Project Nepton

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***Abstract*—The Nepton is a hot beverage container designed with its user in mind. It has two primary functions: alerting the user when his or her hot beverage is at a safe and satisfactory temperature to consume, and reheating the beverage should the temperature fall below desired levels.**

I. Introduction

In a society surrounded by hot beverages, we have all, to our dismay, experienced the Goldilocks principle. We have all had a similar experience: drink an overly hot beverage, realize that it is too hot, place it down to cool, and come back later only to learn that it is now too cold. It is difficult to know when the drink is just right. Moreover, when sipping the hot beverage over a lengthy period of time, it tends to cool down faster than we would like. Enter the Nepton. Our product would address both these issues by providing an E-ink notification system for drink temperature and a proprietary reheating system. It would additionally integrate seamlessly into the digitally connected, smartphone wielding consumer's lifestyle via a convenient app. The app would minimize the need of physical buttons on the Nepton, lending to the minimalistic design, while also allowing easy setup and providing powerful functionality on one's phone and leveraging notifications to compliment the physical indications on the Nepton.

As referenced in our Appendix, a market survey was also disseminated to evaluate the market need for the Nepton. After examining over 100 replies, we have identified two potential markets, one that believes their hot beverage drinking experience could be improved and one that does not own or use a thermos. In the former, it was identified that they regularly used thermoses but couldn't accurately determine the temperature of the liquid inside and whether it is safe to drink. In the latter, it was identified that that those who do not use thermoses choose not to due to their inconvenience. The Nepton addresses both those markets through it's heat sensing capabilities and convenient design choices (fits in most cup holders, easy to clean, lightweight). In our research into the hot beverage market, we also discovered the shocking revelation that consuming overly hot tea, one of the most popular hot beverages in the world, was linked to esophageal squamous cell carcinoma, a form of esophageal cancer. The Nepton would attempt to mitigate this risk by warning users when the drink is past the safe drinking temperature of 137 F. In terms of existing products, there have been smart thermoses created, such as the SmartGear Thermos (See Appendix), but the Nepton is the first that is autonomous from any cable, is calibrated to the user's temperature preference, and alerts the user in a pleasing, simplistic way.

Our group's methodology in approaching this project was to brainstorm difficult or unpleasing situations we encounter daily and then formulate an invention to address it. After the Nepton was conceptualized, the next step was to determine if a market need was present. Surveys were disseminated at this point and a market was evaluated. The following step involved researching feasibility (Proof of concepts can be seen in the Appendix) and designing the product. After the design is complete the prototyping stage begins. The group will perform iterative development, starting with the physical components to facilitate testing. We will develop individual portions of the Nepton and then proceed to integrate and test. The app will be developed in parallel and will be integrated after the hardware has been integrated. We plan to utilize for funds what SASE has provided as well as out-of-pocket funding if necessary.

II. Product Concept

From the user needs gathered and interpreted in the survey, the group then converted those consumer needs into system needs. These system needs are more quantifiable so the group can measure exactly how well the consumer needs are satisfied. Please refer to the appendix for more details.

The Nepton is a ground-breaking hot beverage container that is personally tailored to the modern, digitally-connected consumer. The Nepton's main features are its reheating ability, that can also be used to maintain a specific temperature if so desired, and its revolutionary e-ink outershell. The device has the ability to reheat liquids from 25 C (room temperature) to 54.4 C (optimal hot beverage temperature) in less than an hour. The Nepton can also maintain a specific temperature for at least 2 hours. Furthermore, the temperature sensitive e-ink shell acts as a visual indicator to provide alerts and to let the user know the temperature of the beverage at all times by altering the intensity of the e-ink color/pattern, without the user having to

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physically pick up the drink and take a sip. This is all tied together by our state-of-the-art app that allows the user to have complete control over their Nepton, where they can input their preferred beverage temperatures and customize other parts of the Nepton such as the changing pattern of the e-ink.

Every successful project involves the delivering of results that add value. While the Nepton is a product that our team believes has a definitive market need, it is also something capable of being modeled, constructed, and delivered. The Nepton utilizes existing technologies to achieve its two primary functions: detecting/displaying temperature and heating container contents. Detecting liquid temperature is done by utilizing a thermocouple that contacts the liquid. The thermocouple connects to a small microprocessor which analyzes and transmits the data to a Bluetooth transmitter that connects to the companion app. A functional companion app UI can be seen in the Appendix.

The main calculations needed was how much energy the heating element would require, and how long the heat transfer from the heating element to the liquid would take. For the sake of calculation, the group calculated the energy required to raise the temperature of water from 25 C to 54.4 C, and then calculated the energy that the group's battery could deliver. The group found that the Nepton battery could successfully heat the 16 oz. from room temperature to optimal temperature twice before needing to be recharged. The group also used electrical engineering principles to calculate the time this process would take, which come to around 50 minutes.

Fulfilling the consumer requirements are linked very deeply to every major subsection of the Nepton. The technology utilized in the Nepton includes the heating coil, the e-ink notifier, the thermocouple, the body and the application, and they fulfill the consumer needs and system acceptance criteria. These technologic components and their specific respective links to consumer requirements are shown in more detail in the supporting documentation.

III. Resources and Timeline

The approximated cost of Nepton's raw components is ~$40. The expected costs of custom machining for the body and heat sink, the team anticipates the prototyping cost of the Nepton to significantly increase this cost. Multiple prototype iterations would be required to arrive at an alpha-stage prototype and realistically, the team anticipates the overall cost to be in excess of $1,000. A final prototype would be reasonably expected to be well in excess of $5,000.

The team's project schedule for the planning process and prototyping process can be seen in the Gantt chart within the appendix.

APPENDIX

CONTENTS

Market Competition

Our product is truly one of a kind. No other product has the same subtle color shifting abilities and convenient temperature controls as the Nepton, all neatly packaged into our precision cut stainless-steel unibody container. Other manufactures have tried creating generic novelty mugs, that change between two static images when a hot liquid is poured into it. The Nepton utilizes electrophoretic ink to gracefully shift colors on a gradient, that constantly reacts to the temperature of the liquid inside, thus always giving you visual feedback to the state of your drink.

Other self-heating containers rely on physical motion such as shaking the container to generate enough energy to heat up the liquid, which is both inconvenient and impractical, especially for hot drinks like coffee or tea. Other approaches, such as the single-serving self-heating can by Wolfgang Puck, is not reusable and relies on a dangerous chemical reaction that has reportedly led to cans exploding, overheating, and even melting. The Nepton uses an internal electric heating system, that does not require any physical action from the user to power. The Nepton also runs on a smart alarm system, that automatically turns the container off when it reaches its critical temperature, so you don't have to worry about it exploding.

Market Research (Survey)

Summary:

Nepton's survey was presented to a sample of over 100 individuals under the general title of "Hot Beverage Product Survey." The purpose of this survey was to identify a market opportunity for Nepton. The survey asked participants approximately 10 questions pertaining to their experiences drinking hot beverages or with hot beverage containers. The following are examples of several questions that were asked in the survey:

- From where do you typically get your hot beverages?
- Which of the following complaints, if any, apply to your experiences with hot beverages?
- What are some reasons you do not use a thermos?

Opportunity

Based from the results of the survey, the team has identified two potential markets for Nepton.

1. Individuals who own a thermos but feel that their hot beverage experience could be improved.
    a. 34 individuals responded that they regularly used thermoses or similar non-disposable heat retention containers
    b. Of those 34, 16 responded that one complaint they had with their thermoses was that they were unable to tell when the beverage inside was at a satisfactory temperature for consumption.
2. Individuals who do not own or use a thermos.
    a. 69 individuals responded that they did not regularly use thermoses or similar non-disposable heat retention containers.
    b. Of those 69, 20 responded that thermoses were aesthetically unpleasing and 32 responded that they did not see a need for a thermos.

Conclusion

The team has is targeting these two potential markets with an emphasis on features of Nepton that address the issues brought up by surveyed. Inability to tell whether the beverage inside a thermos was at a satisfactory temperature for consumption Nepton's easily identifiable color-changing feature that alerts the user to the temperature stages of the beverage (Too hot, satisfactory, lukewarm). Inconvenience in using and/or carrying a thermos Inclusion of an adjustable carry-strap that allows Nepton to be carried alongside a bag or slung on the shoulder.

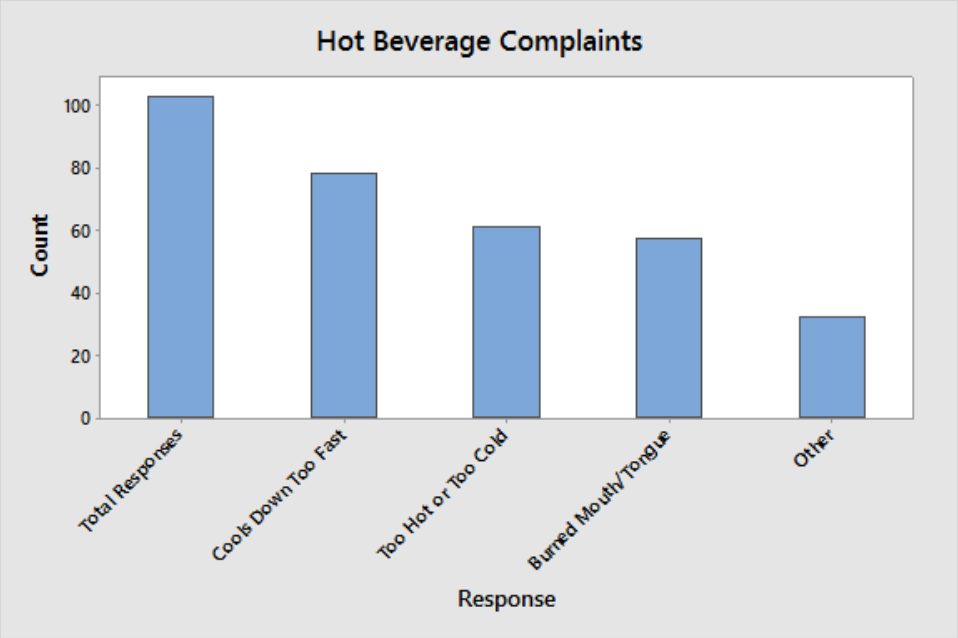


Figure 1: Survey Results – "What are complaints (if any) with your hot beverage experience?"

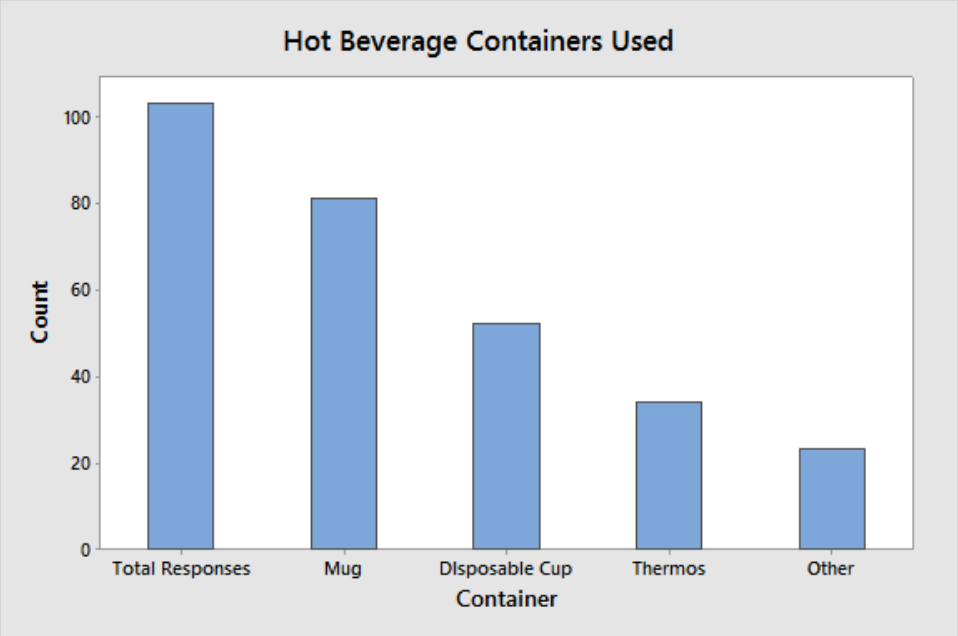


Figure 2: Survey Results – "What container(s) do you use to consume hot beverages?"

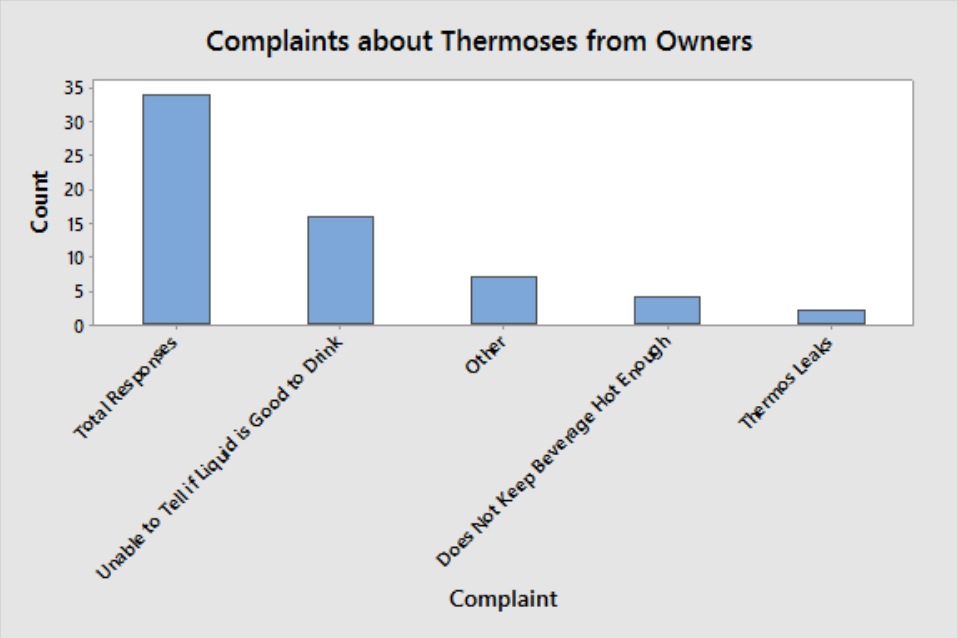


Figure 3: Survey Results – "What are complaints (if any) with your thermos?"

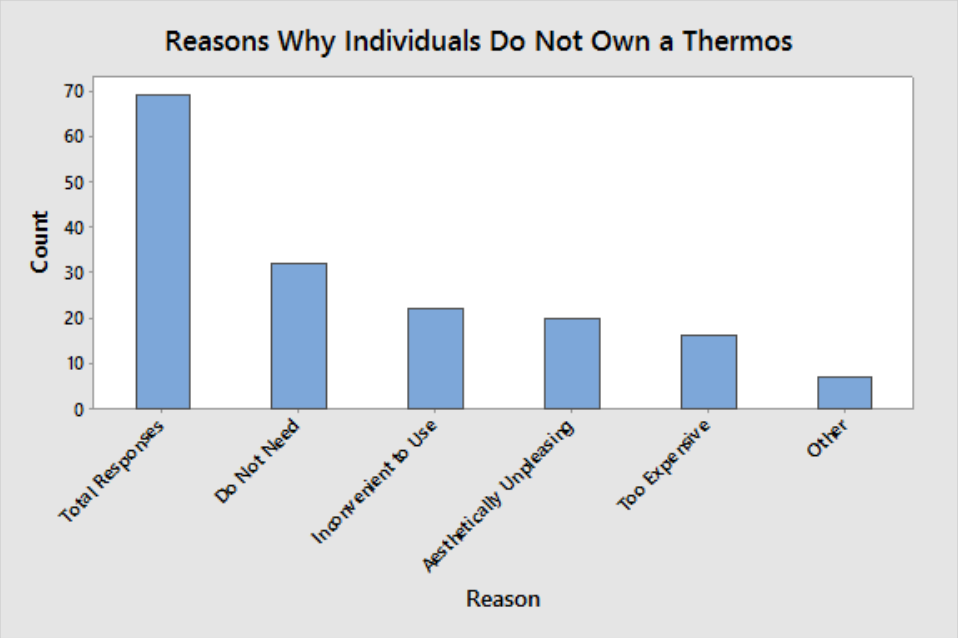


Figure 4: Survey Results – "What are reasons you do not own a thermos?"

Design Process

The design of the Nepton was based on simplicity. The Nepton looks clean and modern, and marriages function and form at every angle. The main body is a curved cylinder for a sleek yet ergonomic design. It measures roughly 10 inches tall with a 3 inch diameter. At the bottom are angled slits to help vent heat from the internal components.

The internal components, starting from the bottom of the thermos, consist of the battery, a layer of insulation, and the electronics. A heat sink wraps around all of these items and transfers excess heat away from the battery and electronics.

The vacuum-enclosed inner-cup, which holds up to 16oz. of liquid, fits snugly into the main body of the thermos. The lid, which contains the heating rod, will have a metallic contact that will allow energy to transfer through from the battery. The lid also features a convenient one-push flip-up design for easy one-handed operation.

Product Concept

Acceptance Criteria from Consumer Need:

AC-1: The Nepton shall be portable and convenient for use in transit and weight no more than 3 pounds.

AC-2 : The Nepton shall seal the beverage with O-rings and be made with material that can withstand temperatures of 200 degrees F without harm to its users.

AC-3: The Nepton shall be made from brushed aluminum and stainless steel, e-ink panels, and clear plastic.

AC-4: The Nepton shall use an e-ink panel to inform the users about the temperature of the beverage, and use a phone application to adjust and calibrate the temperature.

AC-5: The Nepton shall have a standby battery life of 12 hours and a continued use battery life of 2 hours using rechargeable batteries and will have a lifespan of 2 years.

1.0 System Overview

2.0 Requirements

2.1 Functional Requirements

2.1.1 Input Requirements

2.1.1.1 The Nepton system shall accept the Nepton's lid from the customer.
2.1.1.2 The Nepton system shall accept the "Beverage Name" from the customer.
2.1.1.3 The Nepton system shall accept the customer's request to reheat the beverage.
2.1.1.4 The Nepton system shall accept a "Perfect Temperature Recalibration Request" from the customer.
2.1.1.5 The Nepton system shall accept the customer's new "Perfect Temperature Recalibration".
2.1.1.6 The Nepton system shall accept the customer's confirmation of their "Perfect Temperature Recalibration".
2.1.1.7 The Nepton system shall accept the removable inner cup.
2.1.1.8 The Nepton system shall accept the Battery charger from the customer.

2.1.2 Output Requirements:

2.1.2.1 The Nepton system shall provide the Nepton's lid to the customer.
2.1.2.2 The Nepton system shall provide a request for the "Beverage Name" to the customer.
2.1.2.3 The Nepton system shall provide a beverage temperature notification of "Too Cold" to the customer.
2.1.2.4 The Nepton system shall provide a beverage temperature notification of "Too Hot" to the customer.
2.1.2.5 The Nepton system shall provide a beverage temperature notification of "Perfect" to the customer.
2.1.2.6 The Nepton system shall provide a request for the new "Perfect Temperature Recalibration Request" to the customer.
2.1.2.7 The Nepton system shall provide a warning to the customer concerning the temperature boundaries when setting the new "Perfect Temperature Recalibration".
2.1.2.8 The Nepton system shall provide a confirmation to the customer that the new "Perfect Temperature Recalibration" has been set.
2.1.2.9 The Nepton system shall provide the unattached inner cup to the customer.
2.1.2.10 The Nepton system shall provide the inner cup reattached to the Nepton to the customer.
2.1.2.11 The Nepton system shall provide a visual indicating low battery life to the customer.
2.1.2.12 The Nepton system shall provide a visual indicating that the Nepton is currently charging to the customer.

2.1.2.13 The Nepton system shall provide a visual indicating that the Nepton is finished charging to the customer.
2.1.3 Interface Requirements
2.1.3.1 The Nepton system shall provide an easily navigable user interface.
2.1.3.2 The Nepton system shall insulate heat sensitive components from heat generating components.
2.1.3.3 The Nepton system shall require that the container surface touching the beverage be removable for safer cleaning.
2.1.3.4 The Nepton system shall accept user recalibrations to pre-set perfect temperatures.
2.1.3.5 The Nepton system shall accept user changes to temperature notifying patterns.
2.1.4 Functional Requirements
2.1.4.1 The Nepton system shall reheat the beverage inside of it.
2.1.4.2 The Nepton system shall accept customer requests and provide feedback.
2.1.4.3 The Nepton system shall determine Nepton's response to inputs received.
2.1.4.4 The Nepton system shall make carrying the Nepton convenient.
2.1.4.5 The Nepton system shall notify the user of the current temperature of the beverage inside it in relation to the calibrated perfect temperature.
2.1.4.6 The Nepton system shall connect wirelessly to the users smartphone.
2.1.4.7 The Nepton system shall measure the current temperature of the beverage inside it.
2.2 Non-Functional Requirements
2.2.1 Physical Requirements
2.2.1.1 The Nepton system shall maintain a weight less than 2 pounds.
2.2.1.2 The Nepton system shall maintain a height of less than 15 inches but greater than 10 inches.
2.2.1.3 The Nepton system shall have a widest diameter of between 3 and 4 inches.
2.2.1.4 The Nepton system shall utilize a push-button lid deploying system.
2.2.1.5 The Nepton system shall utilize a hinge for the lid.
2.2.1.6 The Nepton system shall provide a means to carry the container conveniently.
2.2.2 Technology Requirements
2.2.2.1 The Nepton system shall utilize thermocouple temperature sensing capabilities.
2.2.2.2 The Nepton system shall incorporate O-rings leak prevention technology.
2.2.2.3 The Nepton system shall incorporate Bluetooth technology.
2.2.2.4 The Nepton system shall incorporate a round-the-thermos e-ink display.
2.2.2.5 The Nepton system shall utilize heating coil heating capabilities.
2.2.2.6 The Nepton system shall utilize battery power when not plugged in.
2.2.2.7 The Nepton system utilize the user's existing smartphone IOS.

PROOF OF CONCEPT

COMPANION APPLICATION

The Nepton application will be developed for iOS for all iPhones. The app will allowed the digitally connected consumer to control all the technical features of the thermos as well as display information such as battery life. The final app will be programmed in Swift, to take advantage of the new and improved graphics, speed and safety improvements, and the new interactive playground. The app will connect and pair to the Nepton via Bluetooth.

Structure and Features
1.0 Home (Page)
1.1 Power Button (Button)
1.1.1 Turn on Nepton
1.2 Side Options Menu (Side Panel)
1.2.1 Swipe or click side menu button to activate
1.2.2 Display current Nepton charge
1.2.3 Calibration
1.2.3.1 Calibrate "Perfect Temperature" for a new drink
1.2.3.2 Warn if temperature set is above recommended temperature to mitigate risk of esophageal cancer
1.2.3.2.1 Ignore warning if desired
1.2.4 Bluetooth Tethering
1.2.4.1 Toggle Bluetooth tethering
1.2.4.2 Initially pair app and Nepton
1.2.5 E-Ink Customization
1.2.5.1 Toggle e-ink notifications

APPLICATION SCREENSHOTS

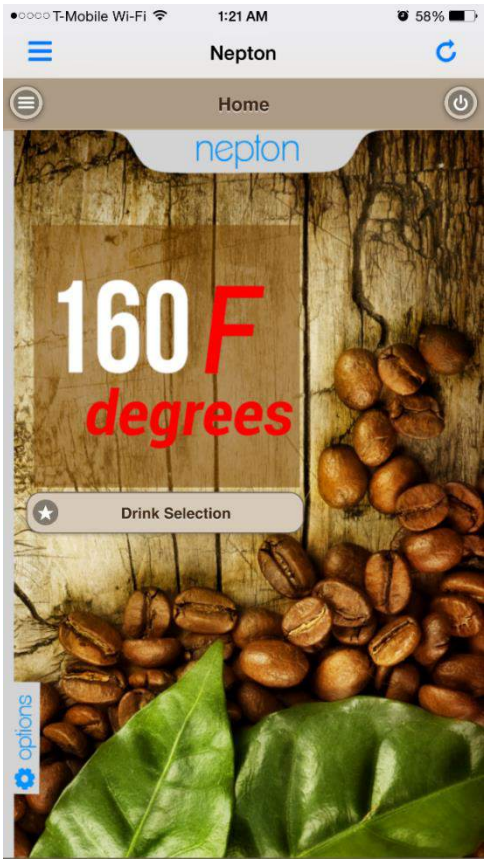


Figure 5: Home Screen

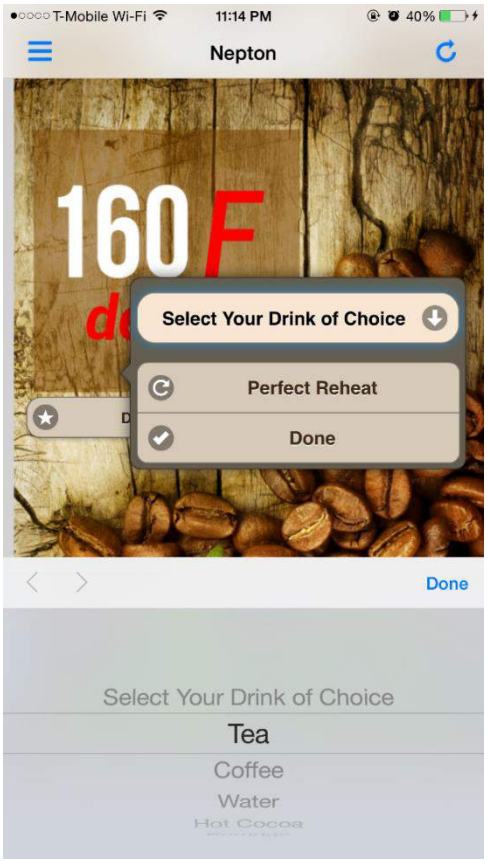


Figure 6: Drink Selection

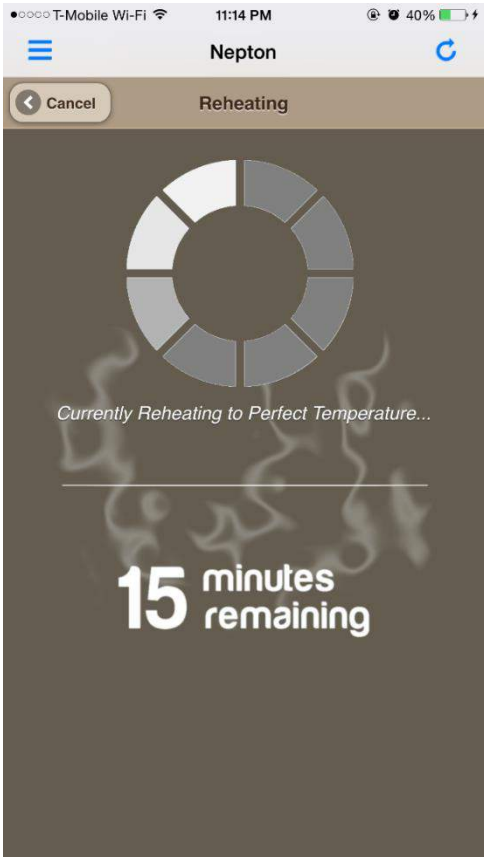


Figure 7: Reheat Screen

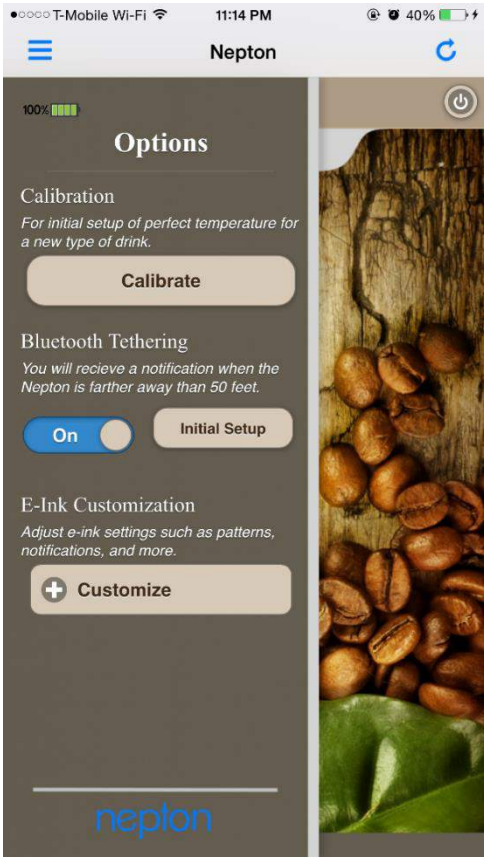


Figure 8: Sidebar Options Menu

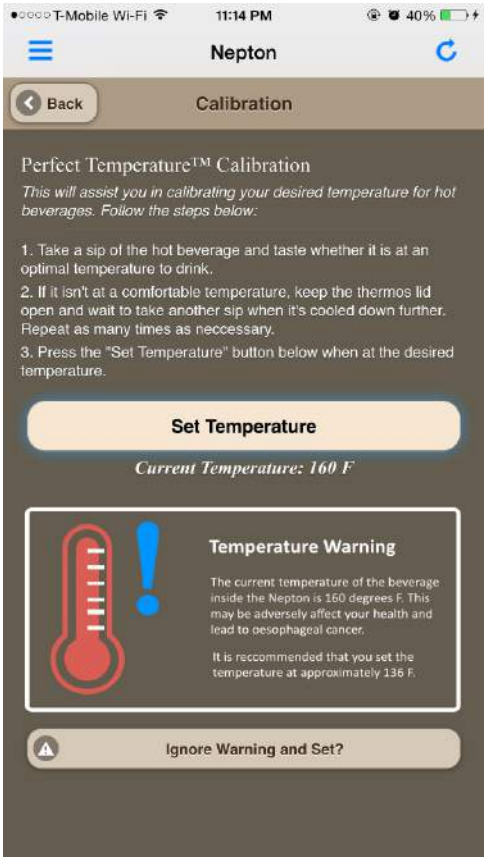


Figure 9: Calibration Screen

Figure 10: Bluetooth Screen Setup

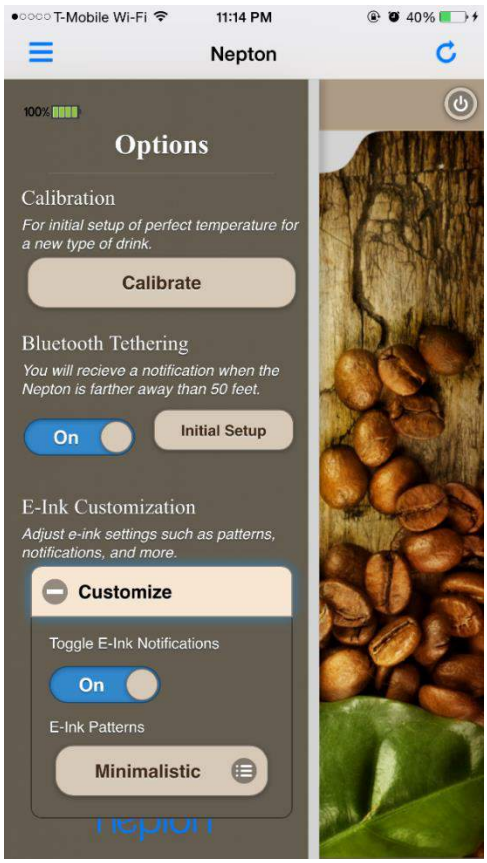


Figure 11: E-Ink Customization Screen

HEATING COIL

Objective:
Increase temperature from 25°C to 54.44°C. 25°C is taken as room temperature. and 54.44°C is taken as 130°F, the optimal "safe temperature" at which to drink tea. Determine the amount of energy required.

Q = heat energy = ?

Assumptions:
1. The liquid is water (coffee, tea, and other beverages are largely water-based)
2. The container is perfectly insulated (no heat loss from conduction, convection, or radiation)
3. The container is a closed system (no mass enters in or out of the system)

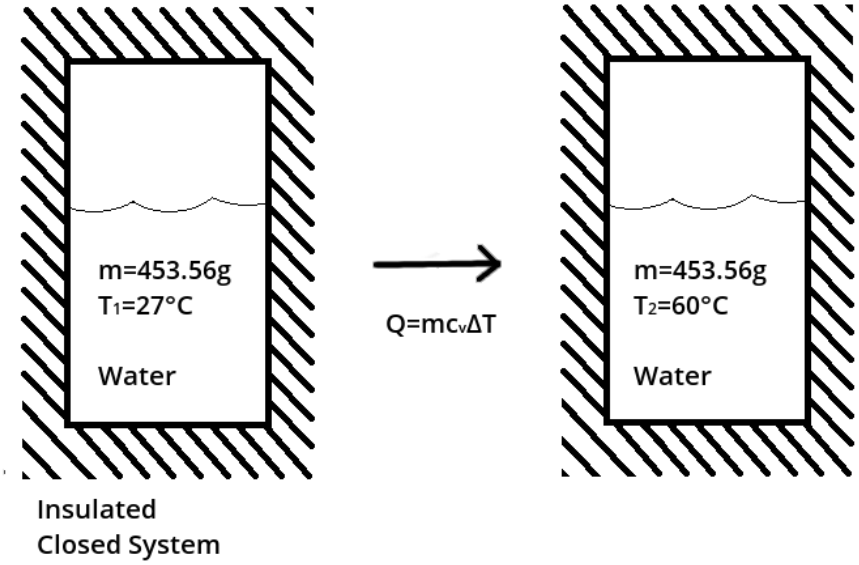


Figure 12: Heating Coil Proof of Concept

Energy Required:
$Q = mc_v\Delta T$
m = 16oz = 453.56g (mass of water)
T_1 = 25°C (room temperature)
T_2 = 54.44°C (target temperature)
c_v = 4.186 kJ/kg°C (specific heat of water, constant volume)
$Q = 0.45356 \times 4.186 \times (54.44 - 25)$
$= \underline{55.89\ kJ}$

Energy Delivered:
Battery Capacity = 6,000 mAh (can provide 10 amperes of current for 1 hour)
P = I*V* (Watts)
V = 8.4*V*
I = 6A
$P = 6 \times 8.4 = 84\ W = 50.4\ J/sec$
$E = P\Delta t = 50.4 \times 3600 = 181440\ J$
$= \underline{181.440\ kJ}$

Rate of Heat Transfer:
The selected battery of choice is a custom lithium manganese oxide (LMO). The battery is rechargeable and has a significantly higher energy density than standard lithium-ion batteries, meaning that it can provide current at a significantly higher rate. Nepton will utilize a 6,000 mAh LMO with a maximum current discharge of 6A.

V = 8.4*V*
I = 6A
$P = 8.4 \times 6 = 50.4W = 50.4\ J/sec$

E = 55890 J
$\Delta t = E / P = 55890 / 50.4$
$= 1108.93$ sec
$= \underline{18.48 \text{ min}}$

BODY

The Nepton's exterior body and interior cup will be made out of stainless steel. A finned aluminum heat sink will be located on the bottom of the Nepton to draw excess heat generated by the battery away from the electronic internals. The heating coil is attached to the top of the Nepton and extends downwards into the interior cup, connected to the battery through metallic contacts. Electronic internals and the battery are located at the bottom of the Nepton. The e-ink exterior is surrounds the exterior body and is insulated from any heat generated from the heating coil and the battery.

NEPTON CAD MODEL DESIGN

Figure 13: Isometric View

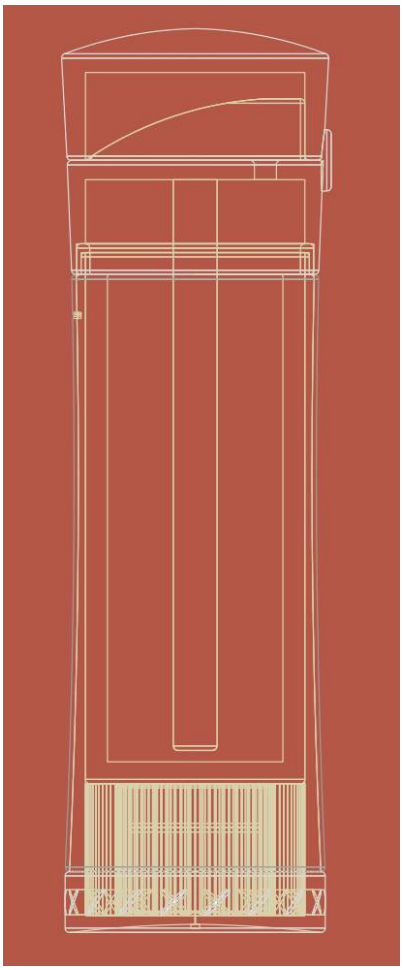


Figure 14: Right View

Figure 15: Top-down View

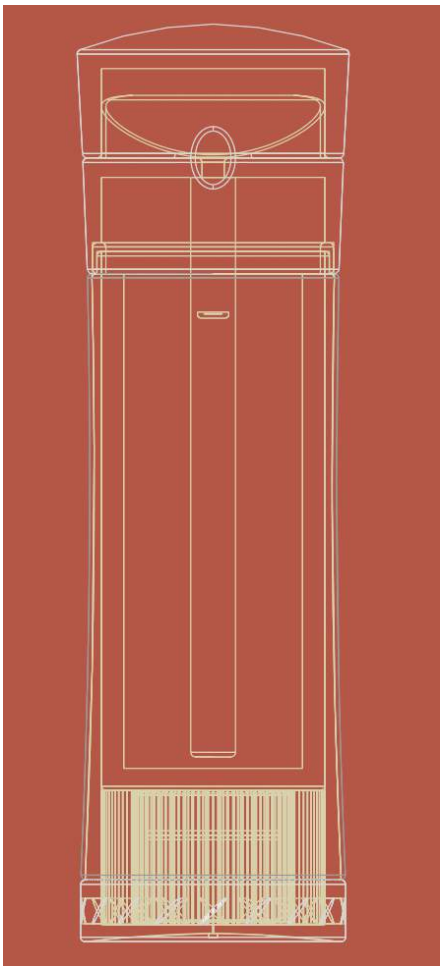


Figure 16: Front View

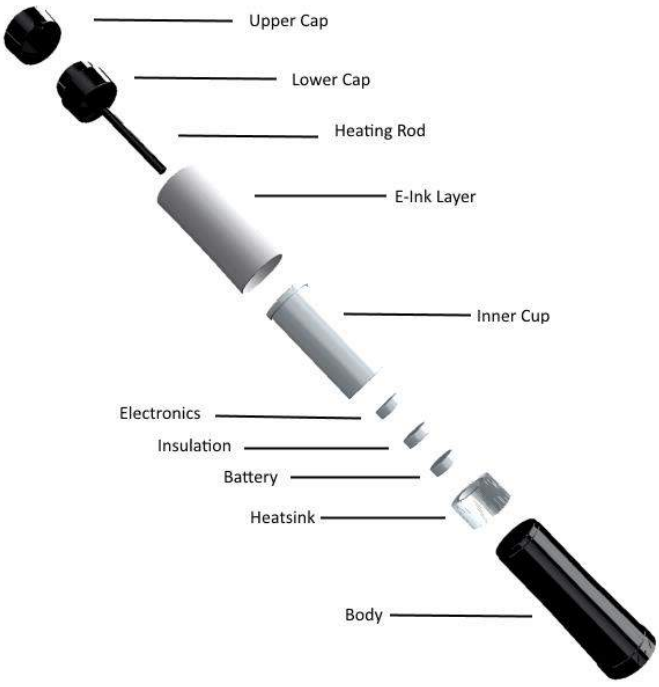


Figure 17: Exploded View

Figure 18: Full Render

Link Between Technology and Consumer

Companion App

Consumer Need:
Control, calibrate, and individualize Nepton's functional and aesthetic settings through an intuitive and easy to use interface.

Summary:
Consumers today expect and demand a certain degree of quality, complexity, and control within their products. Quality in that they can expect the product to work out of the box reasonably well, complexity in that the product is versatile and has multiple functions, and control in that they can adjust the product to best suit their individual preferences or needs. The Nepton team believes that the inclusion of an app fulfills a modern digital consumer's expectations of a technological link in all the aspects mentioned above.

Although the Nepton requires an app in order to function to its full potential, its inclusion is so that consumers have access to adjust Nepton in an intuitive way. Rather than putting temperature calibration, battery life, and heating settings, and other such functions on the physical Nepton, such controls are all included within the app. Including the number of buttons and dials needed to fully control Nepton would not only decrease the portability and aesthetic of Nepton, but also increase the difficulty of using it. The app includes easy to follow instructions that allow the Nepton to function normally out of the box.

Including an app allows the Nepton to be significantly more complex from a feature and functionality standpoint. By shifting data processing and storage to the smartphone, Nepton retains the portability of a beverage container while still having the complexity of a

"smart" product. Features such as temperature calibration, drink settings, and body aesthetic modifications would not be possible without the inclusion of an app to handle the raw data processing required.

While the Nepton itself is significantly more complex than its competitors from a features and functionality standpoint, the Nepton team ensures that this complexity is not translated back to the consumer. Almost every function of the cup is adjustable to the individual needs and preferences of the user. Users will not need to hunt down settings in the app's back end, but will be initially greeted with a welcome screen that quickly points out where and how to adjust different functions within the app.

BODY

Consumer Need:
A durable, convenient, and vacuum-insulated container to store liquids in.

Summary:
While thermoses already exist to cater to all our optimal temperature beverage needs, the Nepton takes this technology and brings it to the cutting edge.

Underneath the innovative e-ink exterior lies the foundational core of the Nepton. The body is crafted from a tough and lightweight stainless-steel which means the product will stand up to drops and dings, and is easy to travel with. The material also allows the exterior surface to maintain a comfortable temperature, so it can always be held no matter how hot the liquid inside may be. Furthermore, stainless-steel will not affect the taste of your beverage, making sure your drinks always taste as they should. And since the container is vacuum sealed, beverages can maintain their temperature (hot OR cold) for up to 24 hours, without even having to utilize our revolutionary heating element.

The container also holds up to 16oz. so you'll always be sure to have the right amount of beverage with you. The lid also features a simple slide-to-open option that is 100% leak-proof. Not to mention our convenient detachable wrist strap for those who want to carry their Neptons and still have their hands free.

E-INK NOTIFIER

Consumer Need:
Inform about the temperature of the beverage it contains in an understandable and applicable medium.

Summary:
One problem that hot beverage drinkers everywhere will agree with is that when their hot beverage is poured into a thermos or other covered drinking container, it is almost impossible to tell if the liquid inside has cooled enough to safely drink. Often, after misjudging the time that has passed, one will drink from the thermos and severely burn their lips, tongue and throats. The only solution is to wait for the drink to cool an enjoyable temperature and drink the beverage then. However, the average person doesn't live a slow, sedentary lifestyle that affords them the time to be constantly checking whether they can drink their beverages or not. Often they will just leave their beverage to cool, and forget about it, missing the opportunity to experience and partake in the enjoyment that comes with consuming a warm beverage at the intended comfortable temperature that they so very deserve.
The Nepton addresses these issues in earnest through it's E-ink temperature notification system.

HEATING ROD

Consumer Need:
Maintain drink temperature or heat up drink without home equipment.

Summary:
Although thermoses are efficient at retaining heat, as more of the liquid contained inside is drunk, the liquid is bound to lose the precious heat one hopes to preserve. A warm or hot drink is meant to be drank as the name specifies, hot or warm. These drinks, while delicious and invoke that warm fuzzy feeling while at their intended temperature, can lose their charm when the temperature drops. Hot cocoa on a frosty Christmas morning provides children and adults with a comforting warmth when hot but quickly loses appeal when the drink turns cold. Certain drinks are simply meant to be consumed hot and warm.
For those with active lifestyles and also enjoy a warm refreshment on the go, a thermos unfortunately does not typically satisfy their thirst when they are away from home. When your delicious drink is depleted, you are mostly out of luck for a hot refill unless there is a

method of reheating nearby. One of the beauties of tea, one of the planet's most popular drinks, is that it is simple and quick to concoct. All that is needed is a tea bag and a hot cup of water. As with many other hot drinks, tea is traditionally served warm. Procuring a tea bag is not difficult and can be brought along with little difficulty. Obtaining hot water away from home however is another story.

The Nepton addresses both these issues in earnest through it's proprietary heating mechanism. The mechanism was designed with convenience in mind and will be powered by a custom rechargeable 6000 mAh Li-LMO battery with a nominal voltage of 8.4 V. The heating mechanism is a heating rod that stems from the cover and sticks into the inner cup of the Nepton.

TEMPERATURE SENSING

Consumer Need:
Measure the temperature for other applications.

Summary:
Temperature is the name of the game when it comes to thermoses and other heat retention beverage dispensers. Many thermoses are able to keep their beverage hot for a very long time. Through the vacuum insulation, it has been able to naturally maintain the original temperature of the beverages poured into it. However, for most thermoses, once the beverage is poured into the thermos, it is almost impossible to tell if the beverage is drinkable or not. Often, the natural heat retaining ability of the thermos is a drawback because it stays hot for too long, rendering the beverages inside inconsumable. Here we see a perfect example of the temperature creating a problem for the end user.

Another problem is that once the heat has been lost and the beverage has cooled to lukewarm bilge water, current thermoses have no way of making the beverages palatable again. The waste from beverages that have become subpar is avoidable if the beverage was able to be reheated. once again, there is an issue with the temperature, and without proper knowledge of what creates the problem, these issues can not be solved.

The Nepton addresses both these issues in earnest through it's added temperature sensing functionality. By utilizing time tested thermocouple technology, the Nepton is able to sense the current temperature of the beverage inside and relay that information for the customer to use. All temperature sensing is relative to the customer's unique and specific desires, so the temperature need of the end user are completely customizable. Using the temperature sensing ability, the Nepton is even able to sense when it is empty, a feature used reliably as a safety feature in the automatic heating mechanism shutdown.

PROTOTYPING/CAD MODELING PROCESS

The design of the Nepton was based in simplicity. The Nepton looks clean and modern, and marriages function and form at every angle. The main body is a curved cylinder for a sleek yet ergonomic design. It measures roughly 10 inches tall with a 3 inch diameter. At the bottom are angled slits to help vent heat from the internal components.

The internal components, starting from the bottom of the thermos, consist of the battery, a layer of insulation, and the electronics. A heat sink wraps around all of these items and transfers excess heat away from the battery and electronics.

The vacuum-enclosed inner-cup, which holds up to 16oz. of liquid, fits snugly into the main body of the thermos. The lid, which contains the heating rod, will have a metallic contact that will allow energy to transfer through from the battery. The lid also features a convenient one-push flip-up design for easy one-handed operation.

PROJECT RESOURCES

SUPPLY CHAIN

	COTS	Custom	In-House
Heating System		X	
Sensor System	X		
E-Ink Notifier		X	
Mobile App			X
Microprocessor	X		
Li-Ion Battery	X		
Accessory Strap		X	
Chassis		X	
Supplementary Parts	X		

DISTRIBUTION

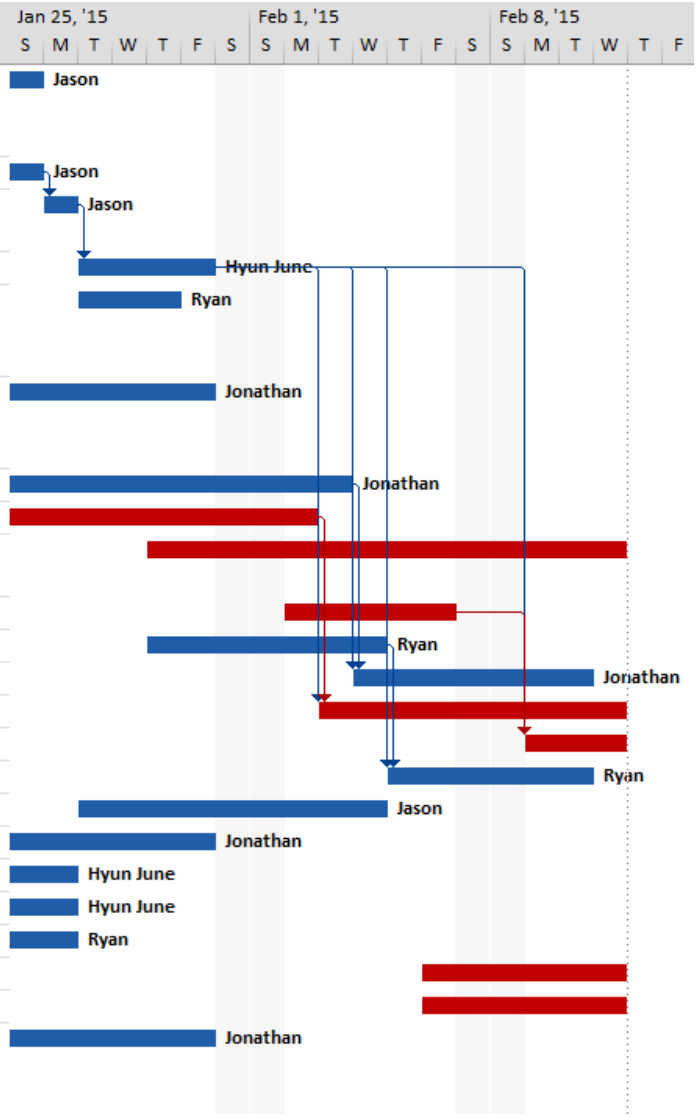
We will aim to initially distribute Nepton through consignment channels such as Modell's to place the product into brick-and-mortar stores for physical viewing and generate more publicity. Consignment channels will be approached first as it allows a mutually beneficial relationship between the retailer and the supplier. The supplier will be able to showroom the product while the retailer does not pay for the product until it has sold. This will be a stepping stone to popularize the product. Once buyer confidence has been established, the retail scope will be expanded to include normal retail channels and we will aim to negotiate further contracts to sell the product.

RAW MATERIALS

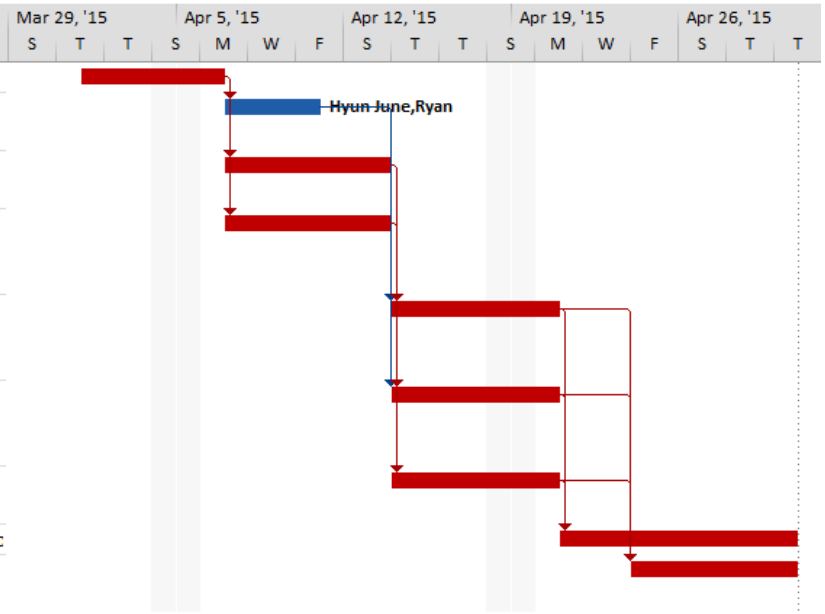
Item	Cost	Price per pound	Weight (lbs)	link
Lithium battery	17.44			http://smile.amazon.com/Venom-3000mAh-6-Cell-Battery-Universal/dp/B000BJL03Q/ref=sr_1_2?ie=UTF8&qid=1423720601&sr=8-2&keywords=3000+mah+nimh+battery
Insulation	5.51			http://smile.amazon.com/M-D-Building-Products-4929-Fiberglass/dp/B00005202C/ref=sr_1_8?ie=UTF8&qid=1423720708&sr=8-8&keywords=heat+insulation
Electronics	~10			Radio Shack
Aluminum (Heat Sink)	0.14112	0.84	0.168	http://www.vincentmetals.com/Daily_Aluminum_Prices.html
Stainless Steel (Main Body)	3.9243	1.27	3.09	http://www.metalprices.com/metal/stainless-steel/stainless-steel-flat-rolled-coil-304
Stainless Steel (Inner Cup)	4.0767	1.27	3.21	http://www.metalprices.com/metal/stainless-steel/stainless-steel-flat-rolled-coil-304
Plastic Viritox (Lower Cap)	0.2288	1.6	0.143	http://standardceramic.com/Materials.html
Plastic Viritox (Upper Cap)	0.248	1.6	0.155	http://standardceramic.com/Materials.html
E-ink Display	12			http://www.pervasivedisplays.com/products/144#tab4
TOTAL	**$53.57**			

PROJECT SCHEDULE

	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1		Demonstrate Relation to Digitally Connected Consumer	1 day	Sun 1/25/15	Sun 1/25/15		Jason
2		Survey	1 day	Sun 1/25/15	Sun 1/25/15		Jason
3		Stakeholder Requirements	1 day	Mon 1/26/15	Mon 1/26/15	2	Jason
4		System Requirements	4 days	Tue 1/27/15	Fri 1/30/15	3	Hyun June
5		Prototyping/CAD Modeling Design Process	3 days	Tue 1/27/15	Thu 1/29/15		Ryan
6		Process from Brainstorming to Actual Creation	6 days	Sun 1/25/15	Fri 1/30/15		Jonathan
7		POC App	8 days	Sun 1/25/15	Tue 2/3/15		Jonathan
8		POC Heating Element	7 days	Sun 1/25/15	Mon 2/2/15		Hyun June
9		POC Temperature Sensing	10 days	Thu 1/29/15	Wed 2/11/15		Jason
10		POC E-ink Notifier	5 days	Mon 2/2/15	Fri 2/6/15		Jonathan,Ryan
11		POC Body	5 days	Thu 1/29/15	Wed 2/4/15		Ryan
12		CS App	5 days	Wed 2/4/15	Tue 2/10/15	7,4	Jonathan
13		CS Heating Element	7 days	Tue 2/3/15	Wed 2/11/15	4,8	Jason
14		CS E-ink Notifier	3 days	Mon 2/9/15	Wed 2/11/15	4,10	Jonathan,Ryan
15		CS Body	4 days	Thu 2/5/15	Tue 2/10/15	4,11	Ryan
16		LT App	7 days	Tue 1/27/15	Wed 2/4/15		Jason
17		LT Heating Element	6 days	Sun 1/25/15	Fri 1/30/15		Jonathan
18		LT Temperature Sensing	2 days	Sun 1/25/15	Mon 1/26/15		Hyun June
19		LT E-ink Notifier	2 days	Sun 1/25/15	Mon 1/26/15		Hyun June
20		LT Body	2 days	Sun 1/25/15	Mon 1/26/15		Ryan
21		Resource Raw Materials	4 days	Fri 2/6/15	Wed 2/11/15		Ryan
22		Resource Manufacturing	4 days	Fri 2/6/15	Wed 2/11/15		Jason
23		Resource Distribution/Supply Chain	6 days	Sun 1/25/15	Fri 1/30/15		Jonathan



	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
24		Acquiring Raw Materials	4 days	Wed 4/1/15	Mon 4/6/15		Hyun June
25		Developing Exterior Body	4 days	Tue 4/7/15	Fri 4/10/15	24	Hyun June,Ryan
26		Developing Electronic Components	5 days	Tue 4/7/15	Mon 4/13/15	24	Jonathan
27		Developing Heating and Temperature Sensing Components	5 days	Tue 4/7/15	Mon 4/13/15	24	Hyun June,Jason
28		Integrating Heating Elements with Exterior Body	5 days	Tue 4/14/15	Mon 4/20/15	25,27	Jason,Ryan
29		Integrating Electronic Components with Exterior Body	5 days	Tue 4/14/15	Mon 4/20/15	25,26	Jonathan, Hyun June
30		Integrating App with Electronic Components	5 days	Tue 4/14/15	Mon 4/20/15	26	Jonathan
31		Prototype Testing	8 days	Tue 4/21/15	Thu 4/30/15	28,29,30	Hyun June,Jason,Jc
32		Iterative Improvement and Revisions	5 days	Fri 4/24/15	Thu 4/30/15	28,29,30	Hyun June,Jason, Jonathan,Ryan



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