# Hydrolink - MVP Report

Ned Bitar

Georgio Feghali

Daniel Sanei

University of California, San Diego

ECE 140B - Art of Product Engineering II

Ramsin Khoshabeh & Richard K. Gessner

6/6/2024

## 1 - Executive Summary

Hydrolink is a startup founded by engineering students from UCSD that specializes in making hydration monitoring easier with water bottle lids that follow standard specifications. These lids, designed to work with brands such as Hydroflask and YETI come equipped with an ESP32 microcontroller, ultrasonic sensor, and customizable LED ring light. Users can utilize the web app to keep track of their hydration levels, set reminders, and access personalized suggestions.

Catering to fitness enthusiasts, and tech-savvy individuals Hydrolink presents a budget-friendly option compared to competitors like LUCY Smart Cap and Water.io. Priced at $35 Hydrolink allows regular bottles to be converted into smart ones at a lower price point for a wider audience.

The financial breakdown indicates a hardware cost of $4.91 per unit leading to a profit margin of 85.97%. With a Customer Acquisition Cost (CAC) of $20 and an initial Lifetime Value (LTV) of $35 Hydrolink achieves a profitability ratio of 1.75:1. Plans for future versions include features like UV light sterilization aimed at further improving this ratio to 3:1.

Our team has successfully created a Minimum Viable Product (MVP) and conducted interviews with customers yielding good feedback. Key functions such as measuring water levels, providing LED reminders, and facilitating communication through the web app are all up and running smoothly.

In the future, the main areas of concentration will be merging functionalities, enhancing user-friendliness, and prioritizing safety. Initially, considering an Anti Roofie cup concept, we shifted our focus to a smart lid after conducting market studies hoping to aim for a wider audience. This experience underscores the significance of grasping customer requirements and ongoing pivots and enhancements to the product.

# 2 - Company Synopsis

## About Us

Hydrolink is a tech startup founded by a team of engineering students who are passionate about health and wellness. Our mission is to make monitoring personal hydration simple and accessible for everyone by providing a smart, cost-effective universal solution that fits any water bottle size of any mainstream brand.

## Our Vision

We aim to foster a community of health-conscious individuals by providing an affordable alternative to existing smart water bottle products. Our goal with this product is to create a trend centered around an aesthetically pleasing smart water bottle lid that successfully carries out essential features while making hydration tracking convenient and affordable.

Beyond the MVP, our team envisions expanding our product line to offer a variety of hydration solutions catering to different customer needs and preferences. Future plans include an assortment of smart water bottle lids targeting niche target markets, guided by customer feedback. We will also pursue partnerships with businesses to integrate Hydrolink into existing technologies and accessories, enhancing their value with hydration tracking and health reminders.

To promote our product and increase visibility, we aim to partner with fitness and wellness brands through social media marketing campaigns. By integrating our technology

into their offerings and services, we can collaborate, grow, and expand our reach, introducing new customers to Hydrolink.

## Team

We are three computer engineering students from the University of California, San Diego. We have a broad and complimentary combined background; Georgio specializes in backend software engineering, machine learning, and recommender systems, Ned is experienced with hardware and electrical-engineering skills (including circuits, soldering, etc.), and Daniel primarily works with embedded systems and robotics. We are committed to creating innovative solutions that enhance everyday life through practical technology.

## Filling in the Gaps

While our team has a diverse set of skills and is capable of successfully delivering an effective MVP for the Hydrolink product, we recognize the need for additional skills to fully realize our vision in the long run. We would benefit from support with web design and web development for the full-stack development of our web application, as that is a field of software development which we each have limited experience. We would also benefit from expertise in product design, as a functional yet aesthetically pleasing and user-friendly physical product is essential to the success of Hydrolink. These additional roles will help us create a more polished, market-ready product and enhance our ability to meet customer needs efficiently.

## Product Overview

Hydrolink offers a universal smart water bottle lid solution equipped with an ESP32 microcontroller, an ultrasonic sensor, and an LED ring light. This lid is compatible with various popular water bottle brands, such as Hydroflask and YETI, making it a versatile, customizable, and cost-effective option for consumers.

The accompanying web application allows users to track their hydration levels, customize their LED ring light settings, and access personalized hydration recommendations. The user-friendly interface and comprehensive features of the web app ensure that users can easily monitor their hydration status and stay on track with their health goals.

## Target Audience

Our primary target audience includes fitness enthusiasts, particularly those who are fascinated by technology, aesthetics, and self-care. Hydrolink also caters to individuals who are meticulous about tracking their life statistics, as well as those who may consistently forget to drink water throughout the day, benefitting from reminders and hydration tracking.

# 3 - Market Overview

## Overview

Hydrolink targets a market segment defined by psychographics (i.e. classifying customers based on social status, interests, opinions), rather than a particular demographic. Individuals who value aesthetics and living a premium lifestyle are the primary target audience. Adjacent personas such as fitness enthusiasts and health-conscious consumers may also be attracted to the product, although we anticipate at a smaller respective proportion.

## Psychographics

We aim to target our advertising campaigns toward individuals seeking an aesthetic, clean, and organized lifestyle. Such individuals may be best characterized through the sample persona of Yoga Yolanda, a middle-aged 45-year old wife and mother of three children who is always looking for ways to improve her and her family's quality of life. By using Hydrolink, Yoga Yolanda can track her hydration and ensure she is drinking enough water throughout the day, providing her skin with the best possible nourishment and her body with just the right amount of water. Knowing she drinks plenty of water each day is a relief, allowing her to tackle challenges throughout the day with clarity of mind. She enjoys the practicality of the smart lid and takes it to her yoga class where her friends share the same technology. They form a small community, proud to show off their Hydrolink, a symbol of self-care and good health.

As an adjacent pursuit, we will also target people who are highly meticulous with optimizing their health and performance. They find great satisfaction from products similar to the Apple Watch, where they can track details about their body such as heart rate, steps taken per day, and miles walked. Such individuals are extremely detail-oriented and will consistently refer to their technological aids to ensure their bodily functions are operating at a healthy, and expected level given their past data. These tech-savvy customers love reading up about the latest tech, looking forward to new devices to incorporate into their lives and further optimize their performance through statistics and numerical analysis.

Another market to explore consists of forgetful hydrators, which includes people in a broad spectrum anywhere from those with Attention Deficit Hyperactive Disorder to those with high-status careers under a great deal of stress and workload. These individuals may lose track of time and prioritize their most important daily tasks, resulting in the passing of several hours without even the slightest sip of water. This will cause dehydration throughout the day, potentially leading to suboptimal performance and fatigue. By incorporating Hydrolink, these customers will receive periodic notifications to look after their health and to drink some water in order to stay on track for the day. This simple and brief reminder will encourage them to take a short break to accomplish the task of drinking more water, just as their Google calendar might outline their tasks to finish for the day. With Hydrolink comes structure, which will benefit these busy-minded individuals throughout their chaotic days.

### Demographics

While our main priority is to target the psychographics specified in the above section, Hydrolink has the potential to successfully convince people that fit certain demographics. With such a demographic, the main selling point would be the value proposition of the smart lid as opposed to the expensive smart water bottle alternatives. Health-conscious individuals within the ages of 18-35 who are often early adopters of new and promising technologies are likely to choose Hydrolink as a cost-effective option given the competitors.

## Market Size Analysis

The total available market for Hydrolink is the global health club industry, which includes all potential customers of the smart lid from gym fitness enthusiasts to health club members. A market research study conducted by Custom Market Insights determined the Global Health and Fitness Club Market size and share revenue to be valued at $83.2 billion in 2022, and is projected to reach $125.23 billion by 2030 (Custom Market Insights, 2023).

The serviceable market for Hydrolink will be the United States, as the smart lid will initially be sold primarily in the U.S. given the prevalence of mainstream reusable water bottle brands being sold in the U.S. market. In 2022, the revenue of the fitness, health and gym club industry in the United States was $45.4 billion, accounting for nearly 47% of the global market at the time (Gough, 2023). It may be significant to note that since the effects of the pandemic, that projection in the United States has lowered to $30.6 billion in 2022 (Gough, 2023).

The addressable market for Hydrolink consists of two markets; the smart water bottle market, and the reusable water bottle market. Hydrolink is a cost-effective competitor to existing smart water bottles, and therefore will compete in the smart water bottle market which has an estimated value of $31.23 million in 2022, projected to reach $96.76 million by 2033 (Smart Water Bottle Market 2023). Hydrolink is a universal solution, with the custom smart lid being available for a broad range of mainstream reusable water bottle brands. Therefore, the second main target market for Hydrolink is the United States reusable water bottle market, which had a valuation of $1.90 billion in 2022, with an expected growth of $2.68 billion in 2030 (U.S. Reusable Water Bottle Market Size). This expands the addressable market for Hydrolink while maintaining the product's original design, without compromising its original design.

# 4 - Competitive Analysis

## Competitors

The main direct competitor is the LUCY Smart Cap produced by the Austrian-founded company Waterdrop, which features UV-C purification, a UV-C LED, a Time-of-Flight sensor, and an accompanying mobile app available on the App Store and Google Play for hydration tracking and reminders. Its key value proposition is the UV-C purification. However, this smart cap is only compatible with Waterdrop company steel and glass water bottles, and is not universal. Additionally, Waterdrop only offers the LUCY Smart Cap in two United States locations, and therefore is not considered a large competitor in the U.S. market. The product retails for a starting price of $129, more expensive than Hydrolink by over a factor of three.

Other, more traditional and U.S. prominent smart water bottle alternatives include HidrateSpark, Water.io, and Ember. HidrateSpark retails for $74.99. The product's key value proposition includes a built-in scale to measure the user's water intake, bottom LEDs to remind the user to take a sip at intervals, and an insulated cup to keep the drink cold. Water.io retails for $99.99 and offers similar hydration tracking features and a smaller LED ring light on the cap. However, despite a similar key value proposition to the HidrateSpark, the Water.io smart water bottle cannot be used with ice or hot water, reducing its versatility. Both of these listed smart water bottle products are accompanied by a mobile app to help the user track hydration statistics and customize their water bottle features (e.g. reminder intervals, LED lights).

The third competitor in this space is Ember, a company that produces an array of smart products including a smart cup, smart mug, smart tumbler, and smart travel mug. This product has a different focus for its key value proposition compared to the previous competitors, as it implements a temperature display, has temperature adjustment (to achieve the desired temperature for the contained liquid), and a built-in battery with an advertised battery life range between 80 minutes to 3 hours. Ember's accompanying mobile app differs from the previous competitors as well, with the main functionalities being setting the mug temperature, customizing presets for various drinks, and receiving notifications when the mug achieves the desired temperature.

### Whitespace

There are existing direct and indirect smart water bottle competitors; however, Hydrolink is uniquely positioned to take advantage of a whitespace in the market. While some competitors already provide similar core features, Hydrolink is a universal lid solution and does not limit the customer by requiring the purchase of a complete water bottle. The compatibility with popular brands such as Hydro Flask and YETI makes Hydrolink more versatile and appealing to potential consumers who already own reusable water bottles, as they can make their existing product into a smart one with a simple lid.

Hydrolink focuses on design and aesthetics, catering to consumers who value style and functionality. The sleek and modern design of the lid, combined with customizable LED ring lights, makes Hydrolink an attractive product, especially for potential users seeking practicality and visual appeal.

By providing essential features within the smart lid itself, Hydrolink eliminates the need to produce a complete water bottle and can consequently offer the product at a fraction of the price of prevalent water bottle products. At an anticipated price point of $35 per smart lid, Hydrolink is significantly more affordable than existing water bottles on the market. This cost-effective price point makes Hydrolink more accessible to a broader consumer base, providing a reasonable solution in the face of expensive existing options.

# 5 - Customer Personas

## Customer Persona #1: Harry Malyan

Harry Malyan, a 24-year-old pre-med Public Health major, is dedicated to promoting healthier lifestyles through public policy and personal example. As a health-conscious individual, he actively seeks tools and technology that support his health goals. Despite his dedication, Harry struggles to maintain consistent hydration due to his busy schedule, often forgetting to drink water during long study or work periods. He finds analog methods like habit trackers or notebooks insufficient for tracking water intake. Harry's needs include a convenient, automated system that tracks water intake, provides consistent reminders, and ensures water purity to align with his health-conscious mindset. Access to data insights on his hydration habits is also important for making informed decisions. In his customer journey, Harry learned about Hydrolink through us and is excited about the product, considering a future purchase once it is launched, ideally priced between $30-$50. Hydrolink meets Harry's needs by providing automated reminders, purifying his water, and offering insightful data, helping him maintain consistent hydration and support his personal health goals. As he experiences the benefits, Harry is likely to advocate for Hydrolink within his public health initiatives and to his peers, promoting healthier habits through both personal use and professional influence. The job-to-be-done for Harry is a reliable, tech-savvy way to maintain consistent hydration throughout his busy day without the hassle of manual tracking. Hydrolink fulfills this need by providing an automated system that reminds him to drink water, purifies his water, and offers insightful data to help him maintain and improve his hydration habits. This not only supports his personal health

goals but also aligns with his professional focus on promoting healthier lifestyles through public policy.

Link to Interview Recording

Link to Interview Notes

### Customer Persona #2: Gali Kechichian

Gali Kechichian, a 20-year-old computer science student, is always on the go, which makes it tough for her to stay hydrated. She wants to maintain regular hydration and loves using technology to make her life easier. But with her hectic study schedule, she often forgets to drink water and doesn't have a reliable way to track it. She needs something convenient, like an automated system to remind her to drink water, and she prefers purified water for safety. Having data insights on her water intake would also help her manage her hydration better. Gali found out about Hydrolink through us and got excited, sharing the news with her friends and classmates. She's considering buying it once it's available, ideally for under $100. She believes Hydrolink will help her stay hydrated with its reminders and data insights, fitting perfectly into her tech-savvy lifestyle. Once she starts using it, she plans to promote it to her peers and within student groups. For Gali, the job-to-be-done is having a reliable, tech-savvy way to stay consistently hydrated without the hassle of manual tracking. Hydrolink fulfills this need by providing an automated system that reminds her to drink water, purifies her water, and gives her useful data to improve her hydration habits. This not only supports her health goals but also fits seamlessly into her busy, tech-focused life as a computer science student.

Link to Interview Recording

Link to Interview Notes

### Customer Persona #3: Sarkis Bozikian

Sarkis Bozikian, a 34-year-old computer engineer, learned about Hydrolink through us. While he wouldn't consider buying it for himself, he shared his interest with his wife, a HydroFlask user. She's keen on purchasing Hydrolink once it's launched, ideally priced around $30, appreciating its water purification feature and minimal phone notifications. In his customer journey, Sarkis sees Hydrolink as valuable for his wife, who finds it helpful and exciting. He recommends it to family and friends, especially those using similar water bottles. For Sarkis, the job-to-be-done is ensuring his wife's hydration reliably and affordably without excessive phone notifications. Hydrolink fulfills this by tracking water intake, purifying water, and offering subtle LED ring reminders on the lid. His wife values this approach and is sold on our unique value proposition: a lid compatible with her existing bottles, avoiding the cost of a new bottle. This practicality and cost-effectiveness make Hydrolink an appealing choice.

Link to Interview Recording

Link to Interview Notes

# 6 - Product Details and Design

## Product Details

Hydrolink is a universal smart water bottle lid designed to enhance hydration tracking and management. It features an LED ring light that turns on as a reminder to drink water, and the light can be customized to match your style. The lid includes an ESP32 microcontroller, which handles processing and connectivity for real-time data updates. An ultrasonic sensor measures the water level in the bottle, ensuring accurate hydration tracking. Hydrolink works with a range of popular water bottle brands like Hydro Flask and YETI, making it easy to upgrade your existing bottles without buying new ones. The accompanying Hydrolink web app enhances the experience with features like daily hydration tracking, LED customization, and personalized hydration recommendations. The app uses user data to offer advice tailored to help you meet your hydration goals. Overall, Hydrolink is a practical, stylish, and tech-savvy solution for staying hydrated.

## System Design and Architecture

The Hydrolink system combines both hardware and software components to create an effective hydration tracking solution. For hardware, it uses the HC-SR04 Ultrasonic Sonar Distance Sensor to measure the distance between the lid and the water surface, allowing it to calculate the amount of water consumed. The 16Bits WS2812 5050 RGB LED ring provides reminders to drink water through visual cues. An ESP32 DEVKIT V1 microprocessor powers the sensors and handles data transmission (via Websockets) to the server.

On the software side, the backend utilizes FastAPI and Uvicorn to run the server, with Supabase managing the database and user authentication. The frontend is built using HTML, CSS, and Vanilla JS, focusing on a mobile-first design for a seamless user experience across all devices. This integrated system ensures reliable and user-friendly hydration management.

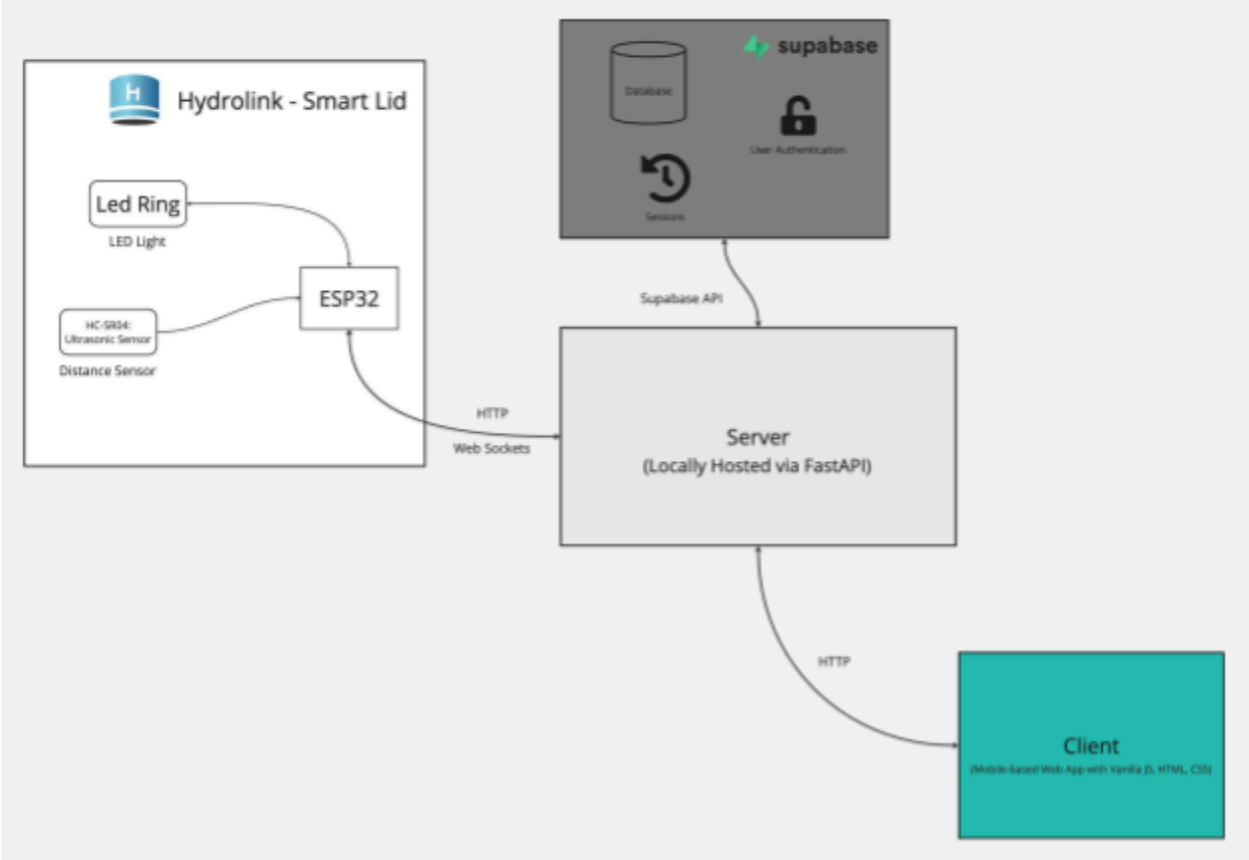


Figure 1 - System Architecture Diagram

## Hardware Prototype

We initially developed the first iteration of the Hydrolink smart lid, which successfully integrated essential components such as the LED ring and ESP32 microcontroller. However, this design was relatively bulky and less efficient in terms of

space utilization. In the second iteration, we focused on making the design more compact while maintaining the same functionality. The new design is smaller than the first, allowing for better integration of the LED and ESP32. This reduction in size was achieved by optimizing the internal layout and reconfiguring the placement of the components. The improved design not only makes the lid more aesthetically pleasing but also enhances its usability and portability. By streamlining the design, we ensured that the components fit more snugly within the lid, resulting in a more durable and efficient product. The compact design also facilitates easier assembly and potential for mass production, making it a more practical solution for market release. Overall, the second iteration represents a significant improvement in design efficiency, component integration, and overall product functionality.

Figure 2 - First Iteration of the Lid

Figure 3 - Second Iteration of the Lid

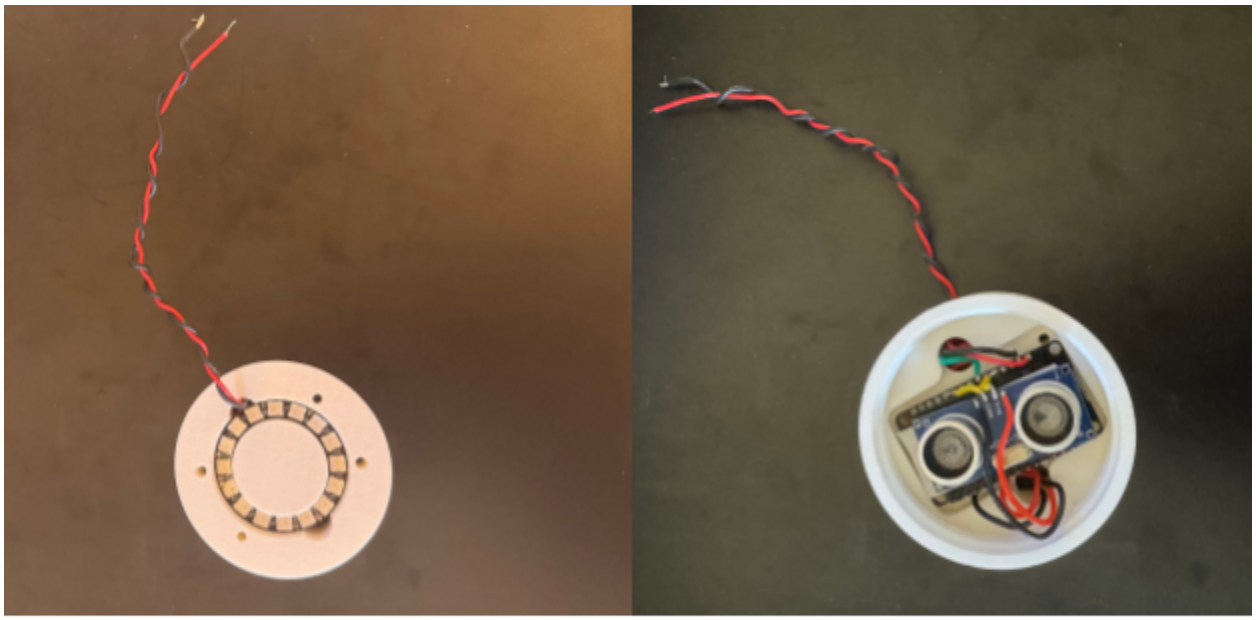

Figure 4 - Final 3D Printed Prototype

## UX/UI

Our iterative UX design process for Hydrolink began with creating low-fidelity wireframes. We brainstormed ideas about the overall functionality of the UI, prioritizing a mobile-first approach to ensure feasibility within a reasonable time frame. Our goal was to design an interface that is as simple as possible, conveying all necessary information with

minimal content on each page. This approach helps users quickly and easily understand how to use Hydrolink.


Figure 5 - Low Fidelity Wireframes

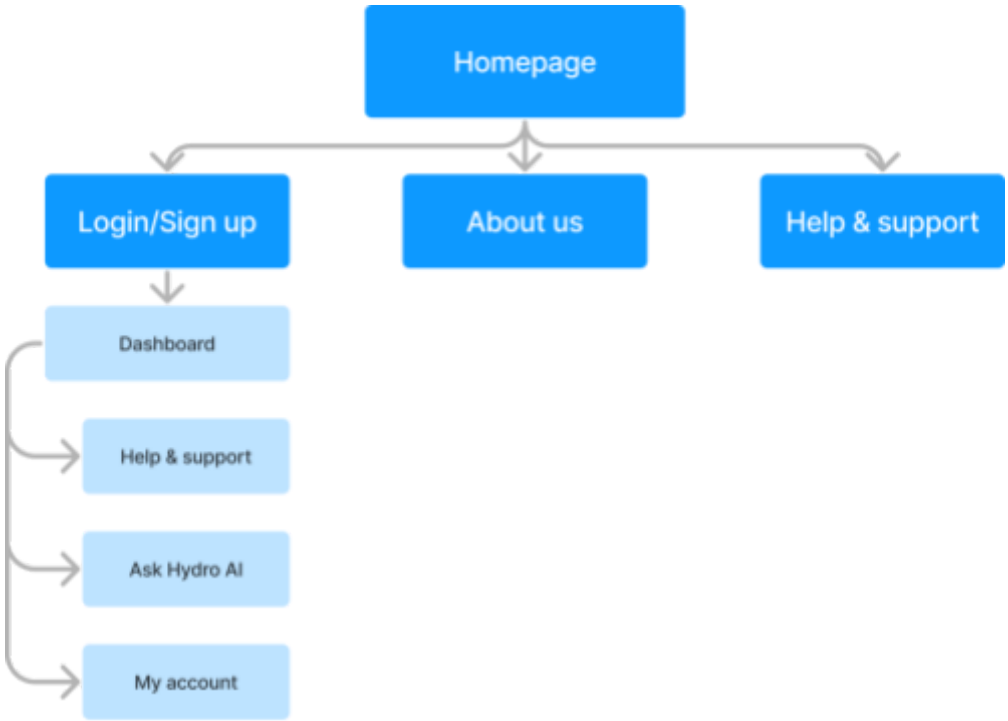


Figure 6 - Information Architecture

Here's our incremental progress for the high-fidelity mockups.


Figure 7 - Round 1 of High Fidelity Mockups

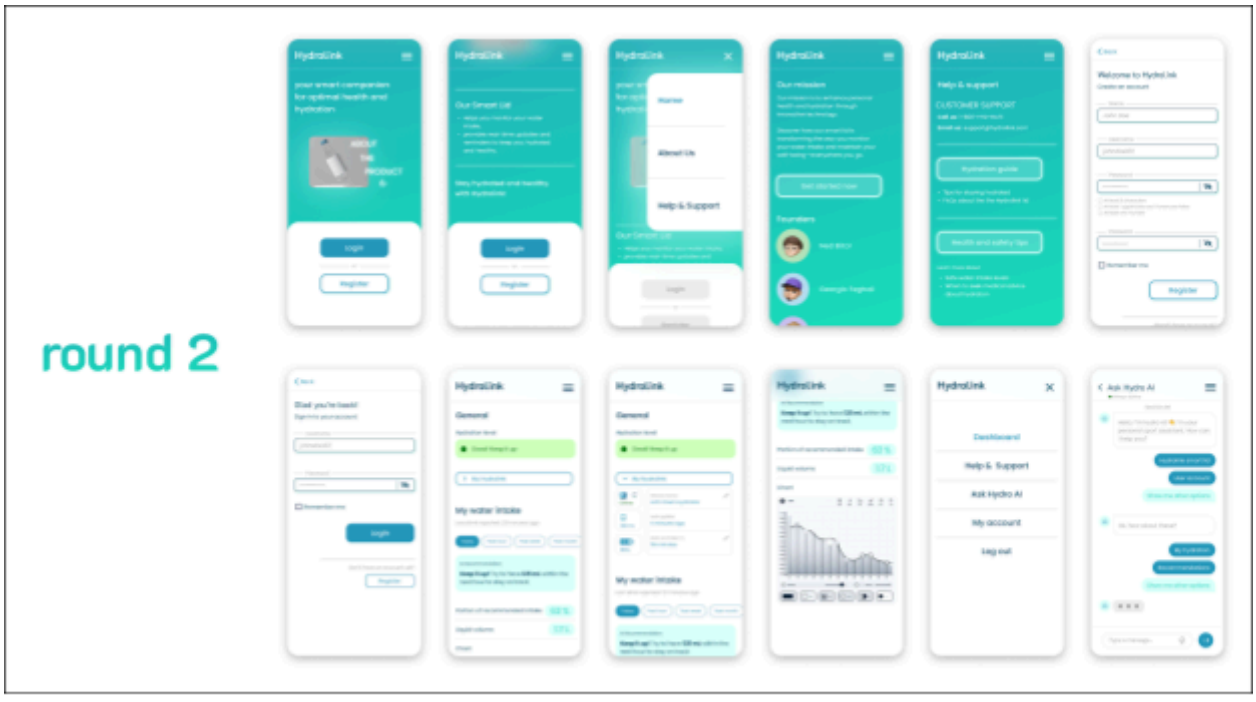


Figure 8 - Round 2 of High Fidelity Mockups

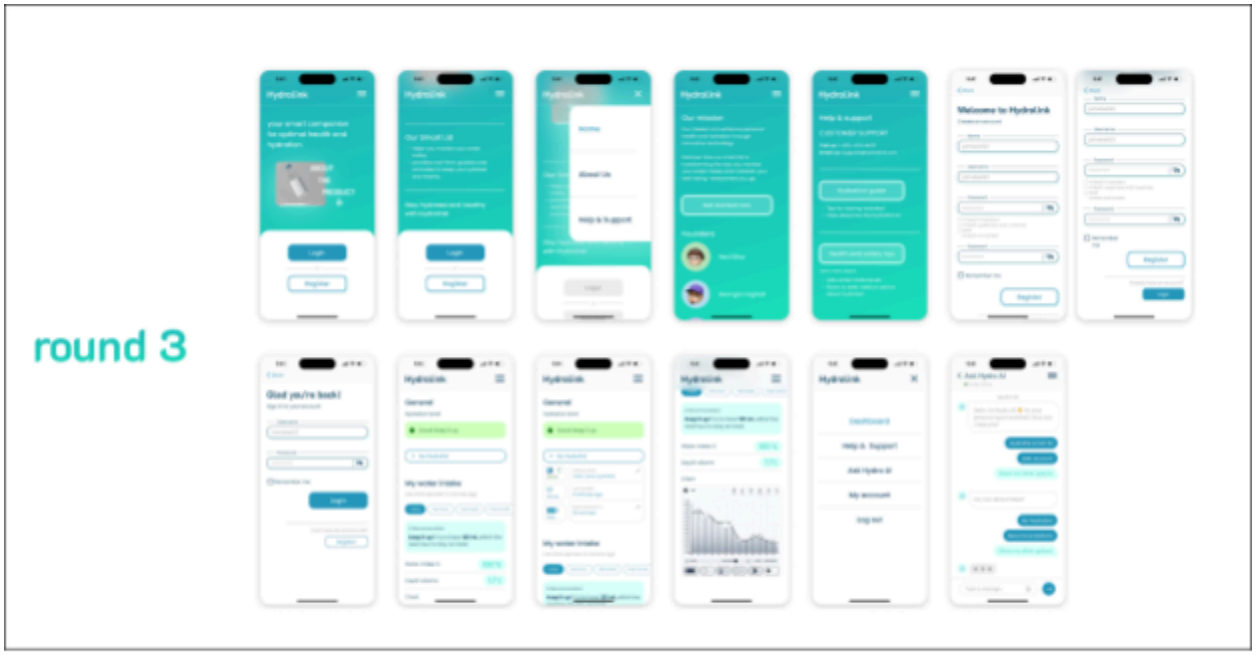


Figure 9 - Round 3 of High Fidelity Mockups

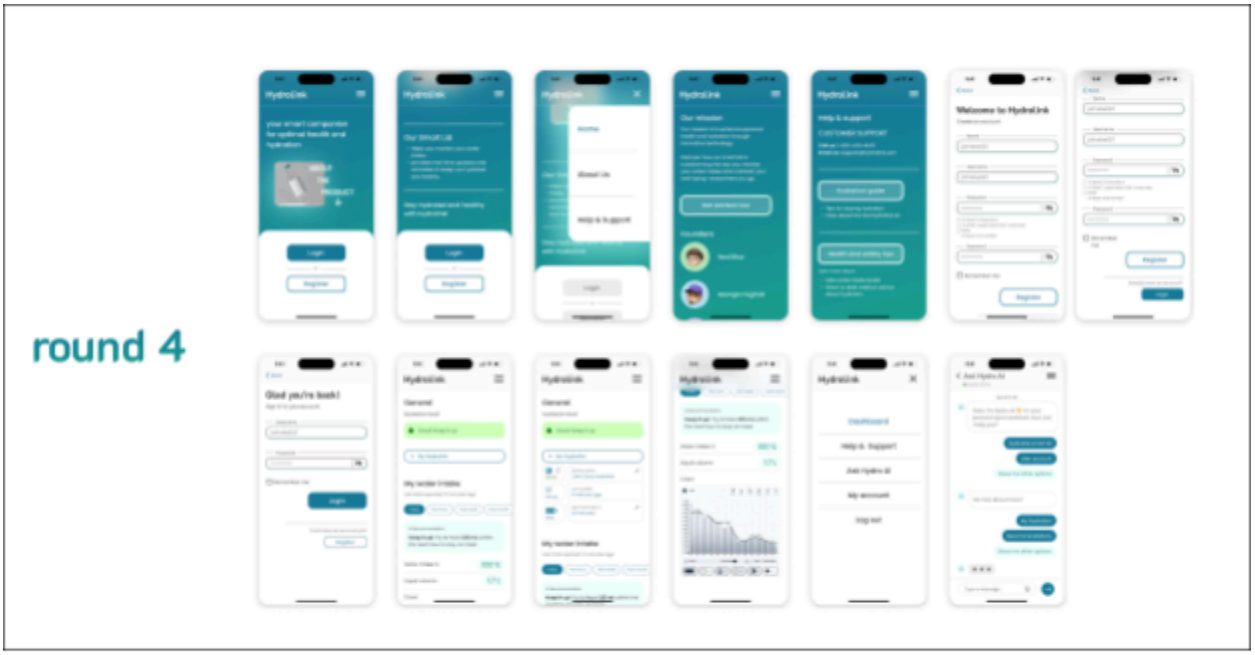


Figure 10 - Round 4 of High Fidelity Mockups

## Accessibility

For accessibility, we evaluated the color contrast in our mockups using a Figma plugin that lets you test the contrast ratio between two colors. This plugin allows us to check whether our colors meet the WCAG 2.1 (Web Content Accessibility Guidelines) standards. For our primary text color, we ensured it complied with the WCAG AAA color contrast standards. As for our secondary and accent colors, they comply with WCAG AA, which is still a good contrast ratio for text, both large and small. Drawing inspiration from Apple's Human Interface Guidelines and Google's Material Design, we also developed our own type scale. While customizing font size isn't currently an option for our users in the latest design iteration, we made sure to utilize tried and tested methods from these established design systems.

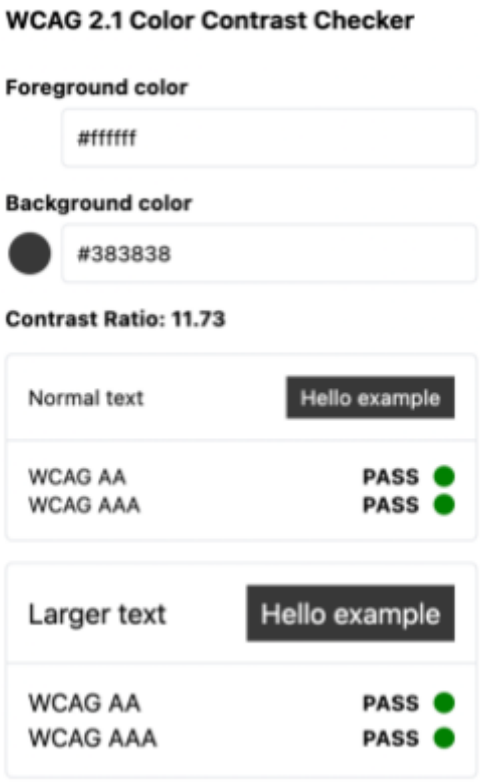


Figure 11 - Primary Text Color WCAG 2.1 Test

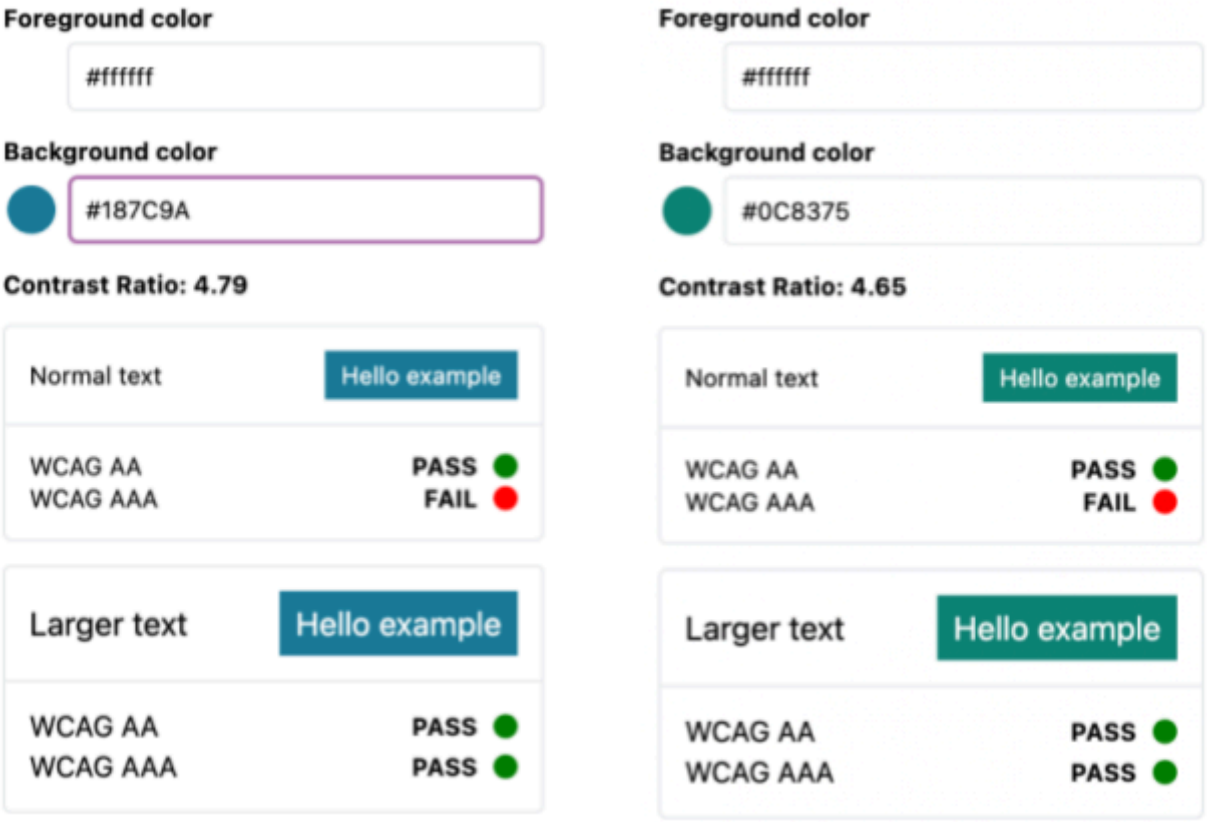


Figure 12 - Secondary and Accent Color WCAG 2.1 Test


Figure 13 - Text Styles

# 7 - Cost and Revenue Models

## Type of Business

The business model for our product is B2C (Business to Consumer). This model focuses on directly selling the smart cup lids to individual consumers who are interested in tracking their hydration levels and improving their water intake habits.

## Cost of MVP

The hardware costs for the Hydrolink MVP include the HC-SR04 Ultrasonic Sonar Distance Sensor at $0.42, the 16Bits WS2812 5050 RGB LED ring at $0.68, and the ESP32 DEVKIT V1 at $3.81. For the future version, the UVC light is estimated to cost $7.50. This brings the total hardware cost for the initial MVP to $4.91, and for the future version with the UVC light to $12.41. There are no costs associated with software development for the MVP. The app will be provided for free to users, ensuring there are no additional costs for customers to access the full functionality of the product. Therefore, the total MVP cost remains $4.91. Note that additional costs such as hosting, manufacturing, packaging, and distribution will be considered in the final production phase.

## Pricing and Return

The selling price per unit for the initial MVP is set at $35, while the future version with UVC light will be priced between $50 and $60. The gross profit per unit for the initial MVP is calculated as $35 - $4.91 = $30.09. For the future version with UVC light, the gross profit per unit is $50 - $12.41 = $37.59 if priced at $50, and $60 - $12.41 = $47.59 if priced at $60. The profit margin for the initial MVP is (30.09 / 35) * 100 ≈ 85.97%. For the future

version with UVC light, the profit margin is (37.59 / 50) * 100 ≈ 75.18% if priced at $50, and (47.59 / 60) * 100 ≈ 79.32% if priced at $60. According to industry data, the average profit margin for consumer electronics products is around 40-50%. Our projected profit margins for both the initial MVP and the future version with UVC light are significantly above the industry average, indicating strong profitability potential for our product. This higher margin is achieved by keeping production costs low and maintaining a competitive yet attractive price point for consumers.

### Customer Acquisition Cost (CAC) and Lifetime Value (LTV)

To acquire customers, we plan to use various marketing channels, including social media ads, influencer marketing, and targeted online advertising. We plan to spend $1000 on social media marketing to acquire 50 new customers, resulting in a CAC of $20 per customer ($1000 / 50 = $20). The LTV is the total revenue expected from a customer over their lifetime, and since our product is a one-time purchase, the LTV is equivalent to the selling price of one unit: $35 for the initial MVP and $50 to $60 for the future version with UVC light. Ideally, the LTV should be at least three times the CAC to ensure strong profitability. Currently, the LTV of $35 compared to a CAC of $20 gives us a ratio of 1.75:1. To achieve the desired 3:1 ratio, we could consider increasing the product price, given that our pricing is already competitive compared to other market offerings. For the future version with UVC light, the LTV of $50 to $60 provides a better ratio: (50 / 20) = 2.5:1 if priced at $50 and (60 / 20) = 3:1 if priced at $60. This indicates that the future version with UVC light not only offers a higher profit margin but also aligns better with our target LTV to CAC ratio, suggesting a potential for increased revenue and profitability.

## Business Growth and Future Changes

In the early stages, growth will be driven by initial marketing campaigns, early adopters, and word-of-mouth referrals. As we scale, economies of scale will reduce production costs, with bulk purchasing of components and streamlined manufacturing processes lowering per-unit costs. Expanding to new markets and demographics can drive further growth, and we may also introduce new features or versions of the product to attract repeat customers and upsell. Continuously improving the product based on customer feedback will help maintain a high customer satisfaction rate, reducing churn and increasing LTV.

# 8 - Traction to Date

## Current Progress and Next Steps

We have recognized the market has a need for a smart water bottle lid. Our lid is capable of providing unique insights into your drinking habits. Our product's core functionality is operational, the ultrasonic sensor can accurately measure the water level in the cup, and the web app can communicate with the lid, allowing for configuration and control. This demonstrates the essential components are working as intended.

Preliminary customer interviews have been conducted, and the feedback indicates a genuine interest in the product. However, further customer testing is necessary to evaluate the physical product and the user interface’s accessibility. This hands-on testing phase will provide valuable insights into the product's usability and potential areas for improvement.

Ultimately, the MVP has been developed, but there are still some key features that need to be implemented and tested. Notably, the UV light sanitation functionality has not been integrated into the current version. Before implementing this feature in the final product, it is crucial to assess how the UV light will interact with the various plastic bottle materials and weather is a risk of degradation.

In summary, the core functionalities of measuring water levels and communicating with the lid are operational, the product still requires the integration of and testing of the UV light sanitizing feature, as well as extensive customer testing to ensure a user-friendly and accessible product before proceeding to the next stage of development.

# 9 - Project Review

## Initial Product Design and Pivot

The product we initially intended to produce was an Anti-Roofie cup. The goal of that product was to indicate if your drink had been tampered with. After conducting several interviews, we realized that product implementation was impractical. Although people were enthusiastic about our idea, they were agreeing with the premise more so than the real implementation. These conversations forced us to take a step back and reconsider our approach. We wanted to create a product that had widespread appeal and also solved a personal pain-point, and we conducted an intense brainstorming session. After discussing our original smart water bottle product idea, we noticed the existing market only consisted of entire water bottles, although the technology seemed simple enough to incorporate a small component with a standard, reusable bottle. We then had the idea to create a universal hardware to make any water bottle smart, and consulted with the course TAs as we went through several implementations before finalizing our pivot to the smart lid. The tech stack would use an ultrasonic sensor to measure the water level, an RGB LED ring to remind you to drink, and for a future implementation, a UV LED to sanitize the cup. To create an IoT device, the lid would be paired with a webapp.

## Development Complications

In building this cup, we faced various complications in understanding the various ways we can communicate with the ESP32 and have it still be intuitive. We went back and forth before eventually deciding to create an accompanying webapp. We are having

difficulties figuring out how to implement service workers, but ideally, they would allow the product to still be functional in the absence of an internet connection.

On the hardware side of things, we had difficulty sourcing sensors capable of accurately measuring the water level. We bought a water level sensor from Amazon that tells you the water level based on conductivity, but it was not accurate enough, and the cost of this sensor alone would raise the product's price range, rendering it unreasonable for us to pursue. We ultimately decided to use an ultrasonic sensor due to its precision and affordability, which made the smart lid a financially viable product to develop.

### Lessons Learned

We have learned a great deal about entrepreneurship and product engineering throughout the successes and failures in building our MVP. Prior to this experience, we presumed that engineering was difficult, and that the business aspects of creating a product would come naturally. Now, we understand that accurately ideating a product and making business decisions are just as important as the engineering. After our failed initial product idea, we learned that as entrepreneurs, we must first find a problem that people have, think about how we can solve that problem, and execute on our idea. Conducting interviews and doing market research and analysis is just as important as the engineering, if not more, because there is no financial purpose or positive impact to a cool technology that people simply would not use. A simple product backed by sound market research will outperform a complex, well-engineered product with little customer interviews and market analysis. We have learned these lessons to heart, especially after going through a significant pivot with our product idea.

# 10 - Accessibility and Ethical Considerations

## Visual Impairments

For individuals with visual impairments, the LED light notifications may not be easily perceivable, so we plan to implement alternative modes of notifications, such as audible alerts or vibrations through the smartphone. The configuration process of the LED lights and sanitation settings may pose challenges for users with cognitive impairments. To address this, we have designed the app interface and instructions to be user-friendly, intuitive, and accessible, and we are considering implementing voice commands.

## Data and Personal Information

At Hydrolink, we prioritize the privacy and security of our users' personal information. We are committed to ethical data collection practices and ensuring that our users are fully informed about the ways their data is being collected and used. Our approach will incorporate transparency, allow for user control, minimize the necessary data being collected, and implement robust security measures to protect our users' personal data. We will comply with all data protection laws and regulations.

The data we collect will include personal information (name, email address, contact details), hydration data (water intake records, hydration goals, scheduled reminders), and usage data (how users interact with the webapp). The purpose of this data collection is solely to provide personalized hydration recommendations and reminders. Users will have full control over accessing and correcting their personal information through the webapp.

Users may request a copy of their data, request a deletion of the personal data, and opt-out of data collection and personalized recommendations through the app settings.

### UV Considerations

While UV light can effectively sanitize the bottle, prolonged exposure can be harmful to human health. Therefore, we will ensure the UV feature is designed with proper safety measures, such as automatic shutoff mechanisms and warning labels. Our goal when designing this product is to minimize waste by integrating it into the existing market of water bottles rather than competing, resulting in fewer bottles in the trash. We strive to consider the environmental impact of the materials, manufacturing, and disposal of our products, aiming to minimize the carbon footprint throughout the product's life cycle. We will research and comply with regulations and standards for the use of UV light for sanitation, as well as any consumer product safety guidelines. To avoid infringing existing patents, we will extensively research patents and seek legal counsel. As a manufacturer, we are potentially liable for any harm or injuries caused by our lid, so we will implement robust quality control and communicate any risks and proper usage instructions to mitigate liability concerns. Additionally, we will ensure that our marketing and advertising claims are truthful, accurate, and do not engage in deceptive practices, with all claims substantiated by facts.

## 11 - Citations

Custom Market Insights. (2023, May 25). Global Health and fitness club market size is anticipated to expand at a CAGR of 7.5% to reach US$ 125.23 billion by 2030 | custom market insights study. Yahoo! Finance. https://finance.yahoo.com/news/global-health-fitness-club-market-182000612.html

Gough, C. (2023, December 12). US Fitness/Health Club Market Size 2023. Statista. https://www.statista.com/statistics/605223/us-fitness-health-club-market-size-2007-2021/

Smart Water Bottle Market. Future Market Insights. (2023, June 8).https://www.futuremarketinsights.com/reports/smart-water-bottle-market

The state of the fitness industry 2023: Key Trends & Statistics. Fitness Industry in 2023: Key Trends & Statistics. (n.d.). https://www.perfectgym.com/en/blog/business/fitness-industry-statistics-trends

U.S. reusable water bottle market size, share report, 2030. U.S. Reusable Water Bottle Market Size, Share Report, 2030. (n.d.). https://www.grandviewresearch.com/industry-analysis/us-reusable-water-bottle-market-report#:~:text=Market%20Size%20%26%20Trends,4.4%25%20from%202023%20to%202030