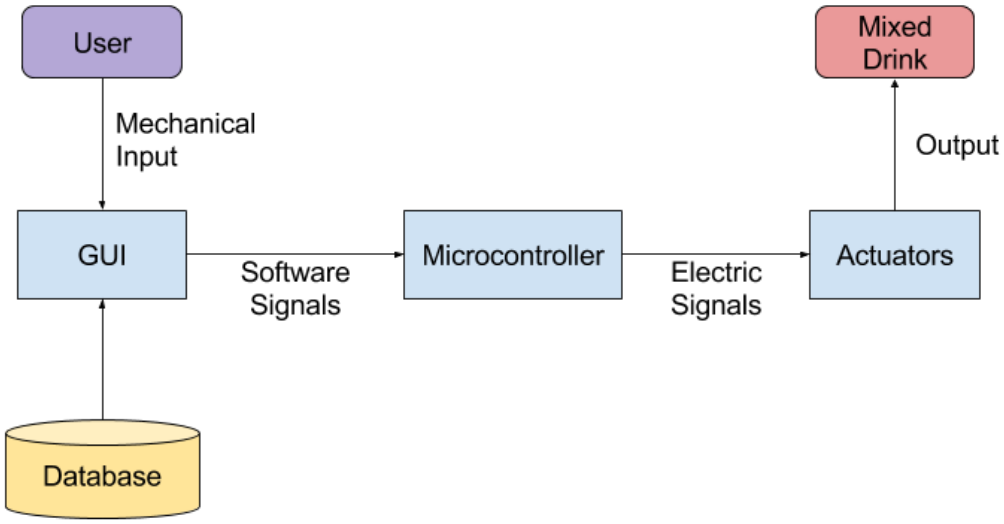

Figure 3: Control Overview

3.0 Business Model and Market Overview

The target market for a production quality version of our automated drink dispensing system is predominantly composed of establishments such as bar, clubs, hotels, sporting arenas, etc. It is a product primarily servicing the entertainment and amenities industry. This space in incredibly large; potential customers exist all around the world. The *Bartini* is not seasonal, nor specific to a small subsection of the market. The end user of the system is an adult of legal drinking age although it would be very possible to serve underage customers by replacing the alcoholic drinks in our automated system with other types of soft drinks and juices, further expanding the potential market.

According to the National Institute on Alcohol Abuse and Alcoholism, 70.7% of American citizens of age claim to drink at least once per year [2]. Recent US census information indicates 76.9% of American citizens are at least 21 years of age which means the maximum number of possible users in the United States alone is approximately 175M people [3]. It is no secret how large the drink/entertainment market is. Lightweight Enterprises is introducing a new product into this proven sector.

Current competition is scarce but in development. The majority of projects that feature similar functionality are fairly young. Possibly the most comparable product, *Monsieur*, is currently active in the US marketplace and selling to a similar demographic [4] in small quantities. *Somabar* is a smaller automated drink mixing machine (similar to the *Keurig* brand of coffee brewing machines) aimed more towards the household appliance market and has only recently debuted at CES 2016 [5]. The *Somabar* has yet to ship and have only done pre-sales via their Kickstarter campaign. The idea of an industrial/consumer grade automated drink mixing machine has yet to be explored in depth. The aforementioned companies have only recently begun to test the market and their success has proven that there is a demand for a project of this nature. Because there are few competitors and no real dominant player in this space, the market for our automated drink dispensing system is present and thus we can justify the need for such a solution.

Lightweight Enterprises has several revenue streams available through the *Bartini* system, the first of which is machine sales. The *Bartini* itself can be sold as a unit with the primary customer being in the commercial space. This is a single-purchase model. A second source of income can be generated by leasing the machine for events. Establishing relations with event planning organizations is an essential step required to expedite revenue from a lease-based model. Lastly, the *Bartini* predominately features branded alcoholic beverages alongside a picture-based GUI. Lightweight Enterprises designed in a way to maximize opportunity for advertisement in the *Bartini*. Brands may pay to have their product in the leased machines and ad space / preferential recipes can be integrated into the GUI platform as required. Offering larger companies exposure is a proven business model and one the team at Lightweight Enterprises is eager to explore. Based upon construction costs and the price of competitors, the *Bartini* would be competitive with a sale price of $2000-4000. A more accurate listing price would require additional market research.

4.0 Budget and Finances

A summary of the finances associated with the *Bartini* is presented in Table 1. Lightweight Enterprises was awarded 450 CAD from the Engineering Science Student Endowment Fund (ESSEF) and the remainder has been paid out of pocket by the three members. The team plans on requesting reimbursement funding from the Wighton fund at the end of the semester. In addition, we received various mechanical pieces such as gears and chains from a local bike shop free of charge. The Kerdi-Board used to build the enclosure was generously donated by Daltile.

Table 1: Final Budget

Equipment	Proposed Cost ($)	Final Cost ($)	Difference
Raspberry Pi 2 Model B	60	54	+6
Servos, Mixing Motor, and Carousel Motor	100	32	+68
Tubing and Fittings	40	30	+10
Solenoid Valves, DC Pump	110	140	-30
LEDs and Visual Components	30	0	+30
Building Materials and Manufacturing • Waterjet Cut Parts • Aluminum Tubing • Bottles • Nuts and Bolts • Glue, Epoxy, Silicone Sealant	300	360	-60
Cooling/Refrigeration	90	0	+90
Touchscreen for Raspberry Pi	90	0	+90
Total	**820**	**616**	**+204**
Tax (12%)	98	74	+24
Contingency	150	80	+70
Total (After-Tax)	**1,068**	**770**	+298

5.0 Schedule

Time management issues were evident throughout the semester as our small team was developing the *Bartini*. Figure 4 shows the many differences between our original schedule and the actual schedule. The most notable delays were associated with the mechanical and hardware tasks. The early delay of many of the streams was caused by the unforeseen challenges and time associated with part acquisition and ordering. Figure 5 shows the project milestones.

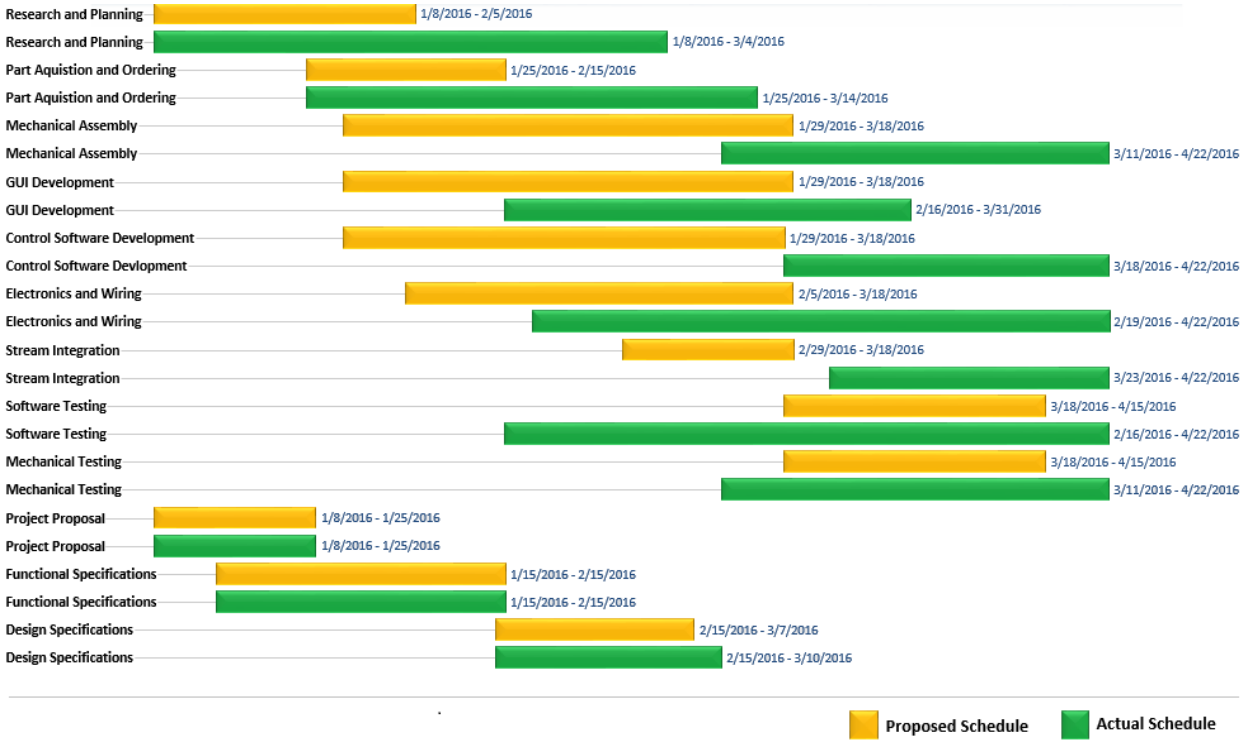

Figure 4: Proposed vs Actual Project Scheduling

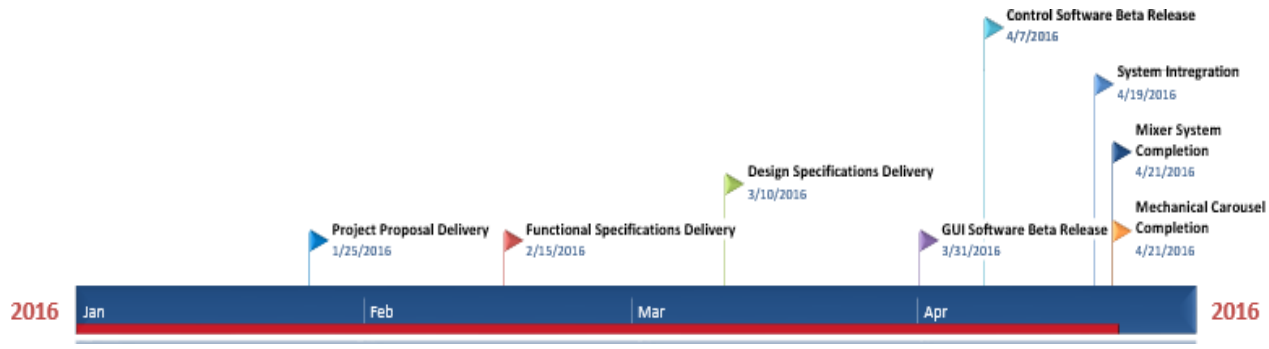

Figure 5: Project Milestones

6.0 Problems and Challenges

Lightweight Enterprises' engineering team was met with many challenges over the course of the *Bartini* development. Beginning with the non-technical challenges, the scheduling quickly became an issue. There was difficulty at the beginning of the project during the research and planning phases. Many potential design aspects were limited due to the availability and cost of parts. Items like low-pressure solenoid valves and cheaper linear actuators were difficult to find in reasonable quantities and often were not available locally. Because of the delay caused by the part acquisition difficult and design iteration cycles, development of the physical *Bartini* system was delayed much later than we had originally anticipated. The GUI software was the exception to this as the user interface could be designed on any Linux-based system so long as it was setup to be compatible with the Raspberry Pi.

The development team was challenged with the level of design to implement. The proof of concept model and the production level model vary enough to warrant different design approaches. The discrepancy between the designs can be largely appropriated to cost of product-level system components. There were some systems in the *Bartini* that were designed specifically for the proof-of-concept system such as the mixer liquid dispensing mechanism which would have been replaced with a more industrial-grade liquid dispensing machine if we had the budget. Communication problems associated with similar differences affected our design specifications document in a negative way. We were faced with many more cost-benefit decisions than initially anticipated. Financial concerns were prevalent over the course of the project. Many of the design aspects the team wanted to implement were significantly out of our budget. Because of this, pre-existing more expensive solutions that would be present in subsequent models of the *Bartini* had to be replaced with cheaper alternatives that often didn't work nearly as well and took much longer to implement compared to the high-end desired components. Finding a balance between performance/design and price may have caused setbacks in the design of the prototype as it continued to drift further away from the ideal solution we had originally envisioned.

Writing software for the Raspberry Pi required learning a new set of tools our group members had yet to be exposed to. Developing in Python was an experience that had to be learned and implemented in real time. There is always a learning curve when working in new programming languages for the first time.

In a mechanical context, the *Bartini* was a much more complicated project than the engineering team had first anticipated. A portion of this complexity can be attributed to the omission of several high-cost existing solutions that our engineers had to circumnavigate. Although team members had exposure to mechanical engineering aspects before, this proved to be the most difficult and time-consuming component of our project. Mechanical components are much more prone to failures due to their physical nature. These mechanical aspects elevated the possibilities of unforeseen problems in a way electrical and software components cannot. In addition, mechanical problems aren't as easy to patch as software ones and can required significant amount of time to deal with. This was a very obvious disadvantage compared to the instant nature of software testing/patching cycle.

Our engineers were also challenged with how to measure the accuracy of fluids in a drink. Originally, the team intended on creating an open loop system dependent on time-based actuation and predictable flow rates however, while designing the project the benefits of a closed-loop measure system became highly appealing. Several discussed feedback mechanisms include a line-scanner, a webcam, and fluid-level sensors. Ultimately, the feedback mechanism was made a secondary priority as the 3 team members worked to produce a demo-ready proof of concept model capable of preforming more basic functionalities.

7.0 Workload and Task Distribution

Lightweight Enterprises was composed of only three engineering students and because of this fact, many of us had to work on multiple aspects of the project. Tasks were generally distributed according to strengths, previous experience, interests, and availability. Table 2 shows a breakdown of tasks required over the course of the capstone project.

Table 2: Task Distribution

Task	Ben Hieltjes	Luke Mulder	Noel Barron
GUI Software	xx		
Database Software	xx		
Control Software	xx	xx	
Electronic Design	x	x	x
Electronic Implementation	x	x	xx
Mechanical Design		xx	
Mechanical Construction		xx	
Part Sourcing	x	xx	xx
Software Testing	xx	x	x
Mechanical Testing	x	xx	xx
Electrical Testing	x	x	x
Documentation	xx	x	x

xx = Primary Responsibility; x = Secondary Responsibility

8.0 Conclusion

Over the course of the semester, Lightweight Enterprises successfully created an automated bartending machine. The *Bartini* was capable of dispensing a mixed drink in under one minute from a selection of ingredients. The project met our functional specifications for a proof-of-concept model as we intended. Additional engineering work would be required to take the *Bartini* to a production level model. A volumetric feedback system, enhanced visual aspects, and an improved mixer delivery system would be implemented in future versions of the Bartini along with a touchscreen interface. Although the product has potential and services a large market, no members of Lightweight enterprises plan on working on the *Bartini* past capstone. This project allowed a group of talented students to practice multidisciplinary engineering skills over the course of a semester. Capstone has provided us with a useful industry-like experience as we near the end of our degrees.

References

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[2] Niaaa.nih.gov, "Alcohol Facts and Statistics | National Institute on Alcohol Abuse and Alcoholism (NIAAA)", 2016. [Online]. Available: http://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/alcohol-facts-and-statistics. [Accessed: 22- Jan- 2016].

[3] Census.gov, "Population estimates, July 1, 2015, (V2015)", 2016. [Online]. Available: http://www.census.gov/quickfacts/table/PST045215/00. [Accessed: 22- Jan- 2016].

[4] MONSIEUR: The Automated Bartender - Professional Quality Cocktails in Seconds, "MONSIEUR: The Automated Bartender", 2016. [Online]. Available: http://monsieur.co/. [Accessed: 22- Jan- 2016].

[5] Somabarkickstarter.com, "Somabar | Robotic Bartender for your Home", 2016. [Online]. Available: http://www.somabarkickstarter.com/. [Accessed: 22- Jan- 2016].

Appendix A: Individual Learning

Ben Hieltjes – VP Systems

After four years of an intensive engineering degree the capstone project has given me something vital to my resume as I enter the professional world, a full engineering project taken from design to demonstration. Typical engineering courses teach skills associated with a particular aspect of technology. The capstone project was an experience that asked all team members to draw from this course work and past co-ops to do what engineers were meant to do, innovate.

This project shed light on various non-technical aspects of engineering I had previously overlooked. Team dynamics and communication skills were emphasized and played a more important role in the project outcome than I had ever experienced before. I became aware of project aspects I had never really considered in the past such as part sourcing, future timeline scheduling, budgeting, and logistics.

The amount of freedom given to the students for this project is rather overwhelming. Many of us are used to following strict guidelines, expectations, and procedures. Given the ability to choose almost every aspect of the project potentially caused more problems than we anticipated. The selection of a project may be the most important decision made in the course. This is where I think capstone may have a fault. The best innovations and technologies are usually founded upon some sort of inspiration and need. Capstone almost feels like its forcing the creation of a project upon groups which may not necessarily be working upon an idea they feel compelled to pursue. From my experience, groups that have a project simply because they need one for capstone have the most difficulty. At times, capstone can seem as though it's a form of "forced innovation". That being said, I believe my takeaways from the course will be beneficial in the years to come.

As luck would have it, immediately following the project semester I will be beginning a project management co-op. Capstone is a perfect experience to have going into this position because it includes all the non-technical aspects like the team dynamics and scheduling. Without this course, it is likely I would underestimate both the difficulty and importance of these issues. Budgeting was also a point of great learning throughout the project as more often than not, design decisions were driven by finances as opposed to engineering.

Technically speaking, the project gave me good insight into the difficulties associated with working around mechanical aspects. Mainly responsible for software aspects, I was given the opportunity to design a software architecture from the ground up on a platform I had never used before (Raspberry Pi) and in a language I have never worked in before (Python). It was quickly evident that my previous experiences in coursework at SFU and software-based co-op were

extremely beneficial as this unfamiliarity was quickly done away with an I felt like I was making real progress developing the *Bartini*.

Overall, my experience developing the *Bartini* will be helpful in my career aspirations as a professional engineer. Although I can say I prefer courses with more structure, the practice of taking an idea from concept to prototype is an invaluable experience that every engineering student needs to partake in. I would like to that my team member, the course instructors and TAs, and Simon Fraser University for providing me with a worthwhile educational experience.

Luke Mulder – CEO

The biggest skill I learnt during this semester was everything involved in working with a team. Before this class I had only had a real team experience from ENSC 100. The first team skill that I learnt was how to schedule time. The whole design could be broken into different components that had to work together in different ways and having each person work on a different part and then find time to collaborate was a challenge. Another skill I learnt was how to discuss ideas with a group and make sure that everyone was on the page. It is easy to say we should do this or we should do that and then have each person walk away with a different impression of how things were going to actually be accomplished. I quickly learnt to always ask questions periodically of my group members to confirm that we were on the same wavelength or guide the discussion to show how I was approaching things. Finally, on the theme of interpersonal skills, I learnt how to deal with suppliers. There were a few parts that needed to be special ordered or times that we needed a solution that we knew would be solved better by a supplier that knows more about their own products. When dealing with suppliers of materials it can take longer than expected to get responses and communication can be an issue.

I learned a lot about designing complex systems. Given the number of types of technologies (pumps, servos, stepper motor, sensors, microcontrollers, GUI) our project used and the number of individual systems we needed to implement, the design phase had to be more rigorous than other projects I have worked on in the past. I learned how to think through all the cases of failure for both the individual modules and how each system interacted with the other. In addition to modes of failure I also had to think of how to design without knowing the final functionality. Because our ability to acquire parts was always changing, I had to make designs that would work in a number of different ways while still retaining the core functionality.

The technical skills that I developed will definitely help me in my future as an engineer. Although I am in computer engineering, knowing about mechanical systems and fabrication can help me when developing code for these types of systems. I learnt how to make CAD files in Solidworks for water jet cutting parts. Then I took these parts and assembled structures and moving assemblies. Writing code and looking at a computer monitor all day can become monotonous and getting to build something physical with my hands was very fulfilling. This experience may lead me to pursue career in an industry that works in both software and physical systems. Lastly I learned about how to control servo motors and stepper motors to drive a mechanical system. This involved learning about how these motors work and the software needed to control their motion precisely.

In conclusion, this capstone project was a good opportunity for me to learn a different side of engineering which will help me better understand my options in choosing a career path in the future. It was a stressful but worthwhile course and I would like to thank Noel Barron and Ben Hieltjes, my group members, Steve Whitmore for all the useful knowledge in creating a successful project, Andrew Rawicz for his guidance on our design, the TAs for marking our documentation and providing feedback and the SFU labs for putting up with our team making such a mess everywhere.

Noel Barron – CFO

Throughout my years as an undergrad in SFU, my experiences have been limited to the courses wired into my curriculum. Capstone has provided me a much needed change of pace, giving me direct control over an engineering project. From the conception of its idea to presenting a working model, I was able to gain valuable experience, both technical and interpersonal.

Working with a small team like the one present in Lightweight Enterprises, I learned how crucial it is to find a role to be able to contribute in the overall team dynamics. After a short amount of time, it became apparent that finding a correct fit in a group of individuals with varying backgrounds and ideas was going to be necessary to ensure that group morale and the general energy of the team flowed in a positive, effective manner. I found myself personally playing the role of mediator, acting as the tipping point between two largely conflicting ideas. By learning this early, I was able to contribute to the developing dynamics of Lightweight Enterprises' members.

My experiences with working on a team has been largely limited to projects with a direct goal with an established, easy to follow series of steps to achieve them. Capstone has given me a taste of what it takes to be a real engineer and come up with an idea and become fully responsible to its success. Given this much freedom, it is easy to see how much I take for granted the basic, well thought out structure of labs and projects assigned to us. From relatively mundane details such as finances and parts acquisition, to more complex decisions revolving software and mechanical architecture, we have been given free rein to make our own choices to ensure that our project is completed. These are experiences which I wouldn't have gained otherwise without the help of capstone.

In a technical standpoint, many of the skills I've gained generally revolves around mechanical concepts and the complexities that it comes with. The *Bartini* was initially a relatively simple idea that grew exponentially complex as it came closer to completion. With a largely limited background in mechanical work, almost everything I touched and helped create was new territory to me and required a fair degree of learning. I learned basic mechanical concepts through dealing with relatively simple tools such as solenoid valves, pumps, and servos at the same time applying various concepts learned from class such as electronic, soldering, and programming skills.

My time developing the *Bartini* has left me various skills and experiences that I hope to take with me as I embark onto the beginning of my life as an engineer. At the conclusion of my spring 2016 term doing capstone, I get a bitter-sweet feeling saying farewell to Lightweight Enterprises. I can say that I have left this term a whole lot wiser, taking away various experiences that will help me further my skills for my future career.

Appendix B: Meeting Minutes and Agendas

Lightweight Enterprises
AGENDA
January 15, 2016
1:30-2:30
Bartini

Purpose of Meeting: To discuss the final options for projects with Dr. Rawicz and decide upon basic design in order to prepare a basic cost analysis for funding request.

Items for Discussion:

- Viability of current project ideas?
- Required subsystems/functionality of project?
- How to begin preparing request for financial aid?

Lightweight Enterprises
MINUTES
January 15, 2016
1:30-2:30
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To discuss the final options for projects with Dr. Rawicz and decide upon basic design in order to prepare a basic cost analysis for funding request.

Minutes: Noel Barron called the meeting to order at 1:30.

A. Approval of the agenda and minutes of the previous meeting

This is the first meeting minutes. No previous report available to review and amend/approve.

B. Business Arising in Meeting

None.

C. Which of our capstone ideas should be pursue?

Discussion: After discussion with Dr. Rawicz, it was decided that we were going to pursue some sort of automated alcoholic drink mixing/dispensing system.

Action: Planning and design could now be focused on a selected project. Online documentation and a team file-share and communication system was to be configured using Google's online services.

D. What are the desired functionalities of our project?

Discussion: After an open discussion, it was agreed that all members would independently design possible solutions to the functionalities they felt were critical to the system. Comparison of functionality and designs was to be done at a later date; a single design for each subsystem will be chosen at that time.

Action: Members were to think of possible solutions and share results within 24hrs.

E. Funding Request

Discussion: The ESSS funding request form was to completed after design of subsystems was selected. Part research and budgeting can be done once the group has settled on a design.

Action: Members designs will determine the budget request. Agreed to complete financial request by Jan 17, 2016.

F. Next Meeting Date

The next meeting was tentatively arranged for January 17, 2016 at SFU Burnaby Campus.

G. Other Business

None. Meeting was adjourned at 2:30.

Lightweight Enterprises
AGENDA
January 22, 2016
10:20-11:34
Bartini

Purpose of Meeting: To discuss and delegate tasks for project proposal. Talk about specifics regarding physical design, company and product name and logo, tools and APIs for GUI.

Items for Discussion:

- Company name
- Product Name
- Physical design
- Fabrication

Lightweight Enterprises
MINUTES
January 22, 2016
10:20-11:34
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To discuss and delegate tasks for project proposal. Talk about specifics regarding physical design, company and product name and logo, tools and APIs for GUI.

Minutes: Noel Barron called the meeting to order at 10:20.

A. Approval of the agenda and minutes of the Jan 15, 2016 meeting

Project successfully chosen and a funding request was sent to ESSS pending approval.

B. Business Arising in Meeting

None.

C. What should our company/product name be?

Discussion: A brainstorm of possible names for our company and product.

Action: A more difficult task than first anticipated. Company name chosen as “Lightweight Enterprises”. Unanimous agreement. Proposals for product name included:

- Libation Station
- Bar Butler
- Automated Bartending Contraption
- Bartini

Group decided unanimously on “Bartini” as a product name.

D. Proposal of physical product design and properties.

Discussion: A SolidWorks model has been created. What amendments are needed to this model?

Action: Acknowledgement of strong and weak points by all members. Minor changes implemented. All members agreed that the final model will depend upon design and function specs as well as availability of parts.

E. Fabrication and Manufacturing

Discussion: Materials and build quality issues discussed.

Action: Members were assigned research on various metal fabrication shops for pricing purposes. Material selection was to be done with a balance of cost and appearance. Rough dimensions acknowledged for purposes of budgeting for the build.

F. Next Meeting Date

The next meeting was tentatively arranged for Feb 5, 2016 at SFU Burnaby Campus.

G. Other Business

None. Meeting was adjourned at 11:34.

Lightweight Enterprises
AGENDA
February 8, 2016
11:14-12:52
Bartini

Purpose of Meeting: To discuss and delegate tasks for functional specifications. Discuss some design choices and subsystems. Decide upon dimensions of project so construction can begin.

Items for Discussion:

- Dimensions and Initial Construction/Fabrication
- Git Repo

Lightweight Enterprises
MINUTES
February 8, 2016
11:14-12:52
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To discuss and delegate tasks for functional specifications. Discuss some design choices and subsystems. Decide upon dimensions of project so construction can begin.

Minutes: Ben Hieltjes called the meeting to order at 11:14.

A. Approval of the agenda and minutes of the Jan 22, 2016 meeting

Project proposal tasks were successfully delegated which lead to a completed proposal. Company name and product name were chosen.

B. Business Arising in Meeting

Use of “Optic” style drink dispensing system. A solution was found on craigslist Vancouver that may simplify the design. Ben Hieltjes was tasked with further investigation of the system.

Ordering the tap pieces needed its priority raised. Luke Mulder completed an order of tap pieces roughly totaling $45 CAD to be shipped from china arriving in 5-15 business days.

C. What are the dimensions of the box structures and metal pieces?

Discussion: A discussion of the sizes of the wooden structures providing the main support and the metal dispensing chamber.

Action: Rough dimensions of mixer box solidified. Ben Hieltjes tasked with construction to be completed within 1 weeks' time. Possible dimensions of metal work discussed. Noel Barron tasked with getting quotes from local metal fab shops. Group agreed that the large lower box would be designed around the metal piece once that had been constructed.

D. GitHub Repository.

Discussion: A GitHub repository was to be created to allow most efficient coding practices between team members

Action: Noel Barron created a GitHub repository for the team. Member Ben Hieltjes and Luke Mulder were given access to the repository via email from Noel.

E. Next Meeting Date

The next meeting was tentatively arranged for Feb 15, 2016 at SFU Burnaby Campus.

F. Other Business

None. Meeting was adjourned at 12:52.

Lightweight Enterprises
AGENDA
February 23, 2016
16:30-18:00
Bartini

Purpose of Meeting: To discuss project status and part acquisition.

Items for Discussion:

- DXF File for presentation to metal working facility
- Mounting of taps and servos for the mixer bottles
- Part Acquisitions challenges
- Software Structure

Lightweight Enterprises
MINUTES
February 23, 2016
16:30-18:00
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To discuss project status and part acquisition.

Minutes: Ben Hieltjes called the meeting to order at 16:30.

A. Approval of the agenda and minutes of the Feb 8, 2016 meeting

Functional specification tasks were successfully delegated which lead to a completed document. Basic design completed.

B. Business Arising in Meeting

None.

C. DXF File

Discussion: Review the DXF file required for metalworking

Action: Explanations of DXF file completed. Critique given by all members. Amendments performed. Noel is to present the file to the metalworking company this week for a final quote.

D. Mounting of taps and servos for the mixer bottles

Discussion: How to go about mounting the servos and how they will connect to the taps.

Action: Potential problems discussed. Considered using solenoid valves in place of tap-servo system. Will depend largely on availability of parts.

E. Part Acquisition challenges

Discussion: Difficulty of acquiring necessary parts in time for construction

Action: Research was done and concluded that finding food-safe, low pressure valves in very difficult within our budget. Parts coming from China a risks and may not be possible within our time frame.

F. Software Structure

Discussion: Members asked about the acceptance of software structure proposed by Ben Hieltjes.

Action: Structure approved. Ben was tasked with furthering the GUI. Noel was tasked with GPIO development.

G. Next Meeting Date

The next meeting was tentatively arranged for Feb 29, 2016 at SFU Burnaby Campus.

H. Other Business

None. Meeting was adjourned at 18:00

Lightweight Enterprises
AGENDA
February 27, 2016
11:00-13:00
Bartini

Purpose of Meeting: To discuss a possible redesign and finalize system components.

Items for Discussion:

- Pump System
- Part Acquisitions challenges
- Timeline

Lightweight Enterprises
MINUTES
February 27, 2016
11:00-13:00
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To discuss a possible redesign and finalize system components.

Minutes: Ben Hieltjes called the meeting to order at 11:00.

A. Approval of the agenda and minutes of the Feb 23, 2016 meeting

Agenda Approved.

B. Business Arising in Meeting

None.

C. Pump System

Discussion: Consideration of use of a pump system for mixers/alcohols or both

Action: Research and part pricing/availability presented. Group agreed to pursue a pump based system for the mixers with possibly of doing the same for the alcohol system if the carousel isn't feasible in the time limits.

D. Part Acquisition challenges

Discussion: Difficulty of acquiring necessary parts in time for construction

Action: A gravity fed food-safe valve was to be purchased from eBay by Noel. Pump was to be purchased on amazon by Luke. Electronic components to be purchased by Noel from a local store.

E. Timeline

Discussion: Discussion of timeline and current progress

Action: Group agreed that project was slightly behind in terms of the mechanical/physical construction. Software is on time. Implementation of the pump system done to reduce variables and hopefully simplify system. Pump system is extendable to alcohol system if time requirements become too strict.

F. Next Meeting Date

The next meeting was tentatively arranged for Feb 26, 2016 at SFU Burnaby Campus.

G. Other Business

None. Meeting was adjourned at 13:00

Lightweight Enterprises
AGENDA
March 10, 2016
14:30-17:00
Bartini

Purpose of Meeting: To discuss design specifications document.

Items for Discussion:

- Design Choices
- Part Acquisitions and substitutions
- Timeline

Lightweight Enterprises
MINUTES
March 10, 2016
14:30-17:00
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To discuss design specifications document.

Minutes: Noel Barron called the meeting to order at 14:30.

A. Approval of the agenda and minutes of the Feb 27, 2016 meeting

Agenda Approved.

B. Business Arising in Meeting

None.

C. Design Choices

Discussion: Justification for current design choices and proposal for undecided design elements

Action: Justifications and design choices were written into design specification document once agreed upon by all team members.

D. Part Acquisitions and substitutions

Discussion: Current state of part acquisition and possible alternatives.

Action: Group members were updated on state of parts. Discussion occurred on whether to use an Arduino instead of auxiliary electronic parts as we already have access to an Arduino and the necessary connections.

E. Timeline

Discussion: Discussion of timeline and current progress

Action: Group agreed that construction is the current bottleneck in the project. Now that sufficient parts have been acquired, physical construction will begin this week and is scheduled to continue for the following 2 weeks. Mechanical testing to be performed as the construction process permits.

F. Next Meeting Date

The next meeting was tentatively arranged for Mar 18, 2016 at SFU Burnaby Campus
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G. Other Business

None. Meeting was adjourned at 17:30

Lightweight Enterprises
AGENDA
April 2, 2016
11:00-17:00
Bartini

Purpose of Meeting: To develop product as a group.

Items for Discussion:

- Development Choices
- Timeline

Lightweight Enterprises
MINUTES
April 2, 2016
11:00-17:00
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To develop product as a group.

Minutes: Ben Hieltjes called the meeting to order at 11:00.

A. Approval of the agenda and minutes of the March 10, 2016 meeting

Agenda Approved.

B. Business Arising in Meeting

None.

C. Development Choices

Discussion: Justification for development choices and software flow

Action: All group members were brought up to speed on the current state of the project. With software mechanisms understood, collective decisions were made pertaining to software control.

D. Timeline

Discussion: Discussion of timeline and current progress

Action: Group agreed that group is behind project schedule. More development meetings as were held today will be required.

E. Next Meeting Date

The next meeting was tentatively arranged for Apr 6, 2016 at SFU Burnaby Campus.

F. Other Business

None. Meeting was adjourned at 17:30

Lightweight Enterprises
AGENDA
April 8, 2016
10:00-14:00
Bartini

Purpose of Meeting: To develop product as a group.

Items for Discussion:

- Development Choices
- Mechanical Issues
- Timeline

Lightweight Enterprises
MINUTES
April 8, 2016
10:00-14:00
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To develop product as a group.

Minutes: Ben Hieltjes called the meeting to order at 10:00.

A. Approval of the agenda and minutes of the April 2nd, 2016 meeting

Agenda Approved.

B. Business Arising in Meeting

None.

C. Development Choices

Discussion: Justification for development choices and software flow

Action: All group members were brought up to speed on the current state of the project. With software mechanisms understood, collective decisions were made pertaining to software control. Electronics and other physical aspects of project underwent preliminary testing

D. Timeline

Discussion: Discussion of timeline and current progress

Action: Group agreed that group is still behind project schedule. Discussed possible solutions to mechanical problems.

E. Next Meeting Date

The next meeting was tentatively arranged for Apr 10, 2016 at SFU Burnaby Campus.

F. Other Business

None. Meeting was adjourned at 14:15

Lightweight Enterprises
AGENDA
April 14, 2016
18:00-20:00
Bartini

Purpose of Meeting: To test the mixer system.

Items for Discussion:

- Switch Circuitry and Wiring
- Mechanical Issues
- Flow Rate

Lightweight Enterprises
MINUTES
April 14, 2016
18:00-20:00
Bartini

Present: Ben Hieltjes, Noel Barron
Absent: Luke Mulder

Purpose of Meeting: To test mixer system.

Minutes: Noel Barron called the meeting to order at 18:00.

A. Approval of the agenda and minutes of the April 8th, 2016 meeting

Agenda Approved.

B. Business Arising in Meeting

None.

C. Switch Circuitry and Wiring

Discussion: Verify soldered prototype circuitry was working as expected

Action: Error examined in testing persistent across all switch-transistor circuitry. Noel was to re-solder correctly for next meeting.

D. Mechanical Issues

Discussion: Discussion of mixer system mechanics

Action: Observed that after many attempts, the mixer system was finally working with the more powerful pump and sealed tubing system.

E. Flow Rate

Discussion: Need to measure approximate flow rate of mixer system to be able to estimate volumes produced by timing alone.

Action: Due to other testing issue arising, this task was pushed to a further date

F. Next Meeting

The next meeting was tentatively arranged for Apr 15, 2016 at SFU Burnaby Campus.

G. Other Business

None. Meeting was adjourned at 20:00

Lightweight Enterprises
AGENDA
April 15, 2016
15:00-19:00
Bartini

Purpose of Meeting: To test the carousel system.

Items for Discussion:

- Mechanical Issues
- Flow Rate

Lightweight Enterprises
MINUTES
April 15, 2016
15:00-19:00
Bartini

Present: Ben Hieltjes, Luke Mulder
Absent: Noel Barron

Purpose of Meeting: To test carousel system.

Minutes: Ben Hieltjes called the meeting to order at 15:00.

A. Approval of the agenda and minutes of the April 14th, 2016 meeting

Agenda Approved.

B. Business Arising in Meeting

None.

C. Mechanical Issues

Discussion: Discussion of carousel system mechanics

Action: Wiring was correct and communications between Raspberry Pi and Arduino working properly. Luke successfully installed the servo mechanism. Observed errors exist in the rotation angle - sometimes enough to cause failure,

D. Flow Rate

Discussion: Need to measure approximate flow rate of alcohol system to be able to estimate volumes produced by timing alone. Feedback system is in design but may not be implemented by the demo.

Action: Testing began and we averaged around 5mL/s. More testing required. Ideally, time-based measurements will be replaced by a feedback system.

E. Next Meeting

The next meeting was tentatively arranged for Apr 16, 2016 at SFU Burnaby Campus.

F. Other Business

None. Meeting was adjourned at 19:00

Lightweight Enterprises
AGENDA
April 18, 2016
14:00-19:00
Bartini

Purpose of Meeting: To work on final construction elements and gather test data.

Items for Discussion:

- Final Construction
- System Integration
- System Test

Lightweight Enterprises
MINUTES
April 18, 2016
14:00-19:00
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To work on final construction elements and gather test data

Minutes: Luke Mulder called the meeting to order at 14:00.

A. Approval of the agenda and minutes of the April 15th, 2016 meeting

Agenda Approved.

B. Business Arising in Meeting

None.

C. Final Construction

Discussion: Finalizing small details required for integration

Action: Acrylic window acquired and cut. Laser positioning module construction began.

D. System Integration

Discussion: Discussion of system integration

Action: Group agreed project was close to integration. Postponed to next meeting.

E. System Test

Discussion: Need to measure approximate flow rate of alcohol system to be able to estimate volumes produced by timing alone. Feedback system is in design but may not be implemented by the demo.

Action: Testing of flow rate in mixer system began. Testing a laser positioning module began.

F. Next Meeting

The next meeting was tentatively arranged for Apr 19, 2016 at SFU Burnaby Campus.

G. Other Business

None. Meeting was adjourned at 19:00

Lightweight Enterprises
AGENDA
April 19, 2016
10:00-20:00
Bartini

Purpose of Meeting: To work on final construction elements and gather test data.

Items for Discussion:

- Final Construction
- System Integration
- System Test

Lightweight Enterprises
MINUTES
April 19, 2016
10:00-20:00
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To work on final construction elements and gather test data

Minutes: Ben Hieltjes called the meeting to order at 10:00.

A. Approval of the agenda and minutes of the April 18th, 2016 meeting

Agenda Approved.

B. Business Arising in Meeting

None.

C. Final Construction

Discussion: Finalizing small details required for integration

Action: Kerdi-board fastened. Mixing chamber attached to dispensing chamber.

D. System Integration

Discussion: Discussion of system integration

Action: Group agreed project was close to integration. Postponed to next meeting.

E. System Test

Discussion: Implementation and testing of ultrasonic sensor.

Action: Testing of ultrasonic sensor was done.

F. Next Meeting

The next meeting was tentatively arranged for Apr 20, 2016 at SFU Burnaby Campus.

G. Other Business

None. Meeting was adjourned late at 21:00

Lightweight Enterprises
AGENDA
April 20, 2016
10:00-22:00
Bartini

Purpose of Meeting: To work on final construction elements and gather test data.

Items for Discussion:

- Final Construction
- System Integration
- System Test

Lightweight Enterprises
MINUTES
April 20, 2016
10:00-22:00
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To work on final construction elements and gather test data

Minutes: Ben Hieltjes called the meeting to order at 10:00.

A. Approval of the agenda and minutes of the April 19th, 2016 meeting

Agenda Approved.

B. Business Arising in Meeting

Required drink status information in GUI. Implemented by Ben Hieltjes.

C. Final Construction

Discussion: Finalizing small details required for integration

Action: Funnel hole drilled into chamber. Box braces fastened. Cut-outs for raspberry pi and power supply finalized.

D. System Integration

Discussion: Discussion of system integration

Action: System integration began. Wiring of final system began.

E. System Test

Discussion: Mixer system was still leaking and given inconsistent flow rates.

Action: Group decided to strip out existing tape/epoxy sealant and redo with clay. Initial test results are promising. Will need full test tomorrow.

F. Next Meeting

The next meeting was tentatively arranged for Apr 21, 2016 at SFU Burnaby Campus.

G. Other Business

None. Meeting was adjourned at 22:00

Lightweight Enterprises
AGENDA
April 21, 2016
10:00-22:00
Bartini

Purpose of Meeting: To work on project for final time before demo. Post-mortem and presentation will be discussed.

Items for Discussion:

- Post-mortem and Presentation
- System Integration
- System Test

Lightweight Enterprises
MINUTES
April 21, 2016
10:00-22:00
Bartini

Present: Ben Hieltjes, Luke Mulder, Noel Barron
Absent: N/A

Purpose of Meeting: To work on project for final time before demo. Post-mortem and presentation will be discussed.

Minutes: Ben Hieltjes called the meeting to order at 10:00.

A. Approval of the agenda and minutes of the April 20th, 2016 meeting

Agenda Approved.

B. Business Arising in Meeting

None.

C. Post-mortem and Presentation

Discussion: Finalizing documents and PowerPoint presentation.

Action: Images and video gathered from system. Discussion of remaining documentation tasks amongst group members.

D. System Integration

Discussion: Final system integration.

Action: Finalized system integration to presentation state.

E. System Test

Discussion: End-to-end testing.

Action: Full system tests began. Will report results at demo.

F. Next Meeting

The next meeting was tentatively arranged for Apr 22, 2016 at SFU Burnaby Campus.

G. Other Business

None. Meeting was adjourned at 22:00