Group 20: Pour Soul Systems Digital Tap Handle

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Design Impact Statement

1.0 Introduction

As the design for the Pour Soul Systems (PSS) digital tap handle nears completion, it is important for the PSS team to consider the impacts of its new product. This assessment will consider the more generalized impacts at play for bars like the economic and cultural/social ones, along with the underlying impacts such as public health, consumer safety, and welfare impacts and environmental impacts. The impacts are caused by two different parts of the device, the production of it and the data that it produces.

2.0 Public Health, Safety, and Welfare Impacts

The purpose of this system is to prevent bartenders from handing out free drinks. It is not to address public health and safety concerns around public drinking. However, it could help provide public health officials with accurate data about alcohol consumption in different areas and environments. However, the more significant public health concerns are around the production of the device. Throughout many of the main countries that produce electronics (China, Korea and Malaysia), negative health effects have been linked to the toxic chemicals and working conditions in electronics factories [2.1]. Unfortunately, it can be next to impossible to find cost effective electronic components that don't have these public health issues. As the company grows, this is important to consider and resources should be put towards finding manufacturing facilities with the best possible practices.

3.0 Cultural and Social Impacts

This device could change "bar culture". The main cultural shift would be through monitoring and limiting the number of buybacks (ordering a certain number of drinks, and receiving one drink free [3.1]) a bartender is handing out. However, the prevalence of this practice varies widely on locations so its impact will vary [3.1]. The system could also be a talking point with customers that would help increase interest in that specific bar. It could play into a futuristic or technological theme of a bar that would create a different type of social atmosphere.

4.0 Environmental Impacts

Manufacturing of any product, especially electronics, has a huge environmental impact. A wide variety of raw materials must be brought in from all over the world and then a great deal of power (that may come from renewable sources but usually doesn't) and water are used to produce the electrical component [4.1]. Then after the components have been made, they still need to be shipped to Pour Soul Systems and based on the costs of components, they will most likely be shipped from China. No matter the method of transportation, more energy, that mostly doesn't come from renewable sources, will be used to transport them. All together, a seemingly simple device requires a lot of resources to produce.

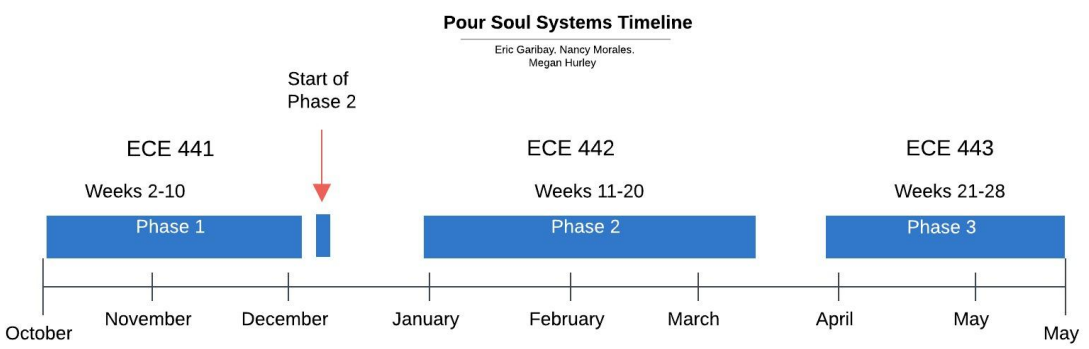
5.0 Economic Factors

These digital tap handles are not made to attach to traditional tap handles, customers must be willing to pay a lot of money upfront to get rid of their old tap handles and replace them with digital ones. But this investment in digital tap handles helps the bar owners on saving money from their kegs. One of the biggest losses to bars is spillage/over-pouring drinks. Now whether it is the device's fault or humans, it must be noted that losing approximately 6 ounces of beer per liter can cost establishments thousands in losses in a year [5.1, 5.2]. To also help with keeping costs low for this drive, Therefore, if these owners can accurately keep track of how much beer is poured per drink, they can better manage which ones are sold a lot, how often they are used, and when to start planning new shipments of kegs to their establishments. And taking into account that the state of Oregon has over 200 breweries, adding this new form of technology to their building can benefit the beer industry overall from the people who have and make the beer to the bartenders serving them all over the state.

6.0 Conclusion

All manufacturing, especially electronics manufacturing, has significant environmental and public health impacts that are important to consider, but difficult to do much about as a small company. However, as the business grows and the orders get larger, it will become more and more important to consider these impacts. The cultural/social impacts and the economic impacts are relevant to consider when the product is being pitched to customers and investors. Collectively, these impacts are key to consider as a business in order to have the most ethical and effective products.

Project Timeline



Phase 1:

Requirements Finalized: Week 8
Research Implication Report: Week 10
Project Charter: Week 10

Phase 2:

Technical Demo: Week 11
First Block Check-Off: Week 14
Second Block Check-Off: Week 17
Final Block Check-Off: Week 20

Phase 3:

Initial System Check-Off: Week 25
Final System Check-Off: Week 28
Project Close Out: Week 28
Project Showcase: Week 28

Scope and Engineering Requirements Summary

Requirement	Customer Requirement	Engineering Requirement
Battery Life	Device does not need to recharge every night.	The system will need to run for 5 hours without fully discharging.
Bluetooth Utilization	Replace Wifi with Bluetooth.	The system will use Bluetooth to transmit the accelerometer data via an antenna on the microcontroller to the software hub.
Data Transfer	The tap handle can store and transfer pour data.	The system will store the x, y, and z axis of the handle and transfer it to the software hub

		every half hour.
Price	The device must be low cost.	The system must cost less than $50 per unit, and this is based on the per 1000 unit prices of individual components.
Rechargable	The device must be rechargeable.	The system must have a rechargeable battery charged by micro USB that increases the battery level after 15 minutes.
Replace Raspberry Pi	Find a replacement for raspberry pi.	The system will have a custom PCB with it's own microcontroller chip and other components that are specifically tailored to the needs of the project.
Size	The device must fit inside the predefined enclosure	The system must fit inside an enclosure that is approximately 5 inches tall, 2 inches wide and 0.5 inches deep.
Sleep Mode	The tap handle should conserve battery when not in use.	After 15 minutes of inactivity, the system transfers its x, y and z accelerometer data and then enters sleep mode.

Risk Register

Risk	Description	Category	Probability	Impact	Performance	Responsible	Action

ID					Indicator	Party	Plan
R1	Component delivery delay	Timeline	60%	M	Shipping dates when ordering parts.	Eric	Reduce
R2	Device isn't waterproof and we try test it and it breaks	Technical and Cost	30%	M	Finding components and/or materials that are IP67 waterproof rating during the research stage.	Nancy	Reduce
R3	PCB Design/Function Issues	Technical	50%	H	We start adding components and they don't fit or we start testing and aren't getting the results we want and there's not another explanation.	Megan	Retain
R4	COVID: limiting ability to use lab spaces, inability to get components, one group member gets it	Timeline	10%	H	OSU Covid statistics and protocols. Student COVID test results	All	Avoid
R5	Project partners want to change requirements late in the project	Scope	10%	L	They communicate this to us in a meeting or slack message.	All	Avoid

The number one thing we learned was to always expect more changes to what the project will look like. Although we had R5, we listed the probability as being low and it should have been much higher. The action plan for it should have been to retain because it is always inevitable that more changes will be made as the project goes along. We also learned that there can always be better communication, specifically with the project partners. The main thing we didn't anticipate was the issues with bluetooth connection and the server. We also expected that per 1000 unit prices would be more readily available. However, this was largely due to our need to use modules due covid limitations.

Future Recommendations

Recommendation	Reasoning	Next Steps
Design an onboard qi charging circuit	The module has to be tucked under the PCB which is not ideal. There's also some noise produced during charging. It would just make the circuit more secure and could be made to output 3.7V instead of 5V, which would eliminate the need for the dc dc converter.	Here is the design I started but wasn't able to implement. The most helpful reference is the Qi Wireless Power Transfer Circuit, specifically part 2.
Design an on board accelerometer circuit instead of using a module.	It would eliminate the unused pins that are on the board and it would help with energy efficiency and control. It would also make the system slimmer and the enclosure could be made slimmer again.	Continue to use the ADXL 345 accelerometer (datasheet). Adafruit has the most documentation available about a module that uses this specific accelerometer.
Explore and implement Bluetooth Classic instead of BLE	During the implementation of the project, it was difficult to find a lot of documentation of BLE, since it came out in 2016. Thus, having Bluetooth Classic may have been simpler in getting the transmission to work between the software	Look at implementation of Bluetooth Classic on the itsybitsy nRF52840. See if Adafruit has documentation of boards that are Bluetooth compatible. This module looks like a good starting point for bridging Bluetooth Classic on an Arduino.
Explore use of ESP32 microcontroller	It has Wifi and Bluetooth Communication capabilities.	Here is a link to all of the documentation for this

	We looked into it but due to limited access to the lab and traditional resources, we were unable to thoroughly use this.	microcontroller.
Make adjustments to the enclosure design.	Based on the new design changes, there are parts of the enclosure that need to be changed.	Start by filling in the holes in the current system since the system is now wirelessly charged. Adjust the threading back to its original shape.
Prioritize creation of technical documentation from engineers so that non-technical members of the team don't have to try to relay the state of the system.	Documentation is much easier to pass along and doesn't require the non-technical members to try to remember information that they aren't familiar with.	Starting from the very beginning, document all technical work through schematics and writing. Provide as much information as possible since it is likely the person receiving the information will not be able to contact you.
Use apps like Notion, Google Drive	These tools help maintain meeting notes, ideas, discussion topics so that all team members are informed of current progress of the project.	Have one team member make a shared google drive and then add all team members to the drive as editors. Follow this same process for Notion.
Communication - Setting bi-weekly or weekly meetings with project sponsor, while setting up weekly meetings with internal (student) team	Bi-weekly meetings with project partners allowed for more meaningful updates. Weekly team meetings helped us stay on the same page and help each other out as needed.	Have each team mate send the times that they are available every week and from the times that overlap, select one time to meet as a team. Send the remaining times to the project partner to determine a time that all parties are consistently available.
If possible work with partner subject matter experts	After the time that students are working with the project is complete, experts will have an easier time picking up the project.	While working on the project, document all the designs and relevant information. Coordinate with project partners to get in contact with their subject matter experts.

References

[2.1] Improving Occupational and Environmental Health in the Global Electronics Industry," https://www.apha.org/policies-and-advocacy/public-health-policy-statements/policy-database/2014/07/21/08/43/improving-occupational-and-environmental-health-in-the-global-electronics-industry (accessed Apr. 11, 2021).

[3.1] K. Fleming, "Buybacks: How a sacred bar ritual got ruined," New York Post, Jun. 25, 2019. https://nypost.com/2019/06/25/buybacks-how-a-sacred-bar-ritual-got-ruined/ (accessed Apr. 11, 2021).

[4.1] "The Environmental Impact of Electronics and E-Waste," Cohen, Aug. 05, 2019. https://www.cohenusa.com/blog/environmental-impact-of-electronics-and-e-waste/ (accessed Apr. 11, 2021).

[5.1] H. Longman, "Bar Waste - Are You Wasting Your Inventory and Losing Money? | Glimpse Corp," *www.glimpsecorp.com*, 24-Aug-2020. [Online]. Available: https://www.glimpsecorp.com/bar-waste-clubs-bars/. (Accessed: 16-Apr-2021).

[5.2] Buzztime Business, "Pour Smart: Why Spills and Overpouring are Costing Your Bar Big Bucks," *Buzztime*, 4-Apr-2014. [Online]. Available: https://www.buzztime.com/business/blog/pour-smart-spills-overpouring-costing-bar-big-bucks/. (Accessed: 16-Apr-2021).