Smart Cooler
Group 23

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No customers, sponsors, or significant contributors ☹

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Project Narrative

There is much to be said about the power of convenience propagating throughout the world right now, as its hold on everyday pedestrians grows stronger and keeps us wanting more. From working remotely for jobs, to getting groceries delivered to your home in a matter of clicks, there is a high degree of satisfaction that comes with being able to do so much with so little effort. This project stems from that idea and uses it as motivation for satiating that need. Sometimes situations warrant having such convenience because it can prevent mishaps and human error in day-to-day activities. A big part of college-life is tailgating for sporting events like football or basketball, where you bring food and drinks to socialize with friends before the actual event. An event like this can take place for hours on end, therefore people bring many different commodities to keep busy, ranging from hotdogs to cook on the grill to water bottles to stay hydrated. This requires bringing many different appliances, which can be heavy and quite cumbersome to drag back and forth. The world needs an item to help lighten the load for all parties involved because we deserve that quality of life and convenience.

Our project aims to create a smart cooler that will have many different functionalities to help combat such hindrances. One of the main features is to introduce a partial lid that is made out of smart glass. Smart glass is a type of glass material that changes its light transmission properties once light, heat, or voltage is introduced to it. It will be powered by a battery that is charged through a solar panel attached to the other lid of the cooler. The smart glass is our solution to a few problems with a cooler: cold loss mitigation and privacy. A portable cooler is usually made cold through ice or ice packs, but everytime someone wants to check what is inside of the cooler, they have to open it and the cooler begins to release the cold air it has trapped inside. This begins to melt the ice, and the problem further develops as the day progresses. This feature will allow you to see the cooler's contents without opening it to help mitigate some temperature loss by not having it open while deciding what you want to grab. Rather than normal glass, the smart glass can turn clear to opaque through the aforementioned processes and give privacy to the cooler's contents when needed. This would be handled through a switch to apply voltage when flipped on.

Another component for our cooler's functionality would be introducing usb ports for the many devices people have with them. Its main purpose would be for charging since dead devices seem to be a common occurrence for outdoor activities. This not only helps with convenience, but safety concerns when left with a powerless device. We will attempt to introduce more miscellaneous components, but the project will mainly focus on implementing these for the consumer.

The end goal for this project is to provide a stable, efficient, and low cost cooler that can help supplement people's many life activities. We will bring in different functionalities to make one that is refreshing to have and pleasant for the average consumer. From here, there are endless other ideas we can employ, but we have only scratched the surface.

Features

Basic:

- PDLC Smart Glass
- PV Panel
- LED Lights
- Temperature probe

Advanced:

- USB Ports
- Rechargeable battery
- Graphical Interface
- Adjustable transparency

Stretch Goals:

- Camera
- Bluetooth Speakers
- Mobile application

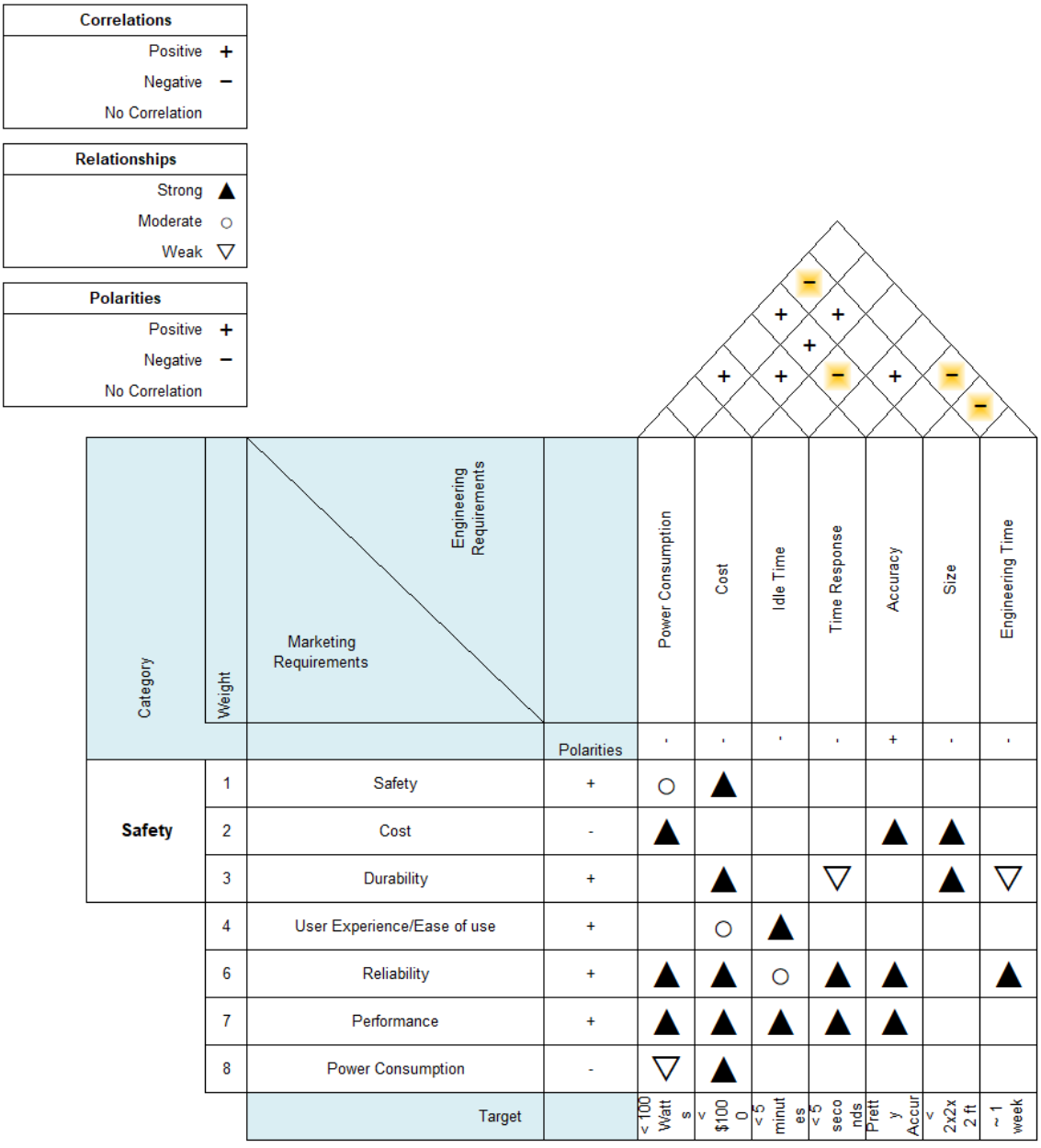
Possible Project Constraints

- New design of the cooler lid must be able to fit properly back onto the cooler to insure the cooler is still effective
- Electrical components contained within the cooler should not be disturbed by other items put inside the cooler (i.e. food, drinks, ice, etc.)
- Electrical components contained within the cooler should take up as little space as possible
- Electrical components, when power, should not change the temperature of the cooler by a large amount
- Components exposed on the outside of the cooler should be okay when exposed to different weather conditions
- Custom PCB should be able to connect to microcontroller and control light adjustment for the glass

Table 1: Requirement Specifications

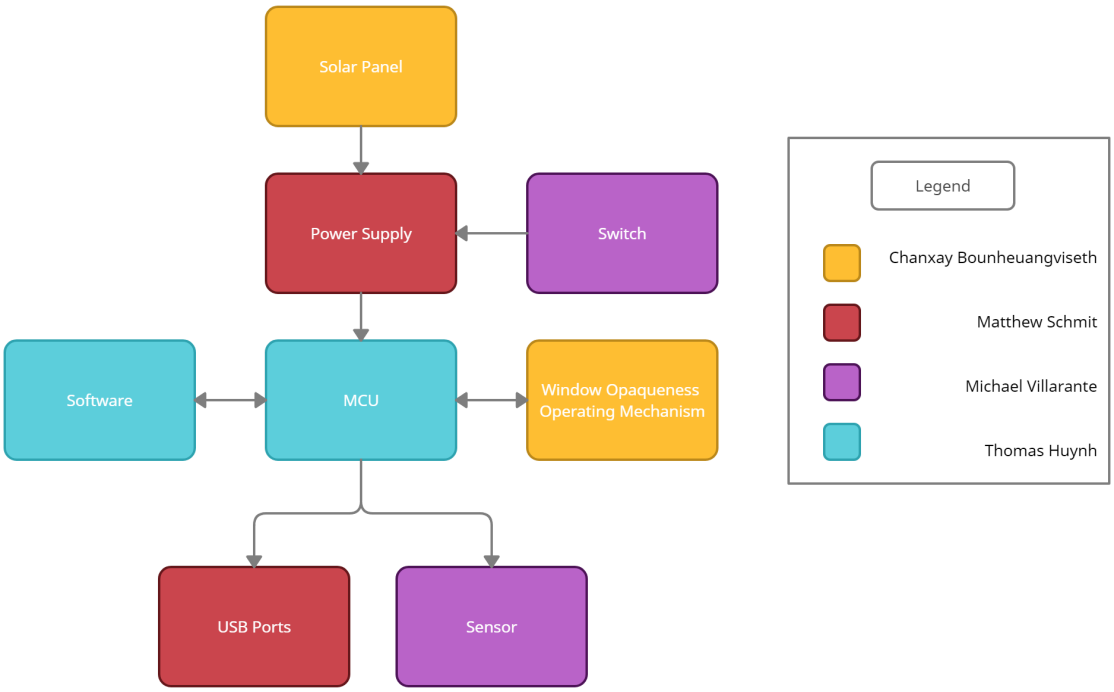
Component(s)	Parameter	Specification
Battery	Discharge Time	4 Hours
PDLC Film	Power Consumption	≤ 10 Watts
PDLC Film	Time to Activate	≤ 5 Seconds
PDLC Film	Transparency	≥ 90%
PDLC Film	Opaqueness	10 - 90 %
Sensor	Accuracy	≥ 95%
Cooler	Weight w/o Food/Drinks	≤ 30 Pounds
PV Panel	Power Output	≥ 100 Watts

Figure 1: House of Quality



Block Diagram

Figure 2: Block Diagram



Budget and Funding

For budgeting, the whole project's estimated cost is gonna be around $700-$800 for both Senior Design 1 and Senior Design 2. Overall, the team is flexible in the budget, but we look to be cost effective in the resources that we acquire for the project. With that, this is not the final total, as things can either go up/down in prices, looking for replacements, damaged items, etc. As for certain items, some might be free and already hanging around, so that will help how much of the budget we are using.

Table 2: Estimated Budget/Funding Information

Item	**Cost**
Smart glass	$150
Solar panel	$150
Switches	$30
Cooler	$30
Battery	$40
PCB	$150
Sensor	$15
Controller	$60
Miscellaneous	$80
Total	$705

Project Milestones

Senior Design 1/Senior Design 2

Table 3: Senior Design 1 Milestones

Milestone	Description	Duration	Dates
Group Formed		1 week	Jan. 13
Project Selection	Divide & Conquer V.1 & Divide & Conquer V.2	5 weeks	Feb. 18
Document Submission: Divide & Conquer V.1			Feb. 4
Document Submission: Divide & Conquer V.2			Feb. 18
Technology Investigation	Hardware Software	2 weeks	Feb. 19 - Mar. 5
60 Page Draft	Divide and Conquer V.2 Revision	3 weeks	Mar. 6 - Ma. 25
Document Submission: 60 Page Draft			Mar. 25
100 Page Report	60 Page Draft Revision	2 weeks	Mar. 25 - Apr. 8
Document Submission: 100 Page Report			Apr. 8
Final Document	100 Page Draft Revision	2 weeks	Apr. 8 - Apr 26
Document Submission: Final Document			Apr. 26

Table 4: Senior Design 2 Milestones

Milestone	Description	Duration	Dates
Build Prototype		TBD	TBA
Test & Redesign		TBD	TBA
Finalize Prototype		TBD	TBA
Peer Presentation		TBD	TBA
Final Report		TBD	TBA
Final Presentation		TBD	TBA

References/Appendix

1. “How To Install Switchable Privacy PDLC Film”, https://www.uniteglass.com/how-to-install-switchable-privacy-pdlc-film
2. “PDLC Film”, https://www.amazon.com/HOHO-Electronic-Switchable-Electric-15cmx15cm/dp/B077P4QJT1
3. “Cooler”, https://www.amazon.com/Best-Choice-Products-Cookouts-Tailgating/dp/B08DZSHTBN/ref=dp_fod_1?pd_rd_i=B08DZSHTBN&psc=1