Deliverable E

Group 8

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

GNG 1103

October 17, 2019

Contents

1.	Introduction	3
2.	2. Reflection	
3.	3. New Problem Statement	
4.	I. Bench Marking	
5.	5. Target Range	
5	5.1 Relay:	
6.	6. Design Criteria	
6	6.1 Relay	5
	6.1.1 Functional Requirements	5
	6.1.2 Non-Functional Requirements	5
	6.1.3 Constraints	5
7.	7. Big Picture	6
8.	3. Work Hours Breakdown	
9.	 List of Potential Risks and Contingency Plan 	9
10.	0. Budget	10
11.	1. Conclusion	10
12.	2. References	11

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	Processing and the second			
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

∦ ♣							Big	Picture	3 ×
			Move	Up (Shit	ft + ↑)				
🖻 Data	 View 	\leftrightarrow	ø	^	~	<	>	â	
LIST	DUE DATE	TITLE	LABELS	MEM	IBERS	STATUS	\$	September, 2019 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 0	01 02
Done	2019/09/17	Find member		CL	J JV	DONE		Find members -	
Done	2019/09/18	Pick Topic		CL	J	DONE		Pick − Pick Topic	
Done	2019/09/19	Do Needs Ide		CL	J	DONE	Ŷz	Ibo Needs Identification	
Done	2019/09/26	Creating Deli		CL	J	DONE		Greating Deliverable B	
Done	2019/09/26	Deciding on a		CL	J	DONE		→ Deciding on a project idea –	
Doing	2019/09/30	Define idea		CL	J	OVERDUE		→ Define idea -	
Doing	2019/10/01	Design idea		CL	J	OVERDUE		l →Da	esi-
- Doing	2019/10/02	Figuring out		CL	J JV	OVERDUE			•
Done	2019/10/02	Benchmark t		CL	J JV	OVERDUE			Be
Done	2019/09/19	Deliverable A		CL	J	DONE		Deliverable A - Contract	
Dono	2010/10/02	Deliverable (01	• • •	DANE			i

Figure 1:Big Picture 1

♠ ♣							Big	yPic	ture															•) >	×
						Indent	t (Shift -	+ →																		
🖿 Data	- 🛛 View	v	•	^	~	<	>	Ū	i																	
LIST	DUE DATE	TITLE	LABELS	MEA	IBERS	STATUS	to:													Oc	tober	, 2019)			
LIST	DOE DATE	IIILE	LABELS	MILI	NBERS	STATUS	~	0	01 02	03 04	05	06	07 0	8 ()9 1	0 1	1 12	2 1	3 1	4 1	5 16	5 17	18	19	20	1
Doing	2019/09/30	Define idea		CL	J	OVERDUE			1																	
Doing	2019/10/01	Design idea		CL	J	OVERDUE		5	Desi De	esign ide	ea															
- Doing	2019/10/02	Figuring out		CL	J. J.	OVERDUE			-	Figu	ring ou	t ho	w to ex	ecut	e our	proj	ect id	eas								
Done	2019/10/02	Benchmark t		CL	VL L	OVERDUE			→Benc-	Bend	hmark t	the lo	dea													
Done	2019/09/19	Deliverable A		CL	VL L	DONE																				
Done	2019/10/03	Deliverable C		CL	VL L	DONE			₩	Deliv-	Delivera	able	с													
Done	2019/10/11	Deliverable D		CL	VL L	DONE				5		De	eliverat	ole C)		-									
Doing	2019/10/16	Deliverable E		CL	VL L	OPEN											1		→D	eliver	able	E-1	Delive	erable	E	
Things To	2019/10/17	First Protoyp		CL	VL L	OPEN														0	•	-		-1		
Things To	2019/10/23	Testing Proto		CL	J. J.	OPEN																4			ng Pr	·
Thinas To	2019/10/30	Deliverable F		CL	J JV	OPEN																		j.		

Figure 2:Big Picture 2

☆ 🏞								Big	Picture															0	×
						Inder	nt (Sh	ift +	→)																
🖿 Data 🗸	 Ø View 	\rightarrow	•	^	*	<	>		Ē																
LIST	DUE DATE	TITLE	LABELS	MEM	BERS	STATUS	s	\$	r, 2019 6 17 1	9 10 7	20 5	21 22	22	24	25 /	6 2	7 29	2 20	30	31	01	02	03	04 0	15 06
Done	2019/10/03	Deliverable C		CL	J JV	DONE				0 19 .	20 2		. 20	24	20 4	.0 2	/ 20	, 29	30	51	01	02	05	04 0	00
Done	2019/10/11	Deliverable D		CL	J	DONE																			
Doing	2019/10/16	Deliverable E		CL	J	OPEN			E- Del	iverable E	=														
Things To	2019/10/17	First Protoyp		CL	J	OPEN			4	-!		Firs	t Prote	оуре											
Things To	2019/10/23	Testing Proto		CL	J	OPEN			•	Testin	g Pro	totype	1	ŀŗ.											
Things To	2019/10/30	Deliverable F		CL	J	OPEN				1			4		C	elive	rable	F		Ŀŗ.					
Things To	2019/10/31	Second Proto		CL	J	OPEN				<u> </u>								O-				1		Se	cond Pr
Things To	2019/11/04	Testing Proto		CL	J	OPEN														9	Test	ing P	rototy	pe 2	Testin
Things To	2019/11/06	Deliverable G		CL	J	OPEN																1		→D	eliverat
Things To	2019/11/07	Third Prototy		CL	J	OPEN																1		- ć	•
Things To	2019/11/14	Testing Proto		CL	J	OPEN																			

Figure 3:Big Picture 3

20						Big	Pictur	9														0	>
					Indent	t (Shift +	· →)																
🖿 Data	 View 	$v \bullet \bullet$	ø	~ ~	<	>	Ē																
LIST	DUE DATE	TITLE	LABELS	MEMBERS	STATUS	•												No	vemb	er, 20)19		
LIST	DOE DATE	11166	LABELS	MEMBERS	STATUS		30 31	01	02 03	04 0	5 06	07	08	09	10 1	1 1	2 13	14	15	16	17	8 1	9
Things To	2019/10/17	First Protoyp		CL J JV	OPEN																		
Things To	2019/10/23	Testing Proto		CL J JV	OPEN																		
Things To	2019/10/30	Deliverable F		CL J JV	OPEN		-																
Things To	2019/10/31	Second Proto		CL J JV	OPEN		4	-		Se	cond P	rototy	/pe										
Things To	2019/11/04	Testing Proto		CL J JV	OPEN			Testin	g Proto	type 2	Testi	ng Pro	ototype	2									
Things To	2019/11/06	Deliverable G		CL J JV	OPEN					→D	elivera	ib <mark>- ı</mark> (Delivera	able (G								
Things To	2019/11/07	Third Prototy		CL J JV	OPEN					6	4	\mathbf{F}		ı.		Thi	rd Pro	totype	2				
Things To	2019/11/14	Testing Proto		CL J JV	OPEN							4		Tes	ting P	ototy	/pe 3		-1				
Things To	2019/11/21	Deliverable H		CL J JV	OPEN													5			Delive	rable	∍ H
Things To	2019/11/22	Deliverable J		CL J JV	OPEN																		

Figure 4:Big Picture 4

2 ¢							Big	Pictu	ire																	0	3
						Indent	(Shift +	→)																			
🖹 Data	 View 	\rightarrow	ø	^	~	<	>	Ē																			
list	DUE DATE	TITLE	LABELS	MEME	RERS	STATUS	•	No	vemb	er, 201	9																
	2013/10/23	reating rioto	LNDELU	UL .		UPEN	~	14	15	16 1	7 1	B 19	20	21	22	23	24	25	26	27	28	29	30	01	02	03	
Things To	2019/10/30	Deliverable F		CL .	J	OPEN																					
hings To	2019/10/31	Second Proto		CL .	J	OPEN																					
hings To	2019/11/04	Testing Proto		CL .	J	OPEN																					
hings To	2019/11/06	Deliverable G		CL .	J	OPEN																					
hings To	2019/11/07	Third Prototy		CL .	J	OPEN		otype	e																		
hings To	2019/11/14	Testing Proto		CL .	J	OPEN			ŀ.																		
Things To	2019/11/21	Deliverable H		CL .	JV	OPEN		4		D	eliver	able I	н		Ŀ.												
Things To	2019/11/22	Deliverable J		CL .	J	OPEN								1	Deli	- [Delive	rable	J								
Things To	2019/11/25	Deliverable		CL .	JV.	OPEN										i.	- +	Deliv		elive	rable	1					
Things To	2019/12/03	Full Final Pres		CL .	J JN	OPEN										L	-0	Full	Final	Pres	senta	ition	Feed	back	'qui:	zzes	1

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

Deliverable E

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=15 71364661&sr=8-1spons&psc=1&smid=A2XZVOPECQVFD3&spLa=ZW5jcnlwdGVkUXVhbGImaW VyPUEzVVVQVVBKMkZLTTNPJmVuY3J5cHRIZEIkPUEwMDQ3NDMyMVcxUD AyUkJONDhENyZlbmNyeXB0ZWRBZEIkPUEwMTUwOTUxM0VZTkZIS1BHUU NWRiZ3aWRnZXROYW1IPXNwX2F0ZiZhY3Rpb249Y2xpY2tSZWRpcmVjdCZk

b05vdExvZ0NsaWNrPXRydWU.

- [2] 5V 1 One Channel Relay Module Low Level for SCM Household Appliance Control for arduino DIY Kit-in Relays from Home Improvement on AliExpress -11.11_Double 11_Singles' Day. (n.d.). Retrieved from https://www.aliexpress.com/item/32708600505.html.
- [3] 5V 30A High Power 1 Channel Relay Module with Optocoupler H/L Level Triger for Arduino Mega AVR PIC DSP ARM SLA 5VDC SL A-in Relays from Home Improvement on AliExpress - 11.11_Double 11_Singles' Day. (n.d.). Retrieved from https://www.aliexpress.com/item/32642667729.html.
- [4] AmazonBasics USB 2.0 Printer Cable A-Male to B-Male Cord 6 Feet (1.8 Meters): Amazon.ca: Computers & Tablets. (n.d.). Retrieved from https://www.amazon.ca/AmazonBasics-USB-2-0-Cable-Male/dp/B00NH11KIK/ref=sr_1_4?keywords=arduino+usb+cable&qid=15713648 29&sr=8-4.
- [5] ARDUINO A000066 Uno R3 DIP Edition, 1.5": Amazon.ca: Computers & Tablets. (n.d.). Retrieved from https://www.amazon.ca/ARDUINO-A000066-Uno-DIP-1-5/dp/B008GRTSV6/ref=sr_1_5?keywords=arduino+uno&qid=1571364789&sr=8-5.
- [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=157136474 9&sr=8-3.