Initial Project Documentation

Divide and Conquer

February 1, 2019

$H_2\Omega$

A smart water bottle system that keeps record of a user's water intake and self sanitizes.

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Group B

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1.0 Project Narrative

In today's day and age, it seems as though everyone is constantly on the move trying to stay afloat between school, work, exercise, and family time. Getting caught up in the day and forgetting to eat is not unheard of, but in general people don't ignore the feeling of hunger. However, the same cannot be said for remembering to hydrate. Drinking enough water daily is critical to the human body's overall function and health. It is natural for people to be preoccupied and forget to drink or, for some reason, they don't drink enough so they won't need to use the restroom.

The motivation behind creating a water bottle that tracks how much water its user consumes as well as self-sanitizing is to keep people healthy. It should be noted that this does not stop at people not drinking enough water, but to those who are on liquid restricted diets due to medical conditions as well. Writing a note every time you refill your water bottle or measuring how much you have already consumed is not only inaccurate but it's also very unlikely a person will stick with it. Older people tend to forget to drink enough water or they can't sense that they are thirsty which can cause a severe decline in their health and renal function. This water bottle would try and preemptively tackle a bad habit before serious health issues arise and cause any permanent harm.

There are a few water bottles on the market that track how much water you drink, or they self-sanitize but the H-2-Ohm would be combining these critical objectives into one bottle. The main goals are to be accurate, low cost, waterproof, and energy efficient. Accuracy of determining the water level in the bottle is critical to keeping track of the user's intake. To do this a sensor will need to be set up to take measurements after every time the user removes and then places the cap back on the bottle, indicating they took a sip of water. All of this information will be sent through a microcontroller to analyze. When the cap is placed back on the bottle this will send a signal to the controller to indicate that the water level sensor should be activated if the water bottle is upright, which in turn will send its data back to the controller.

Most products strive to be low cost but it is especially import to this design since water should not be a luxury. Expensive water bottles turn people towards buying plastic non-reusable ones that are polluting the Earth. It also only makes sense that the H-2-Ohm be waterproof. This is critical for the functionality and lifetime of the product. The entire system will always be in close proximity to water and it is imperative to keep the water from ruining the electronic components.

When it comes to power efficiency, the bottle would run on a battery that would only need to be replaced a few times per year. The battery will need to power the microcontroller, sensor, detector, and sanitation. The sanitation will keep the bottle and the water clean on the inside. The sanitation cycle will be run on timed intervals throughout the day in order to keep the bottle and its components in the best possible conditions.

H-2-Ohm will tie all of this together into an application for a mobile device that will pair with the bottle to keep the user alerted and engaged with their water consumption. The application will tell the user how much water they have consumed, let them set water consumption ranges/limits and notify users if they have not been drinking enough water or have drank too much water. Also, for general safety of the user the bottle's sanitation cycle will immediately turn off and not activate with the cap of the bottle off. Over all this product will improve the health of many people and since everyone needs to consume some amount of water, it can be used by anyone on Earth.

2.0 Requirements Specifications

Battery:

- Minimum lifespan of one month
- Power all the peripheral components
- Ability to be replaced by bottle owner

Wireless Communications:

- Bottle shall connect to a mobile device wirelessly
- Have a minimum connectivity distance of 4 feet
- Bottle shall pair with mobile device within 20 seconds
- Button-press initiates wireless communication functionality

Water Sip Detection:

- A magnet pair will indicate if the cap has been removed or placed back on the bottle
- After sip detection is activated the accelerometer will begin to check the bottles orientation and initiate water level measurements
- Sanitization mechanism is disabled when cap is off

Water Level Sensing:

- Bottle shall have a sensor that detects the water level
- Sensing will be accurate to nearest ounce
- An accelerometer will check if the bottle is upright for 2 minutes and trigger water level sensing once that condition is met
- Water level sensor will take the average of 3 measurements when triggered

Water Purification Method:

- Get rid of 98% - 99.999% of bacteria in bottle
- Use an electronically powered purification technique
- Purification will be timed to sanitize every 3 hours for a 1 minute interval

System Housing:

- The electrical system will be housed in a waterproof environment

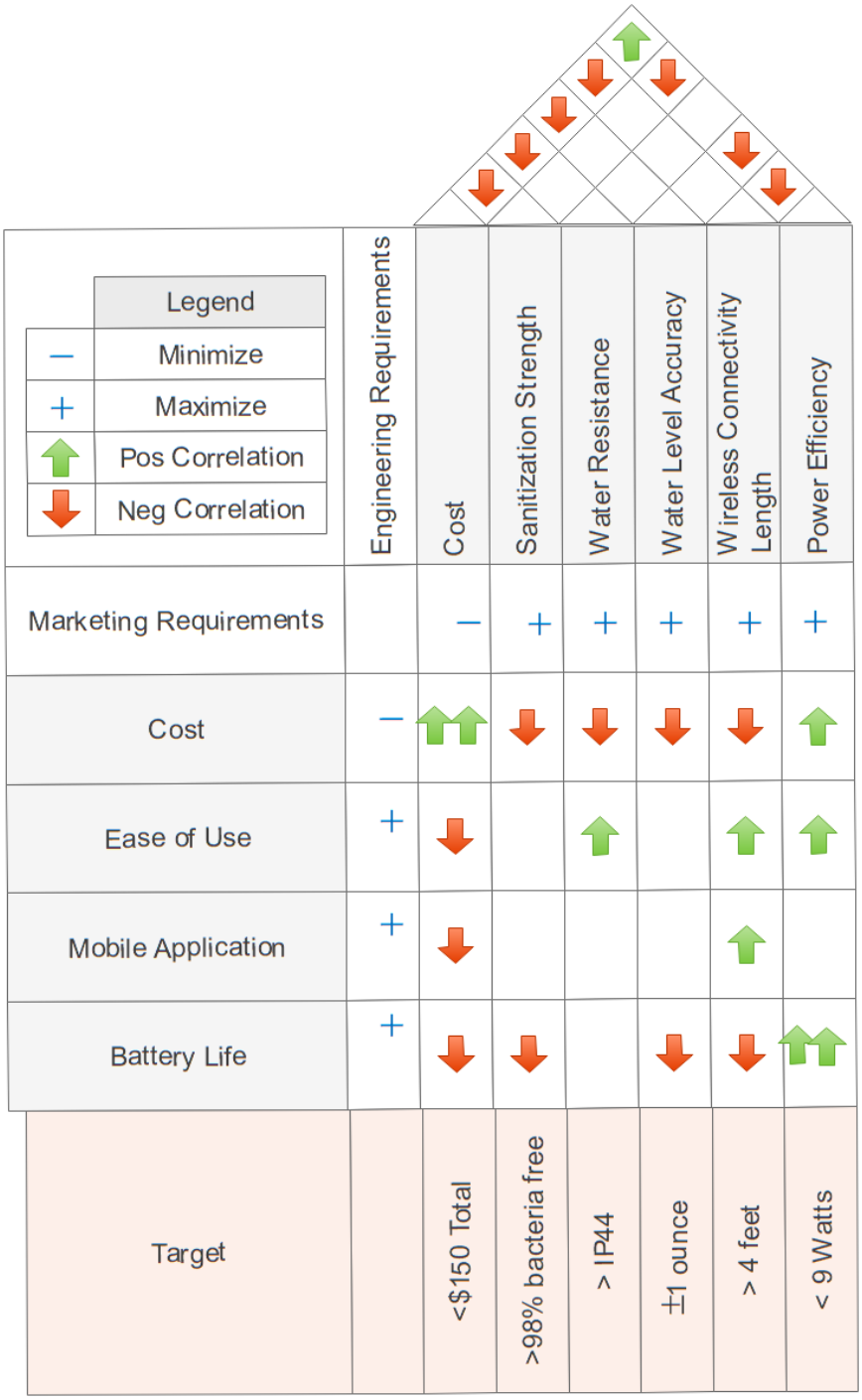
Software Application:

- Records users daily water intake
- Allows users to set their water intake levels
- Customizes water consumption goals based on height weight and gender
- Utilize local data storage
- Ability to enable/disable notifications if not enough water has been drunk
- Ability to enable/disable notifications to remind the user to drink water
- Application shall have a graphic image to show consumption progress

Constraints

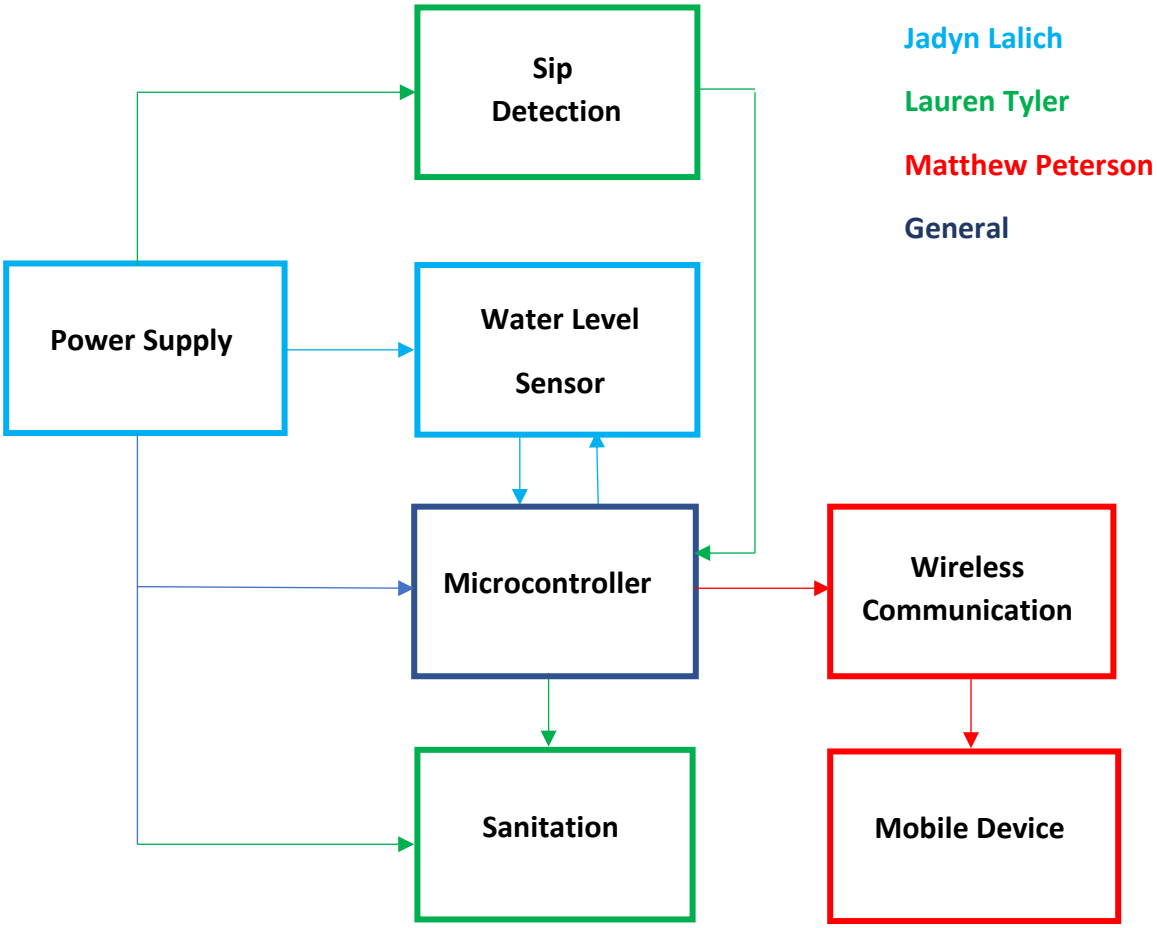
- Safely washing the water bottle and not ruining any electrical components.
- Regulating sanitation safety as to not harm the user of the bottle in any way.
- Keeping cost down for product marketability.
- Researching the correct biological factors that go into how much each individual should drink based on their height and weight.

3.0 House of Quality



4.0 Block Diagram

4.1 Hardware Diagram



Jadyn Lalich

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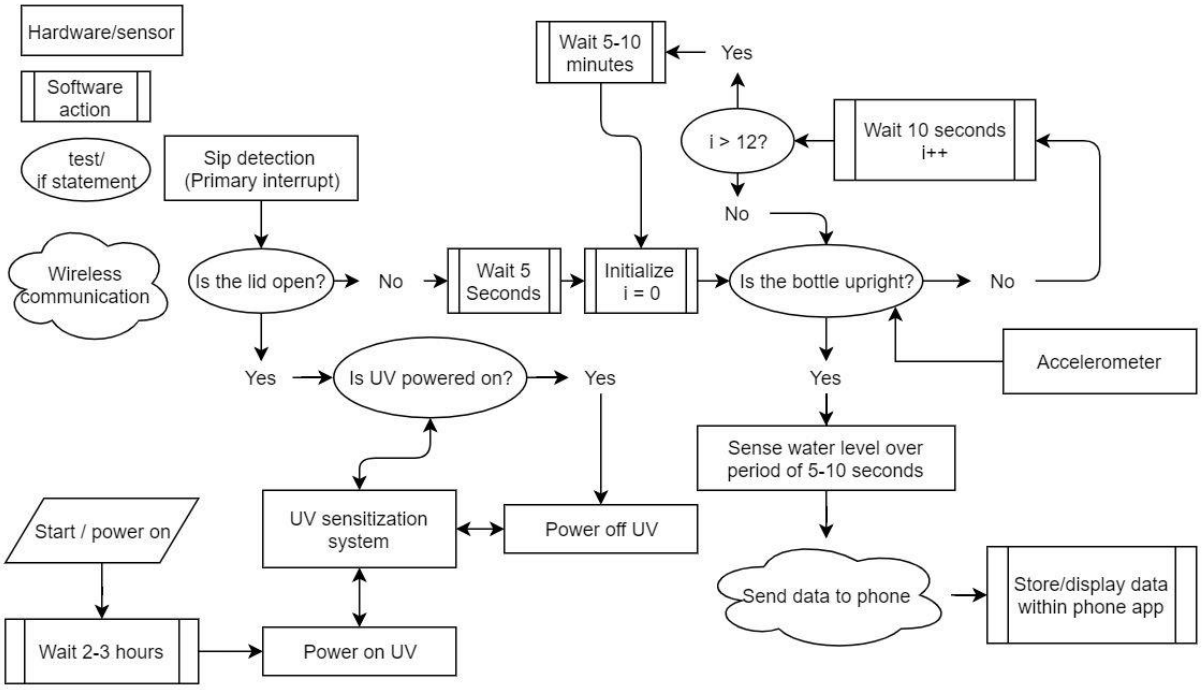
General

Research Stage:
Selection of an efficient and accurate water level sensor that will send its data to the microcontroller. Accelerometer selection as well as a power supply strong enough to run the multiple components.

Research Stage:
Determining the most reliable way to detect when someone has taken a drink from the bottle so the new water level can be read. As well as researching different sanitation techniques.

Research Stage:
Creating an android application that is accurate and user friendly. Transferring the data collected from the microcontroller through wireless communication.

4.2 Software Diagram



5.0 Estimated Project Budget and Financing

Part	Quantity	Estimated Cost (each)	Total Cost
Wireless Communication Module	1	$12.95	$12.95
Wireless Communication Enabling	1	$0.95	$0.95
Power Supply	5	$1.00	$5.00
Battery Holder	1	$1.95	$1.95
Water Level Sensor	1	$59.95	$59.95
Water Purification Module	1	$16.45	$16.45
Microcontroller	1	$15.95	$15.95
PCB	3	$16	$48
Water Bottle	1	$29.92	$29.92
Accelerometer	1	$17.50	$17.50
System Housing	2	$10	$20
Miscellaneous Parts	-	-	$30
TOTAL			**$258.62**

It should be noted that this project will be self-funded. The estimated cost in the table below will be the responsibility of the team and equally split between all three members. Overall the total cost of this project even with an emergency fund for unforeseen complications will not be extreme and can easily be managed between the members.

6.0 Project Milestones

Senior Design I		
Task	**Due Date**	**People**
Form Group	01/10/2019	Group B
Project Idea	01/22/2019	Group B
Initial Report	02/01/2019	Group B
Idea Review with Professor	02/06/2019	Group B
Milestone 1 – Idea Finalized		
Update Initial Report	02/15/2019	Group B
Product Requirements Explored	03/01/2019	Group B
Milestone 2 – Full Requirements & Specifications Defined		
Order Test Components	03/01/2019	Group B
45 Page Document	03/29/2019	Group B
Test Components	03/30/2019	Group B
75 Page Document	04/12/2019	Group B
Final Document Due	04/22/2019	Group B
Milestone 3 – Research & Final Document Completed		
Senior Design II		
Order PCB	TBD	Group B
Parts Check/Order Parts	TBD	Group B
Hardware and Software check	TBD	Group B
Assemble Prototype	TBD	Group B
Test Final Product	TBD	Group B
Milestone 4 – Final Product Works		
Final Presentation	TBD	Group B
Milestone 5 – Senior Design is Completed		