

# **Smart Koozie Proposal**

**Robert McKay, Juan Salas, Yohan Ksor**

**Description:** As summer grows nearer, people across the world will rejoice as the weather becomes more pleasant. They may even begin to venture outside to soak in the rays; I know I will. I don't know about you, but one thing that makes a hot summer day even better is an ice cold beverage or two. Something about the warm weather and a cold drink just feels so right. Now, picture this: You're about to enjoy a nice afternoon with your buddies. You reach in your cooler to grab a beverage and - oh no! - your drinks are warm. In a moment your day is made significantly worse. You probably get sad at the fact that this day will not be a great day. You may even go back inside. You see, a warm beverage just isn't refreshing, and no one should have to drink one. That's where the Smart Koozie comes in. The Smart Koozie is an elegant, ergonomic, and "cool" looking koozie that actively cools down your drink and keeps it at your desired temperature. Beyond that, The Smart Koozie is equipped with sensors that can detect and count how many drinks you've had for those days when you maybe have a few too many and lose count. Now, you're probably asking: "How do I control my Smart Koozie??" Well, The Smart Koozie is equipped with physical buttons and a small display which allow the user to set their preferred temperature. The display will also show your drink count. Furthermore, the Smart Koozie will also come with wireless control through an app. The app will also be able to tell you additional statistics such as average time per beverage and power draw statistics. It may even be able to track your drinks over time. Offering key insights into how many beverages you drink (health benefits).

**Justification:** I think the Smart Koozie would be a really fun idea as it is something I would actually use pretty often. I'm honestly super excited to work on it and put it to use. Also, I think it has the added benefit of being relevant or impressive to laypeople and not just CS majors, which may make for a more interesting presentation.

**Challenges:** Despite being simple in concept, The Smart Koozie actually presents a number of interesting engineering and software challenges. These stem from three key requirements that I have identified in order for the Koozie to be practical:

1. Ergonomics
  - a. The koozie must be handheld, so we must figure out how to compactly package our components such that it is comfortable in the hand.
2. Power and Efficiency - This also relates to ergonomics
  - a. Being battery powered, the koozie must cool the drink as efficiently as possible so that the battery can be a reasonable size and price.
    - i. With some help from chatGPT, I determined that a 12oz can of beer kept at 32F while it is 75F outside absorbs 3-15W of heat depending on how well it is insulated. Our cooler has to absorb an equal amount of heat to keep the can at a steady temperature, using battery power. As such, we must design our koozie in a way that keeps the can as insulated as

possible. Also, we need to be able to account for the fact that the cooler isn't 100% efficient and that some cooling power will be wasted.

- ii. The cooler used is more efficient if you are able to remove heat from it quickly. Heatsinks will definitely be needed, and we may need to explore implementing a fan into the product as well. This may introduce some interesting implications in software as well.

### 3. Safety and waterproofing

- a. As it is a product that will be around liquid, we need to be sure that it won't break/electrocute its users if it gets wet.
  - i. I've worked with electronics on boats so I have some ideas from that.

**Stretch Goal #1, Cooling and Efficiency Testing:** This will probably be the longest phase as it will take a lot of tinkering and experimentation. Essentially the goal of this phase will be to design an insulation and cooling apparatus that is as efficient as possible. This will give us a better idea of how big our battery must be, which is essential to know before we can design a real enclosure due to size constraints.

**Stretch Goal #2, Drink Counter and Physical IO:** This should be simple in theory. The drink counter could either be a switch of some kind or a pressure sensor (might be able to get some more interesting data for the app with this route). This should also be where we finalize our PCB and get everything working with the physical buttons and screen.

**Stretch Goal #3, App Integration:** By this point, we should have a working product so all that's left to do is create some sort of app to control the koozie and collect data from it. Probably bluetooth connected.

## **Clarification of Features and Components(Summary):**

### Features:

1. Koozie that actively cools your drink
2. Keeps track of how many drinks you've had that session
3. Controlled through physical IO buttons and screen and/or app
4. Battery powered

### Components:

1. Sensing: Temperature sensor, switch or pressure sensor to count how many drinks you've had, some way to monitor power draw
2. Wireless communication: Probably a bluetooth module
3. PCB: Used to connect everything together. Shouldn't be computationally expensive, but size is a major concern, as is power draw
4. Other: Cooler, heatsinks, insulating material, fan(?), battery, some way of charging-USB C would be nice and could also be used for updating firmware, other small components
  - a. The cooler is a 4cmx4cm pad that utilizes the Peltier effect to remove heat using electricity - no refrigerant required.
  - b. (<https://www.sparkfun.com/thermoelectric-cooler.html> )

## Collaboration Plan

### Responsibilities:

- Design and conception: Team effort. Everyone will contribute to this aspect of our project, and provide input and insight into making our idea a reality.
- Modeling: Robert. I have a lot of experience in creating CAD models and assemblies. I will use input from the rest of the team in determining the dimensions and implementing other design choices.
- Electronics: Juan Salas. I've taken various physics classes and I'm confident about my circuit knowledge.
- PCB Design: Yohan Ksor.
- Software: Again, this will be a team effort.

Communication: We will meet through Zoom, text message, and in person in various study places around campus. We will use VS Code and GitHub to update and share code with one another.

Expectations: Meet at least one to twice a week to discuss our progress and goals for the week. Stay communicative, if there are any problems or roadblocks, we must ensure we're all supporting each other. Meet deadlines always.

**Back Up Plan:** Realistically, there is a decent chance that we will not be able to create a koozie that will be able to create the necessary thermal gradient that will keep drinks at an ice-cold temperature. We think it's possible, but there are a lot of unknowns regarding the efficiency of the coolers and what temperatures they can maintain. At minimum, we should be able to create something that keeps it cooler than the ambient temperature, but it's hard to say how much colder at this stage. Also, even if our cooling solution keeps it cold enough, it's possible that it will draw more power than is feasible to supply with a reasonably sized battery. As such, our product may end up being larger than we would like, or even wall powered. In short, our final product may not live up to all current expectations, but we should be able to create something that comes somewhat close at the very least.

We could also create a smart koozie that keeps the drink cold the traditional way, but has a sensor that notifies the user to start drinking faster as their beer is getting warm.