

BottleGuard Final Report

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Abstract

While inhabiting shared living spaces like apartments have their advantages, such as cheaper living, they also have their fair share of annoyances, one of which being sharing beverage items. Often times, it becomes hard to effectively convey one's preferences for what items should be shared and to what extent the sharing of that item should continue. Additionally, it is hard to mitigate other individuals from simply disregarding another's sharing preferences, and over indulging in their generosity. The BottleGuard can assuage these problems by allowing the owner to communicate in real time to their apartment mates whether they want to share or not from anywhere in the world. With a complimentary app, BottleGuard can be controlled remotely from anywhere with internet, signalling the owner's sharing preference via a multi-colored led. Users will also be notified of unwelcome use of their beverages as BottleGuard replaces the bottle's original cap, and notifies owners of use with a gyroscope sensor built into the cap. At a rather competitive price of \$25, 13,107 units will need to be sold in order to break even on the production and development costs. Through proper production scheduling and adequate risk prevention and mitigation, BottleGuard will soon bring to customers the ability to share when desired while also maintaining the peace of mind that they won't be taken advantage of.

Introduction

Bailey is a college student who lives in an apartment with several roommates. They all share the same fridge, and some of the items within. Although she is generally fine sharing her drinks with others, sometimes Bailey would like to keep them to herself when she gets a soda that is difficult to find or when the drink is running out. Due to their busy schedules, however, she finds it difficult to communicate that with all of her roommates. She resents the fact that sometimes her roommates help themselves to her drinks without asking for permission first because they were not aware that she didn't want to share. Bailey would like a way to remind her roommates in the moment of whether or not she is willing to share. Additionally, she wants to know when someone tries to open the bottle and take her soda when she has not granted permission.

She has tried different methods of expressing her intentions, such as sticking Post-it notes on her bottles or sending a text message to their roommate group that she'd prefer if they didn't take her drink. However, these methods have not proven to be effective since text messages are often ignored or overlooked, and Post-it notes are prone to falling off the bottle. She finds a bottle lock called KwikTop but decides against using it since she understands that everyone's schedule is different from hers, and such an inflexible method of keeping the drink to herself defeats the idea of sharing the drink, and can sour Bailey's relationship with her roommates. Moreover, a bottle lock comes at a fixed size and can only fit on one type of bottle, while she wishes to share a variety of drinks that come in markedly different bottle

sizes like soda bottles or milk jugs. Ideally, she also wants something that does not take up much room in the fridge, as she only has a limited amount of fridge space allocated to her.

Our device, BottleGuard, will solve all of Bailey's problems, providing an advantage over competitors by allowing for a nearly instantaneous response notification to attempted use and to communicate the owner's preferences to all users. BottleGuard is a compact cap replacement that can be fitted on to various types of bottles. It would let Bailey's roommates know if she wanted to share the drink through a sharing mode that displays a green light to indicate a desire to share and a red light to indicate when one does not want to share. With a simple button press from the app, Bailey can set the light on the device from red to green from anywhere in the world with an Internet connection. The green light would then indicate her consent to share for the next couple minutes, allowing her roommate to pour their drink, before changing back to red again and signifying that permission is needed. Bailey can also choose to keep the light green and leave sharing open. When the light is red, any attempt to open the bottle will trigger a warning sound and send a notification with the time the bottle was opened to Bailey's phone. Bailey can now be more secure in knowing that she can be aware of if and when her roommates try to take her drinks, or use them without permission.

There are a few risks inherent with BottleGuard, but nothing too dire. The largest risks come from users trying to misuse the device by subjecting it to environments that BottleGuard was not designed for such as an oven or microwave. These risks will be covered with more depth later on, however the greatest mitigation factor for a majority of the risks will be found in warning and instructions provided in a manual with each device. BottleGuard is priced at a competitive twenty five dollars per device, allowing for the company to break even after the sale of approximately 13,107 units.

Market overview: Price / Performance

Price Performance Chart and Key Attribute Matrix

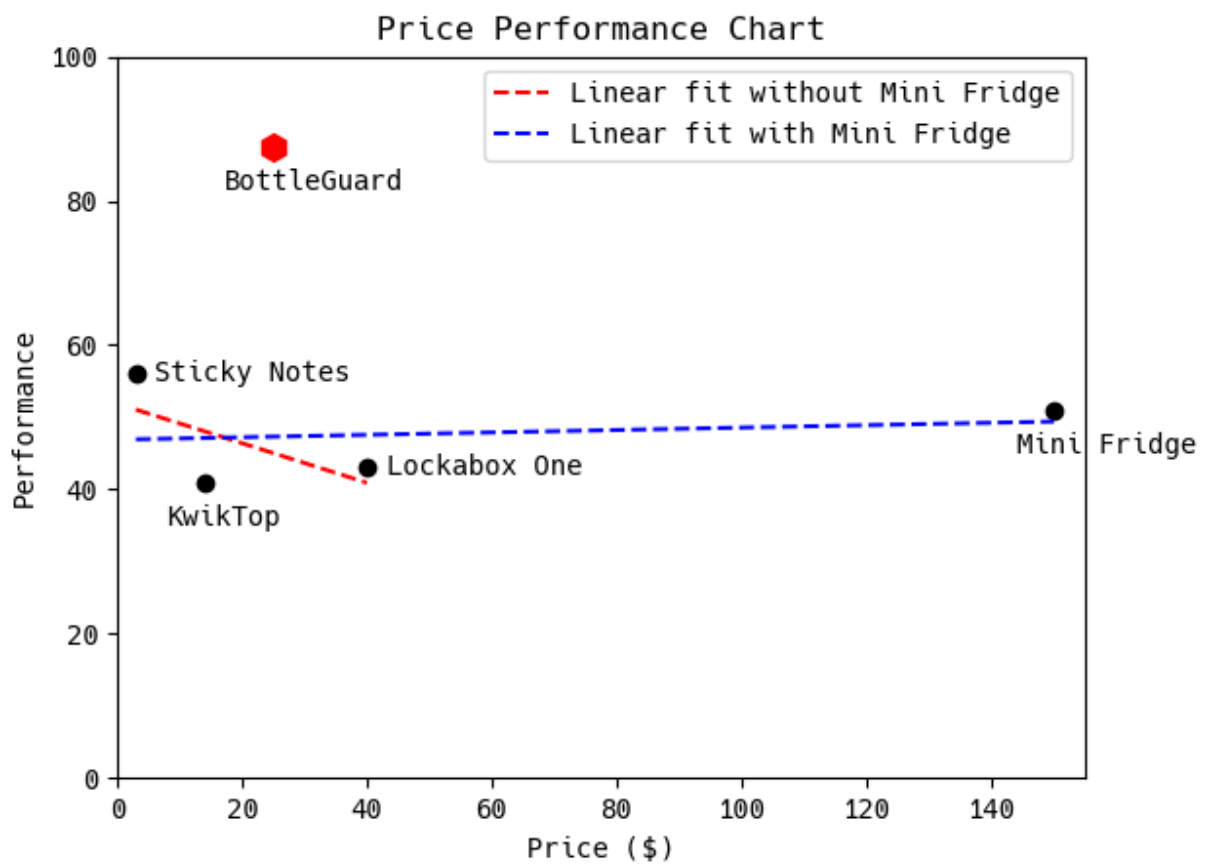


Figure 1: Price Performance Chart

	Weight	BottleGuard	Sticky Notes Pack	KwikTop	Lockabox One	MiniFridge
Ease of Sharing	35%	10	6	3	3	9
Access Notification	30%	10	0	4	4	0
Universal fit	20%	6	10	4	8	9
Compact	15%	7	10	7	3	1
Performance	100%	87.5	56	41.0	43.0	51
Price		\$25	\$2.99	\$13.69	\$39.99	\$150

Figure 2: Key Attribute Matrix

Competition

The top competitors for BottleGuard are Kwiktop and a pack of sticky notes. Kwiktop is a combination lock that prevents access to the beverage without the combination. This product does not allow the user to easily share the beverage because the user locks the bottle, making it impossible to drink without the combination. If the user does not lock the bottle, another person may assume that the user wants to share, whether or not that is the user's actual desire.

The sticky notes are cheap and can be used on every bottle. However, this solution does not allow the user to change their sharing preferences without physical intervention. If the user had a no sharing note but now wants to share, the user has to physically remove the note, which will not work if the user is away from the bottle. Additionally, the notes will give no notification to the user of whether or not someone is, or has, taken the beverage.

The competitive advantage that BottleGuard has over its competitors is the ability to allow the user to express their desire, or lack thereof, to share their beverage. With the app, the user only needs to press one button to tell others that they can drink the beverage, or that they are not allowed to drink. Being able to remotely change one's sharing preferences and receive notifications when the bottle is accessed, in addition to BottleGuard's competitive pricing, gives BottleGuard a high performance score and desirable location in the Price Performance chart, above the linear fit line. There are two lines of linear fit, depending on the competition being taken into account. If looking at all the competitors listed in Figure , including the minifridge, a linear fit line of positive slope can be drawn. However, should

the minifridge be disregarded, a negative slope linear fit line results. This reversal of slope direction is due to the fact that the fridge, sans the price, is a very competitive solution to the unmet need. The fridge makes sharing easy as it is as simple as opening a fridge door, and it has a strong ability to fit nearly any size beverage container. However, when pricing is taken into account, the minifridge becomes much less viable. Therefore, should one consider that the fridge is no longer a competitor, a negatively sloped line is drawn due to the fact that sticky notes are extremely cheap and easy to use.

Key Attributes

The unmet need story highlights the ability to share the beverage whenever the user wants to without being physically present, therefore **ease of sharing** is the most important key attribute. Without this attribute, the user is unable to express their desire to share the beverage or not. If the user is willing to share but did not tell anyone, a person who wants to take the beverage will have to ask for permission first, or will not take the drink assuming no permission is needed, which could be inconvenient for the user. But if the user does not want to share and did not notify others, those others could take the beverage assuming permission is given. Next, **access notification** is an important attribute to look for in the product because without access notification, the user would not know when someone is taking beverage without permission. Following access notification comes **universal fit**. This attribute allows the user to use the product on a variety of bottles with different cap sizes, which allows the user to enjoy different beverages without having to buy different products for different bottles. Finally, **compactness** allows the user to use the product without taking up too much space in the fridge or any place where the user keeps the bottle.

Price

The prices shown in the figures above are essentially all one time purchase calculations. All competitors are a one time purchase that do not require any part replacements. The only exception is for the sticky notes pack, which has to be bought again when the pack is finished. However, due to the large amount of sticky notes that can come in one pack, the recurring price of buying new sticky notes was not calculated in the total price as one could probably get away with buying about one pack a year. Since BottleGuard's batteries are rechargeable, there is no need to buy extra batteries or replacements for the device. Therefore giving BottleGuard a one time purchase price as well.

Product Overview

Program Risk and Mitigation

In terms of consumer reception risk, there is a possibility that consumers will opt for the cheaper sticky notes or KwikTop instead. To mitigate this risk, we will market BottleGuard's ease of sharing and ability to notify, which are attributes that are uncharacteristic of other products in its price vicinity. Other than that, we believe our asking price of \$25 should not significantly deter consumers from purchasing the product for any other reasons.

In terms of failure modes, one possible complication is the development of mold or other bacteria on the device as a result of the user failing to properly wash it. To illustrate, the mold could come in contact with the bottle contents. When the user drinks the bottle contents, he/she becomes unknowingly poisoned. This can lead to severe upset stomachs and nausea/vomiting. To mitigate the risk of this scenario occurring, we will add a clear warning in the instruction manual stating that the device needs to be regularly washed to avoid this issue.

A second possible complication is that the small size of the device makes it a choking hazard. This primarily applies to young children, who may easily access the device, attempt to eat it, and choke. This could have fatal consequences. In order to mitigate this risk, we will add a choking hazard warning label, a warning directed at parents that detail it is unsafe to leave unsupervised children with the device, and an age restriction to further deter unsupervised children from playing with device.

Lastly, a possible complication may arise from heating the device to sufficiently high temperatures. Our device is not engineered to withstand high heat sources such as microwaves and ovens. In these cases, heated batteries may pose serious harm if they release flammable substances and are ignited, creating an explosion. To mitigate this risk, we will include a warning label that directs users to not use the device in microwaves, ovens, or any other areas with high heat.

Financial Summary

Key Milestones

- Unit cost: \$4.069
- Unit retail price: \$25
- Development cost: \$274.4K

- Break even quantity: 13107

Unit Cost Breakdown

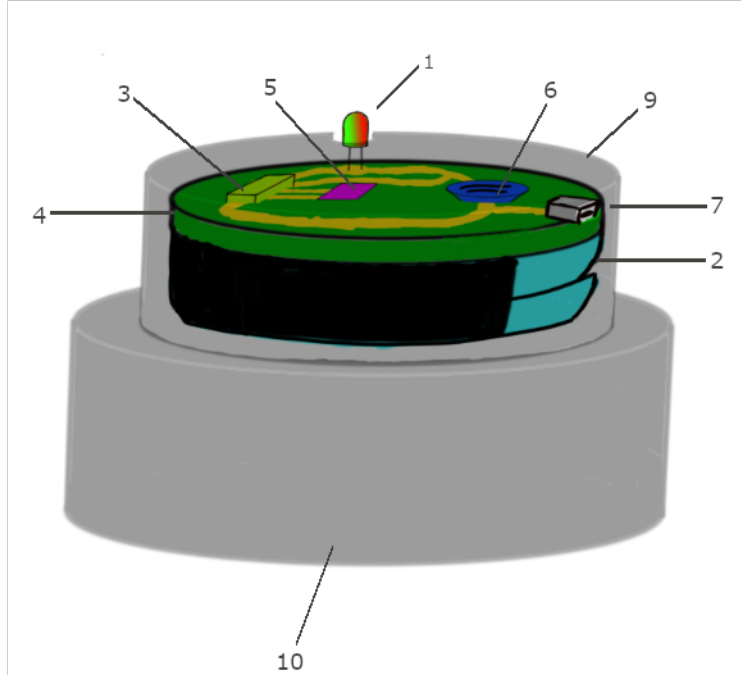


Figure 3: Side view of BottleGuard with all parts labeled with their ID from the BOM below.

ID	Component	Quantify	Cost per unit	Total cost
Electronics				\$3.869
1	Color adjustable LED	1	\$0.035	\$0.035
2	Rechargeable CR2450 batteries	2	\$0.04	\$0.08
3	Microcontroller with embedded Wi-Fi chip	1	\$1.60	\$1.60
4	Printed Circuit Board (PCB) and assembly	1	\$0.52	\$0.52
5	Gyroscope	1	\$1.44	\$1.44
6	Speaker	1	\$0.194	\$0.194
Mechanical				\$0.20
7	Micro-USB Charging Port	1	\$0.10	\$0.10
8	Micro-USB Cable	1	\$0.09	\$0.09
9	Enclosure (plastic)	1	\$0.01	\$0.01
10	The cap (plastic)	1	\$0.01	\$0.01
Total				\$4.069

Table 1: Detailed Bill of Materials for each part in BottleGuard. BOM with MOQ and part numbers/links to source vendors is included in the appendix..

Development Cost Breakdown

Labor: \$258K

	Engineering Weeks								
	SW			Electrical			Mechanical		
	Sr.	Mid	Jr.	Sr.	Mid	Jr.	Sr.	Mid	Jr.
Main Body									
Enclosure Design							1	2	1
Controller Board									
PCB Design	0	0	0	1	2	1			
Microcontroller code	2	4	0	0	0	0			
Wiring / Power management	0	0	0	0	0	4			
Cap									
Cap design							2	4	2
App									
UX	1	2	1						
Specs	1	2	0						
Systems									
UI design	1	1	1						
Coding	1	1	1						
Debugging	2	8	8						
Overall Integration and Verification									
Integration	1	2	0	1	2	0	1	2	0
Verification	2	1	0	2	1	0	2	1	0
Costs									
Total (weeks)	11	21	11	4	5	5	6	9	3
Total (years)	0.212	0.404	0.212	0.077	0.096	0.096	0.115	0.173	0.058

Table 2: Estimated work weeks required for the development of BottleGuard. Detailed WBS with salary calculations as well as manager / benefits calculations is included in the appendix.

From the work weeks in Table 2 and standard industry salaries, the total salary needed for engineers is \$127K. With department managers and project managers each needing 25% of total engineering time, we would need an additional \$44K for department managers and \$35.3K for project manager. In total, it would take \$206.4K for all labor costs, which comes up to \$258K with 25% benefits.

Capital: \$5K

Since BottleGuard's outer design is relatively simple, molds and tooling for the enclosure and the cap would cost an estimated \$5K total.

NRE: \$10K

The universal cap design is the most important part of the design, and thus an extra \$10K is allocated to the mechanical engineers to help expedite the process. This money will go towards buying required equipment for testing as well as contracting any external help if needed.

Risk Inventory: \$2.7K

As BottleGuard's break even quantity (13107) is way above the MOQ of almost all components, we can keep a low risk inventory on all of them. One notable exception is the gyroscope, which must be purchased in reels of 5000. With the break even quantity of 13107, we would have to order 15000 gyroscopes at \$1.44, leaving us with 1893 gyroscopes as risk inventory. The total cost for this risk inventory is \$2.7K.

Break Even Quantity Analysis

Each unit is being sold for a retail price of \$25 for a profit of \$21 per device. The total development cost including labor, capital, NRE, and risk inventory is \$274.4K, giving us:

$$\text{Break Even Quantity} = \frac{\text{Total Development Cost}}{\text{Profit per unit}} = 13107$$

The complete calculation including the initial break even calculation as well as the first pass to reduce MOQ is included in the appendix.

Delivery Date and Key Milestones

Our three engineering teams (Software, Electrical, and Mechanical) will work towards completing our main deliverables, which are the app, electronics, plastic cap, and the final product after integration and verification. The chart below shows the complete breakdown of the weeks needed per deliverable as well as what each team is responsible for. The software team will be working on the app, which we estimate to take 5 weeks. The plastic cap will be completed by the mechanical engineering team at the end of 6 weeks. The electrical engineering will design and wire the electronic components, while the software team will code the microcontroller. The electronic components for the device will be ready by the end of week 8. After 4 weeks of integration and verification by all teams, the prototype will be completed. We estimate the full product design to take around 16 weeks, and during this time period we will continually improve our design and try to make the cycle more

efficient. Accounting for the time needed to set up mass production, marketing, and some other operations, we expect our product to enter the market within a year.

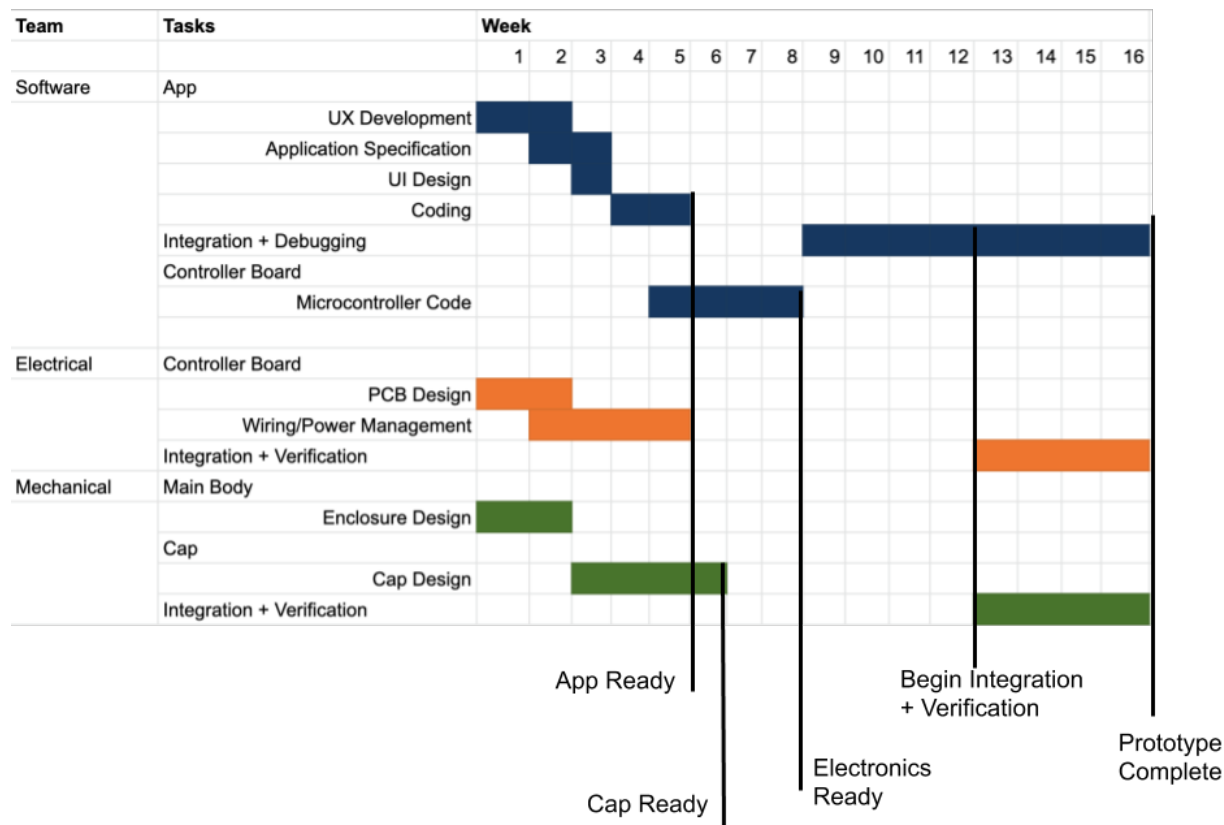


Figure 4: Complete product development cycle with key milestones marked

Summary and Recommendations

Given rising housing costs these days, most young adults live with other roommates or friends in a situation that usually involves sharing a refrigerator. Some of them, like in Bailey's case, want to share their beverages. However, they also like to control the sharing process and dictate when they want to share and when they do not. As illustrated in the previous sections, **BottleGuard** is the best fit to address these needs. BottleGuard stands strong amongst other competitors, enabling its customers to display their intentions and share their drinks with minimal fuss. This happens through a simple app that controls the red or green light shown on top of the device, without the need of physical attendance by the customer.

Most importantly, it provides the customer with flexibility — the ability to arm the device through a simple touch of a button on a phone app. Moreover, BottleGuard will send notifications through the app to the customer when someone tries to open the cap without asking for permission (or when the bottle is on the “not sharing” mode). Additionally, an alarm sound will be triggered when someone opens the bottle without permission. It is important to mention that our device is strategically designed with a smart sensor so as to not give false notification if someone moves the bottle or relocates it within the fridge. Lastly, as illustrated in the previous sections, our product fits most standard caps and is compact so it does not take much space in the fridge.

Studies show that almost 14 million U.S. adults are living in a shared household [CITE], illustrating that there exists a large market for our product to penetrate. Moreover, our device will not only help people living at home, but also employees who work in offices that contain shared refrigerators, further increasing our number of targeted customers. With all these components considered, we believe that BottleGuard will succeed in the marketplace financially. With your investment of \$275,000, you can help bring BottleGuard to reality and help countless customers share their drinks in a manageable fashion.

Appendix

Unmet Need

Bailey is a college student who lives in an apartment with several roommates. They all share the same fridge, and some of the items within. Although she is generally fine sharing her drinks with others, sometimes Bailey would like to keep them to herself when she gets a soda that is difficult to find or when the drink is running out. Due to their busy schedules, however, she finds it difficult to communicate that with all of her roommates. She resents the fact that sometimes her roommates help themselves to her drinks without asking for permission first because they were not aware that she didn't want to share. Bailey would like a way to remind her roommates in the moment of whether or not she is willing to share. Additionally, she wants to know when someone tries to open the bottle and take her soda when she has not granted permission.

She has tried different methods of expressing her intentions, such as sticking Post-it notes on her bottles or sending a text message to their roommate group that she'd prefer if they didn't take her drink. However, these methods have not proven to be effective since text messages are often ignored or overlooked, and Post-it notes are prone to falling off the bottle. She finds a bottle lock called KwikTop but decides against using it since she understands that everyone's schedule is different from hers, and such an inflexible method of keeping the drink to herself defeats the idea of sharing the drink, and can sour Bailey's relationship with her roommates. Moreover, a bottle lock comes at a fixed size and can only fit on one type of bottle, while she wishes to share a variety of drinks that come in markedly different bottle sizes like soda bottles or milk jugs. Ideally, she also wants something that does not take up much room in the fridge, as she only has a limited amount of fridge space allocated to her.

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Concept of Operations

As a potential customer, I would like to purchase the device at a department store or through an online platform like Amazon. Once received, I expect a straightforward instruction manual that will allow me to configure my device quickly and tell me to recharge the device using the included Micro-USB cable before first use. I could then proceed to replace the bottle's cap with the device. I expect that my device should be able to fit an assortment of bottles, and not take up a considerable amount of space in the fridge.

After the device is prepared, I could download a free app on my smartphone that will interface with the device. First, I expect the app to have one buttons for "not sharing" and "sharing" modes, which I can toggle between depending on whether or not I wished to share the drink. When I select "not sharing", the device should flash a red light. When I select "sharing", the app should give me the option to "share" for a limited amount of time or leave the device on "sharing" mode until I switch it back. Second, I expect there to be a notification settings option that will allow me to choose to enable all notifications, enable notifications only when device is on not sharing mode, or to disable all notifications when it is on sharing mode. Lastly, I could connect my phone to my device and connect the device to my home WiFi network through a menu in the app.

Once configured, I should still be able to open my beverage normally and receive a notification about it. If I leave the house and travel anywhere in the world, I could receive a notification via WiFi whenever my beverage is opened. Simultaneously, the device's speaker will make a warning sound. I should receive these notifications promptly so that I can immediately message my roommates and make an inquiry about their use of my drink. I should receive a timestamp that will let me know when my drink was accessed, so that I can more easily find out who opened my drink. I expect these timestamps of each use (along with the sharing mode status at the time) to appear in an organized access log on the app sorted by time.

When I have finished my beverage, I could simply remove the device from the old beverage bottle and attach it to a new one without any configuration. My only responsibility should be to recharge the device every week through the micro-USB charging port. When the device is low on power, I expect it to send me a notification through the app to remind me of charging.

Complete Specifications

Customer Requirements	Engineering Response
<p>Ease of sharing:</p> <ul style="list-style-type: none"> - Owner does not have to be physically present to share - Device can easily indicate whether owner wants to share or not 	<p>Display intentions clearly:</p> <ul style="list-style-type: none"> - Light indicates owner's intentions - Owner can change light from red to green when willing to share - Owner can also choose to change the light to green for a set period of time - Sound when sensors are triggered and light is red <p>Ease of sharing without being physically present:</p> <ul style="list-style-type: none"> - Device has no lock, acts like a regular bottle cap
<p>Access Notification</p> <ul style="list-style-type: none"> - Notification as soon as the bottle is opened - No false alarms if the bottle is knocked around - Record of when the bottle is opened 	<p>Notification:</p> <ul style="list-style-type: none"> - Within 5 seconds after someone triggers device - When the device is removed, a gyroscope sensor is activated which triggers a wireless signal to be sent. <p>Accurate:</p> <ul style="list-style-type: none"> - Only process twisting motion of the cap using the gyroscope to prevent false alarms <p>Record:</p> <ul style="list-style-type: none"> - App records the time when it receives signal from device - Accurate to within 5 seconds of opening the bottle
<p>Universal fit:</p> <ul style="list-style-type: none"> - Need to fit different common sizes of bottles 	<p>Designed to fit variety of bottles:</p> <ul style="list-style-type: none"> - Plastic inner cap can fit smaller bottles (28mm diameter), - Outer cap can fit larger bottles (38mm diameter) - Dimensions are consistent with the caps of common household beverages such as juice and milk jugs.
<p>Compact:</p> <ul style="list-style-type: none"> - Does not take up much space 	<p>Dimensions:</p> <ul style="list-style-type: none"> - Diameter of lower cap: 38mm - Diameter of upper enclosure: 28mm - Height: 35mm

Complete FMECA

	Cause	Effect	Severity	Probability	Detectability	RPN	Mitigation
Cap part of device can come into direct contact with liquid	Device is never washed	Mold forms due to improper cleaning, customer gets poisoned	5.0	4.0	8.0	160	Warning in manual to properly wash device
Device is not heat resistant	Device is put in oven	Device's enclosure melts down, batteries explode, causing a fire that burns down their house and causing injuries	7.0	2.0	8.0	112	Warning in manual to avoid placing device in oven
Device contains metal	Device is put in microwave	Device's batteries and metal components spark and potentially explode and cause a fire	7.0	2.0	8.0	112	warning in manual to avoid placing device in microwave oven
Device can roll around on the floor	Device has round edges	Customer steps on device and slips, falling to their death	10.0	1.0	10.0	100	Warning in manual informing users not to leave device lying on floor as it could be a slipping hazard or painful to step on

Device is easily accessible to small children	Child in house opens the fridge and chew on the device	Child chokes on the device and dies	10.0	1.0	8.0	80	Add choking hazard warning in manual
Device has low battery life	Battery runs out of power before the drink is finished	Cap no longer warns of attempted use but can't be recharged because it has replaced the bottle's original cap	1.0	8.0	10.0	80	Device sends notification to user's phone at low battery charge
One or more materials are allergy-inducing	Customer exposed to device is allergic to material	Customer receives severe allergic reaction that is irritating and requires medical attention	7.0	1.0	10.0	70	Add a list of materials used in the manual as well as on the packaging of the device
Battery has no way to stop charging once it is at full capacity	Battery overcharged	Battery possibly explodes or lights on fire, injuring the customer and causing a fire	7.0	1.0	10.0	70	Modern charging circuits stop the charge when the battery is full
Device has no mechanism of detecting hostile intentions	Evil roommate repeatedly take off cap to set off continuous stream of notifications	Customer is spammed with notifications	1.0	5.0	10.0	50	Customer can stop notifications from the device in the app
Device is thrown or swung	Roommates get mad at customer, take out device and use it as a weapon	Customer is injured from device	5.0	1.0	10.0	50	Add warning against throwing device in instruction manual

Device contains access points for water	Charging port not covered	Customer spills water into the port, device stops working	1.0	4.0	10.0	40.0	Add a rubber cover for the charging port
Device's container is damaged	The customer exposes the device to cold temperatures (below 0C) when they try to put their devices in the freezer.	The electronics are damaged and the device no longer works	1.0	3.0	10.0	30	Add a warning sign against usage in cold temperatures in the user manual
Device circuitry is not properly insulated from outside environment	Poor manufacturing/design	Customer spills water on device, device stops working	1.0	3.0	10.0	30	Add insulation testing during manufacture to make sure that the device is properly insulated
As IOT device, it is hacked into	IOT devices are susceptible to outside hacking	Hacker changes the code and device loses its original function.	1.0	2.0	10.0	20	Carry out pentests to make sure that the software is secure
Battery Explodes	Battery is not properly manufactured	Battery Acid melts the bottom of the cap, falling into the drink and poisons the user	5.0	1.0	3.0	15	Warning in manual to check device for damages

PCB Quotes



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Dimensions

28 × 28 mm

Layers

1 2 4 6 8 10

Quantity ?

1000

Solder mask color

☐ No mask **Least expensive color** ☐ Black ☐ Black Matte ☐ Blue ☐ Green ☐ Green Matte ☐ Purple ☐ Red ☐ Transparent ☐ White ☐ Yellow

Silkscreen ?

☐ None **Top** ☐ Bottom ☐ Both

Surface Finish

Cheapest

Board Thickness

1.6mm/0.062"

Copper Weight ?

1 oz

Min. Trace/Space

6 mil

Min. Drill

16 mil

Gold Fingers ?

0

Include Stencil

No

Quality Certifications

Not required

Number of Designs

Separated Only by Silkscreen ?

1

Ship to:

United States

Boards arrive in ?

Default time

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Prices are shown in US Dollar

Company	Color	Qty	Price	Total with shipping ▲	Total Days ?
ADVERTISEMENT					
JLCPCB (EasyEDA)	Green	1.000	US\$45.00 total	Total boards + shipping:	
China			US\$0.04 each	S.F Express (Economy) :	US\$69.07 20 days
★★★★★ (28)				UPS Worldwide Saver:	US\$87.55 11 days
Read or write reviews				DHL International Express:	US\$90.34 9 days
				Go to Order Page ?	
JLCPCB (EasyEDA)	Green	1.000	US\$45.00 total	Total boards + shipping:	
China			US\$0.04 each	S.F Express (Economy) :	US\$69.07 20 days
★★★★★ (28)				UPS Worldwide Saver:	US\$87.55 11 days
Read or write reviews				DHL International Express:	US\$90.34 9 days
				Go to Order Page ?	

Figure 5: Quotes for PCB fabrication

Compare prices from 7 PCB assemblers at once:

[ALLPCB](#) • [Bittele \(7pcb\)](#) • [PCB Assembly Express](#) • [PCBCART](#) • [PCBWay](#) • [Seed Studio](#) • [ShenZhen2U](#)

Quantity

1000

Number of Unique Parts ?

4

Number of SMT Parts ?

2

Number of Fine Pitch Parts ?

0

Number of BGA/QFN/LCC Parts ?

0

Number of Through-Hole Parts

2

Assembly Sides ?

One side

Class III Inspection

No

Ship to

United States

GET PRICES

You can sort the results by clicking on the column headers. Prices do not include PCB fabrication or the cost of components.

Prices are shown in **US Dollar**

Company	Qty	Prices ▲
PCBCART China ★★★★★ (4) Read or write reviews	1.000	US\$480.00 total (US\$0.48 / board)

Figure 6: Quote for PCB assembly

Detailed Work Breakdown Structure

	Engineering Weeks								
	SW			Electrical			Mechanical		
	Sr.	Mid	Jr.	Sr.	Mid	Jr.	Sr.	Mid	Jr.
Main Body									
Enclosure Design							1	2	1
Controller Board									
PCB Design	0	0	0	1	2	1			
Microcontroller code	2	4	0	0	0	0			
Wiring / Power management	0	0	0	0	0	4			
Cap									
Cap design							2	4	2
App									
UX	1	2	1						
Specs	1	2	0						
Systems									
UI design	1	1	1						
Coding	1	1	1						
Debugging	2	8	8						
Overall Integration and Verification									
Integration	1	2	0	1	2	0	1	2	0
Verification	2	1	0	2	1	0	2	1	0
Costs									
Total (weeks)	11	21	11	4	5	5	6	9	3
Total (years)	0.212	0.404	0.212	0.077	0.096	0.096	0.115	0.173	0.058
Salary (k\$/year)	106.8	89	71.2	109.2	91	72.8	98.4	82	65.6
Labor cost (k\$)	22.592	35.942	15.062	8.400	8.750	7.000	11.354	14.192	3.785
Total engineering cost	127.077								
Extra costs									
Department manager time (weeks)	10.75			3.5			4.5		
Department manager salary	122								
Department manager cost	43.990								
Program manager time (weeks)	18.75								
Program mananger salary	98								
Program manager cost	35.337								
Total costs									
Total cost with manager	206.404								
Total cost with benefits	258.005								

Table 4: Detailed WBS including all detailed salary calculations and manager hours

Detailed Bill of Materials

ID	Component	Quantity	Cost per unit	Total cost	MOQ	Product Number / Link
				\$3.869		
Electronics						
1	Color adjustable LED	1	\$0.035	\$0.035	1000	https://www.alibaba.com/product-detail/szvanfun-brand-hot-sale-5mm-led_60692902276.html
2	Rechargeable CR2450 batteries	2	\$0.04	\$0.08	1	https://www.alibaba.com/product-detail/Rechargeable-Lithium-Battery-3v-CR2032-CR2450_60815710449.html
3	Microcontroller with embedded Wi-Fi chip	1	\$1.60	\$1.60	1	Mouser: 356-ESP8266EX
4	Printed Circuit Board (PCB) and assembly	1	\$0.52	\$0.52	1000	Quote from https://pcbsshopper.com/
5	Gyroscope	1	\$1.44	\$1.44	Multiples of 5000	Mouser: 262-BMG250
6	Speaker	1	\$0.194	\$0.194	10000	Mouser: 81-7BB-15-6
				\$0.20		
Mechanical						
7	Micro-USB Charging Port	1	\$0.10	\$0.10	500	https://www.alibaba.com/product-detail/Hot-sell-micro-usb-pcb-micro_60461848110.html
8	Micro-USB Cable	1	\$0.09	\$0.09	10	https://www.alibaba.com/product-detail/Customized-economic-USB-to-V8-Micro_60776132292.html
9	Enclosure (plastic)	1	\$0.01	\$0.01	3000	
10	The cap (plastic)	1	\$0.01	\$0.01	3000	https://www.alibaba.com/product-detail/M5703-white-polyethylene-hdpe-plastic-raw_62155521986.html
Total				\$4.069		

Table 5: Detailed BOM including product number or links to the source vendors. Mouser refers to Mouser.com.

Break Even Calculations

Break even calculations									
	Risk Inventory costs	Price per unit	Development cost	Capital and NRE costs	Total cost	Selling price	Profit per unit	Break even quantity	
Initial	\$21,600.00	\$4.069	\$258,004.81	\$15,000.00	\$294,604.81	\$25.00	\$20.93	14076	
First Pass	\$1,330.56	\$4.069	\$258,004.81	\$15,000.00	\$274,335.37	\$25.00	\$20.93	13107	

Table 6: Break even calculations including initial and first pass

Risk Inventory Calculations

Risk inventory calculations					
Component	MOQ	Break even quantity	Unit cost (\$)	Risk inventory units	Risk inventory cost (\$)
Gyroscope (initial pass)	15000	14076	\$1.44	924	\$1,330.56
Gyroscope (first pass)	15000	13107	\$1.44	1893	\$2,725.92

Table 7: Detailed risk inventory calculations

References

U.S. Plastic Corporation. (2003). How do I know how to calculate a cap & neck size? Retrieved from <https://www.usplastic.com/knowledgebase/article.aspx?contentkey=625>.

International Society of Beverage Technologists, Thread Specs Standard. Retrieved from <https://www.bevtech.org/threadspecs.asp>