Deliverable E

Group 8

Thomas Alkhoury, Laura Godfrey, James Hight, Cecilia Lou & Julian Ward

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Contents

1. Introduction

Due to the feedback we received during the client-meeting had after Deliverable D we have decided to refocus our project onto a new idea. The booking system and counter had already been accomplished by CEED which we were unaware of. However, we were able to reconvene and discuss as a group a new idea which we think will meet CEEDs needs and improve the workspace. Within this deliverable we will recomplete Deliverable B & C as well as complete Deliverable E. This will be accomplished by reflecting on the recent client meeting, creating a new problem statement, benchmarking our new product, creating a target range and design criteria for this project, as well as demonstrating our Trello and Big Picture organization, breaking down our potential work hours, creating a list of potential risks and contingency, and finally creating a budget.

2. Reflection

During the client-meeting we had with CEED this week, we received some feedback from the client about our idea solution. They responded that there was no need for a booking system for makerspace and that the counter system was extremely similar to the current system with the card sign in. The biggest concern however was how the system would be enforced in a space. The users have no incentive to perform a sign in action. Therefore, as a team, we re-discussed our options and re-examined our problem statement. This led us to our new problem statement below. It also brought us to our new solution which would be a system for Brunsfield, and this would be enforced by the current card sign in system. The machines would only have power after the user signs in and their training confirmed by the system. This solves the issue of enforcing the sign in system. Using the dashboard interface, the machines can be displayed through a monitor.

3. New Problem Statement

CEED needs a way to bar access to machines to users who do not have the appropriate training.

4. Bench Marking

Relay

	5V 1 One Channel Relay Module	5V 30A High Power 1-Channel Relay Module	ELEGOO 4 Channel	ELEGOO 8 Channel
Photo				
Design	PCB [2]	PCB [3]	PCB [6]	PCB [7]
Price (Tax Excluded)	2.18$ (AliExpress) [2]	4.50$ (AliExpress) [3]	10.86$ (Amazon) [6]	12.86$ (Amazon) [7]
Number of Channels	1 [2]	1 [3]	4 [6]	8 [7]
Maximum Amperage	10A [2]	30A [3]	10A [6]	10A [7]
Maximum Voltage (AC)	250V [2]	240V [3]	250V [6]	250V [7]

5. Target Range

5.1 Relay:

- Budget: $2.18-$12.88
- Number of channels: 1-8
- Max amperage: 10A-30A
- Max Voltage: 240V-250V

6. Design Criteria

- Total cost must be under 100$

6.1 Relay

6.1.1 Functional Requirements

- Must be a messenger between Arduino board and power source
- Material must be durable and strong (users stepping on it or kicking it)
- Must be able to cut off power sources
- Must take up small amount of space
- Must be able to take a large amount of voltage

6.1.2 Non-Functional Requirements

- Aesthetics
- Product life (years)
- Safety
- Reliability

6.1.3 Constraints

- Cost ($)
- Size (Can’t be a hazard)
- Voltage capacity (must be compatible with the machines)
- Durability

7. Big Picture

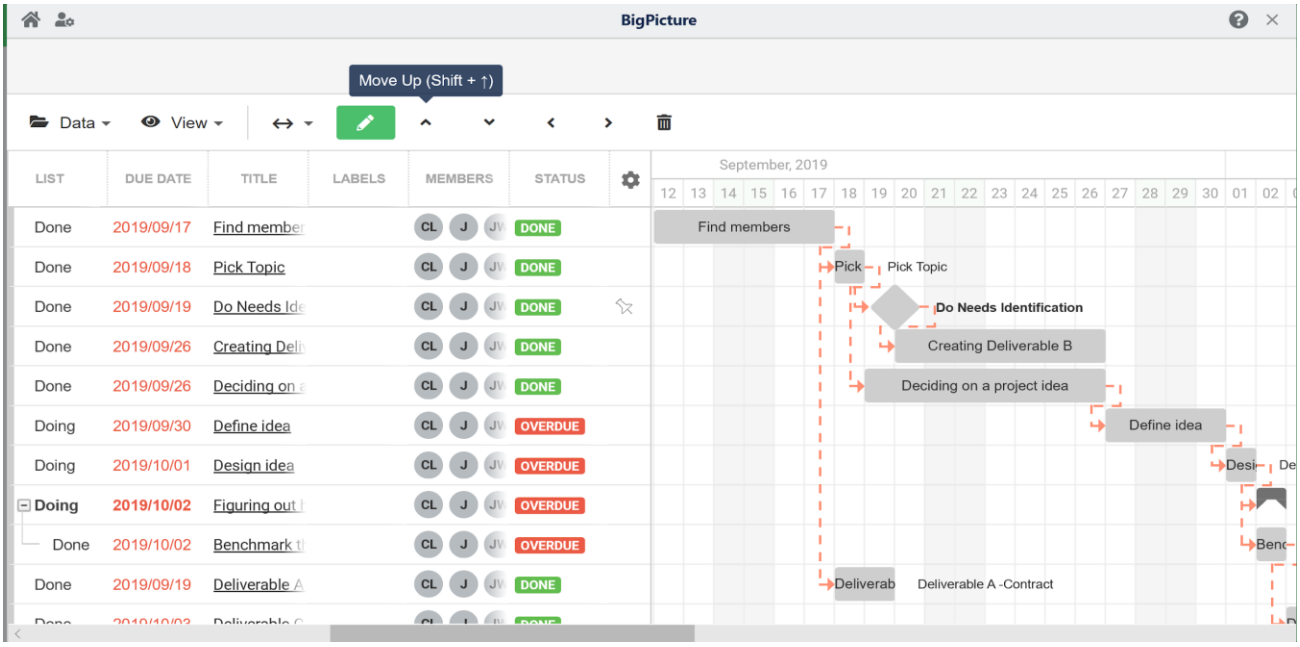

Figure 1:Big Picture 1

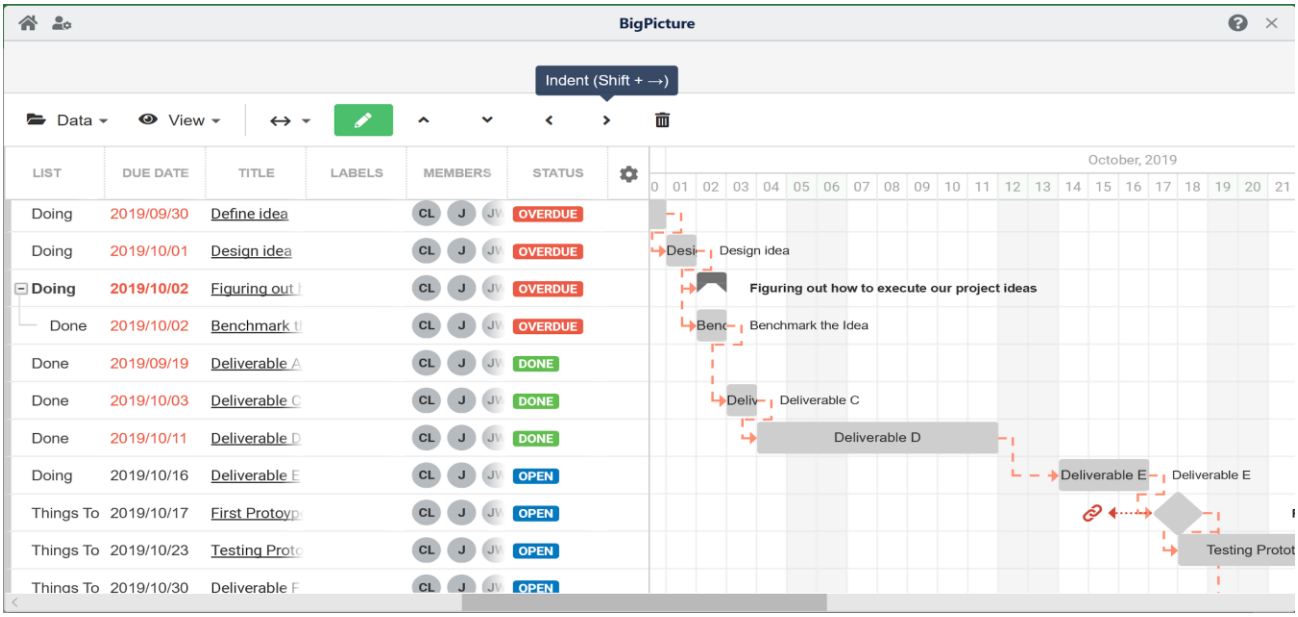

Figure 2:Big Picture 2

Deliverable E

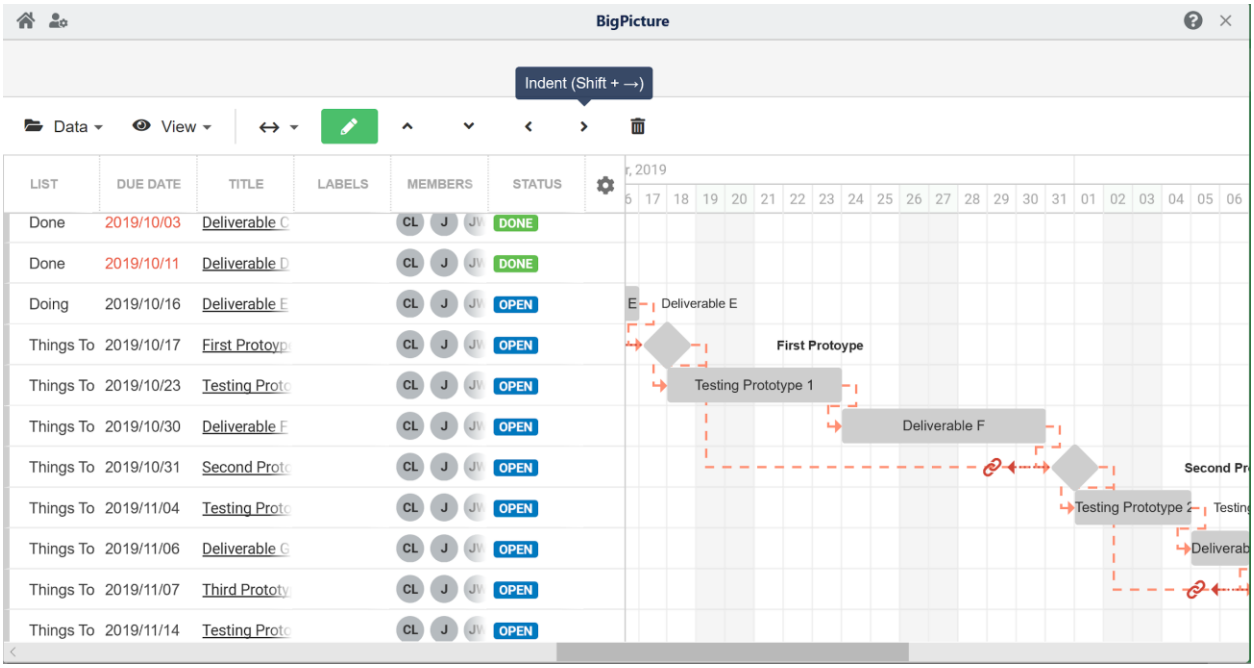

Figure 3:Big Picture 3

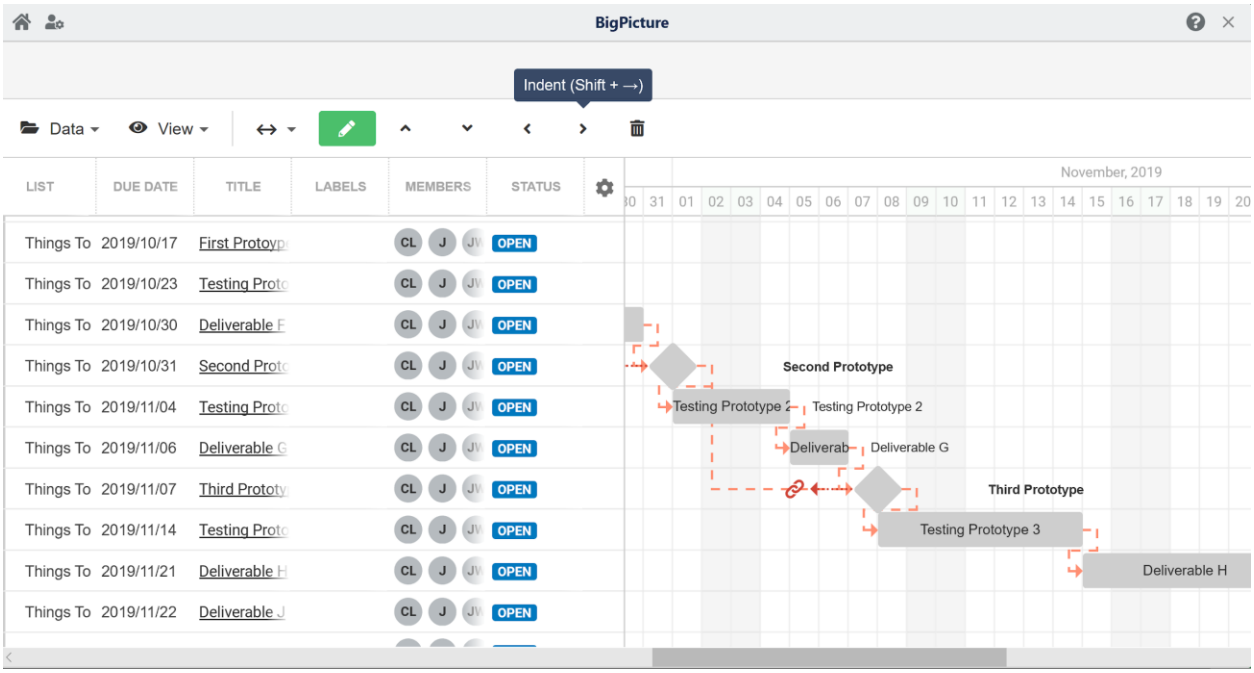

Figure 4:Big Picture 4

Deliverable E

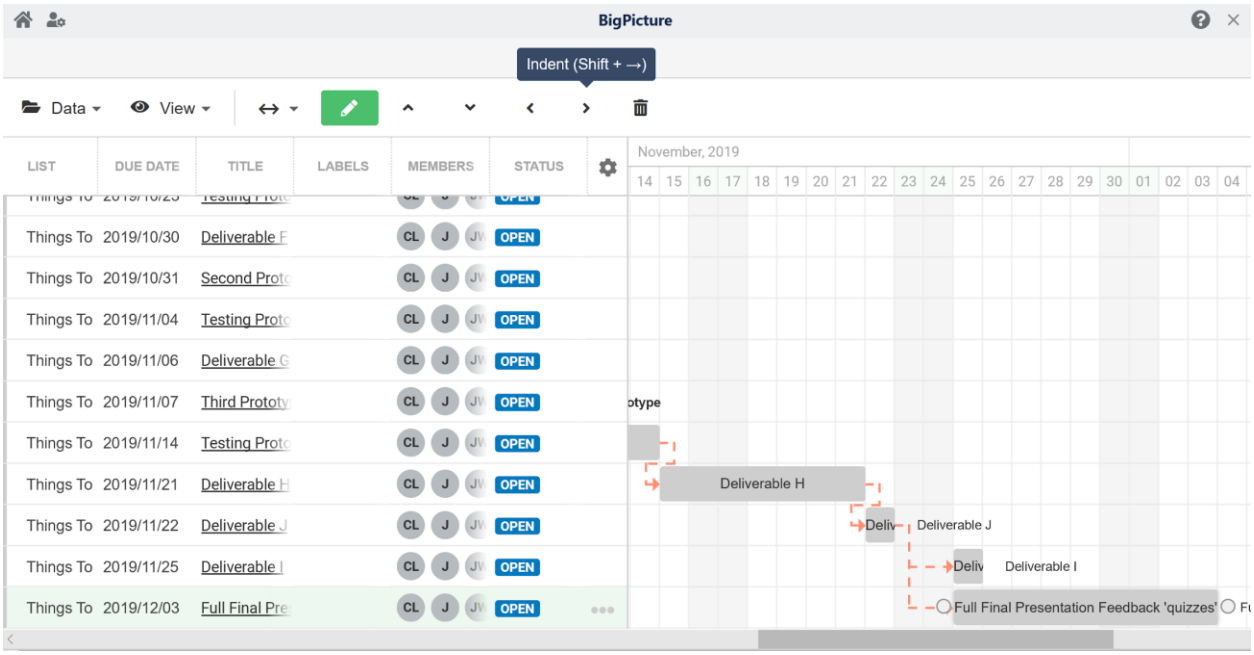

Figure 5:Big Picture 5

8.Work Hours Breakdown

Idea Brainstroming	Worst Case	Best Case	Expected Hours			Worst Case	Best Case	Expected Hours
Benchmarking	4	1	2.5		**Total**	118	53.25	85.625
Figuring out ways to exeute idea	6	2	4		**Per Person**	23.6	10.65	17.125
Deliverable E								
Trello	1.5	0.5	1					
Budget	1.5	0.75	1.125					
Workhours Breakdown	1.5	0.5	1					
Admin (Splitting work, Discussion..)	1	0.25	0.625					
First Prototype								
Protyping Test Plan	4	1	2.5					
Define Stopping Criteria	1	0.5	0.75					
Developing the Prototype	5	3	4					
Proof of Concept	4	2	3					
Analysis and Results	2	0.5	1.25					
Client Meeting	0.5	0.25	0.375					
Admin (Splitting Work, Discussion...)	1	0.5	0.75					

Figure 6:Work Hours Spreadsheet 1

Second Prototype			
Protyping Test Plan	5	2	3.5
Define Stopping Criteria	1	0.5	0.75
Developing the Prototype	10	5	7.5
Documenting the Prototype	10	5	7.5
Comparison to Previous Prototype	2	1	1.5
Testing	2	0.75	1.375
Analysis and Results	2	0.5	1.25
Client Meeting	0.5	0.25	0.375
Admin (Splitting Work, Disussion...)	1	0.5	0.75
Final Prototype			
Protyping Test Plan	5	2	3.5
Define Stopping Criteria	1	0.5	0.75
Developing the Prototype	10	5	7.5
Documenting the Prototype	10	5	7.5
Comparison to Previous Prototype	2	1	1.5
Analysis and Results	2	0.5	1.25
Testing	2	0.75	1.375
Client Meeting	0.5	0.25	0.375

Figure 7:Work Hours Spreadsheet 2

Client Meeting	0.5	0.25	0.375
Admin (Splitting Work, Disussion...)	1	0.5	0.75
Deliverable J			
Discussion	1	0.5	0.75
Content Prep	3	2	2.5
Making the Powerpoint	5	3	4
Practicing the Presentation	2	1	1.5
Deliverable I			
Writing the Pitch	3	1.5	2.25
Discussion	2	0.75	1.375
Practicing the Presentation	2	0.75	1.375

Figure 8:Work Hours Spreadsheet 3

9. List of Potential Risks and Contingency Plan

Risk	Contingency

• The hardware needed is unavailable
  ○ Relay
  ○ RFID scanner
	Use any hardware that is readily available for use at the University of Ottawa (e.g. in the ready-made Arduino kits, the RFID scanners that the Makerspace currently has).

• Arduino software and Dashboard does not integrate	Figure out how to do the project without Arduino. Just use Dashboard.
• Creating a system takes more time and work than initially anticipated ○ Dashboard might not be able to support	Remove some of the features of the system and focus on the functionality of the important parts

• Dashboard setup might be harder than anticipated.
  ○ Not aesthetically pleasing
  ○ Fewer functions
	Keep the layout of the dashboard simple and easy to understand. Worry about aesthetics after dashboard works.

• Possible problems with hardware (e.g. breadboard, RFID scanner)	Ask Dr. Knox, Rob, or Essraa for help and try to figure out a way around (possibly using a different method).
• Coding Difficulties: ○ Advanced booking system proves too difficult to code	Ask for help from experienced coders or find examples of similar codes online to help us figure it out. We can also watch Dashboard tutorials and read the user guides to look for solutions.

10. Budget

Materials we need:

- Arduino Wires
- Arduino USB plugin
- Breadboards
- Raspberry pie
- Only 1 of each
- Relay

Item/Fund	Minimum Cost (Tax Included)	Maximum Cost (Tax Included)
Arduino UNO	15.76$ (Third Party) [8]	35.92$ [5]
Arduino PCB Wires	11.29$ (Multiple Wires) [1]	11.29$ (Multiple Wires) [1]
Arduino USB Cable	0.00$ (Included Third Party) [8]	5.01$ [4]
Breadboard	3.26$	12.41$ (3 Included)
Relay	2.46$ [2]	14.53$ [7]
Overall Cost	32.77$	79.16$
Contingency Fund	67.23$	20.84$

11. Conclusion

In conclusion, after receiving the feedback from CEED during the client meeting, we have adapted out idea to target Brunsfield instead of Makerspace. The execution of the idea will require approximately 84 hours or 18 hours of work per person and cost us around 50 dollars. This deliverable addresses several possible problems that may occur as well as contingency plans for those problems. Through this deliverable, we are better equipped to approach the building of the first prototype.

12. References

[1] 120pcs Jumper Wires / Dupont Cable 20cm Length Multicolored(10 color) 40pin M to F, 40pin M to M, 40pin F to F Breadboard Jumper Wires Ribbon Cables Kit for Arduino / DIY/ Raspberry Pi 2 3: Amazon.ca: Electronics. (n.d.). Retrieved from https://www.amazon.ca/120pcs-Multicolored-Breadboard-Arduino-Raspberry/dp/B072L1XMJR/ref=sr_1_1_sspa?keywords=arduino+wires&qid=1571364661&sr=8-1-spons&psc=1&smid=A2XZVOPECQVFD3&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEzVVVQVVBKMkZLTTNPJmVuY3J5cHRlZElkPUEwMDQ3NDMyMVcxUDAyUkJONDhENyZlbmNyeXB0ZWRBZElkPUEwMTUwOTUxM0VZTkZIS1BHUUNWRiZ3aWRnZXROYW1lPXNwX2F0ZiZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0NsaWNrPXRydWU.

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[6] ELEGOO 4 Channel DC 5V Relay Module with Optocoupler for Arduino UNO R3 MEGA 2560 1280 DSP ARM PIC AVR STM32 Raspberry Pi: Amazon.ca: Electronics. (n.d.). Retrieved from https://www.amazon.ca/dp/B06XCKQ1M9/ref=twister_B07DCKFLZJ?_encoding=UTF8&psc=1.

[7] ELEGOO 8 Channel DC 5V Relay Module with Optocoupler for Arduino UNO R3 MEGA 2560 1280 DSP ARM PIC AVR STM32 Raspberry Pi: Amazon.ca: Electronics. (n.d.). Retrieved from https://www.amazon.ca/dp/B06XCN5JNH/ref=twister_B07DCKFLZJ?_encoding=UTF8&th=1.

[8] Elegoo UNO R3 Board ATmega328P ATMEGA16U2 with USB Cable for Arduino: Amazon.ca: Industrial & Scientific. (n.d.). Retrieved from https://www.amazon.ca/Elegoo-Board-ATmega328P-ATMEGA16U2-Arduino/dp/B01EWOE0UU/ref=sr_1_3?keywords=arduino+uno&qid=1571364749&sr=8-3.