

See-Rynge

A Liquid Measurement Device For the Blind and Low-Vision Community

Executive Summary

See-Rynge is a revolutionary tool that addresses the overlooked challenges faced by blind and low-vision individuals in accurate liquid measurement tasks. In a market scarce on alternatives providing truly independent, accurate, and versatile measurement solutions for the blind and low-vision community, See-Rynge stands out by seamlessly integrating automation, precision, and user-friendly technology. While usable by both the sighted and blind communities, See-Rynge employs tactile buttons, audio feedback, and an accessible companion app to specifically cater to the over 20 million Americans who have a visual impairment.

With a commitment to accessibility, the See-Rynge Team aims to keep the device affordable, priced below \$50. Having successfully developed a Minimum Viable Product, our focus is on finalizing a compact hardware design, expanding supported liquid volume ranges, and refining user workflow with thorough testing at local blind advocacy group meetings. This innovative product addresses a large unmet need and embodies our dedication to enhancing accessibility and independence for the blind and low vision community.

The Problem

Liquid measurement, a daily task for many, is effortlessly carried out by a significant portion of the American population in activities like medication administration and meal preparation. However, for the majority of low-vision individuals globally, this common practice is challenging due to the strong emphasis on visual ability. This challenge is further exacerbated by the absence of visually accessible liquid measuring devices, forcing blind and low-vision individuals to estimate measurements themselves or seek daily assistance, undermining their autonomy. One poignant instance that deeply resonated with our group involves a blind mother whose child had contracted eye cancer. This mother faced the serious risk of having her child taken away because several professionals believed she wouldn't be able to accurately measure her child's necessary medication. This heartbreaking narrative not only underscores the severity of this issue but also serves as the driving force propelling the development of this device forward.

Competitive Analysis

Presently, the market lacks a comprehensive solution that fully tackles the challenge of precise liquid measurement for blind and low-vision people. The existing options either fall short in providing genuine independence, lack versatility for general-purpose use, or fail to meet the required accuracy standards. Among these alternatives is a makeshift DIY tactile syringe, consisting of makeshift buttons or knife markings. However, a DIY syringe is a crude, often imprecise alternative and its creation often requires aid from a sighted individual. Another alternative is a syringe specifically designed for diabetes applications (i.e., Count-A-Dose).

Although this is a more tactile and refined alternative, it only supports insulin dosage in very small volume ranges. In addition, measuring cups with large text can be helpful for individuals who retain some limited vision. However, such cups lack tactility and precision, and are not a viable option for completely blind users. The final options available are talking measuring cups/kitchen scales that audibly announce the weight or volume being measured. Although the audio feedback is helpful, these devices lack the critical tactility and precision required for precise measurements, particularly in applications such as medical dosage.

The Solution: See-Rynge

To address this market gap, we developed See-Rynge: a handheld liquid measurement device for the blind and low-vision community. Our device uses a lightweight stepper motor to draw precise volumes of liquid into a disposable syringe, which can then be detached for flexible use. To accommodate low-vision users, See-Rynge features tactile buttons for each of its user inputs and each button is also associated with a distinct sound cue to provide audio feedback. The user may adjust the measurement volume as needed by using the buttons or by inputting a desired volume into a bluetooth-enabled companion phone application. This companion application can also track all of the measurements taken by the physical device and can act as a databank of common medications and their dosages for different age ranges. See-Rynge is currently powered by a 9 volt battery and encased within custom laser-cut housing to ensure that it is lightweight, portable, and comfortable to use.

When compared to current accessible liquid measurement alternatives, See-Rynge offers significant advantages in accuracy and precision while ensuring user independence. See-Rynge is mechanically precise, demonstrating an average volumetric error of only 1.05% in quantitative trials, well within FDA syringe standards. Additionally, See-Rynge has been observed to work with a wide range of viscosities, ensuring reliable and versatile use no matter the liquid being measured. A diagram of See-Rynge and its companion app can be found in Appendix Figure 1 and 2, respectively.

Market Analysis

Market research indicates a substantial demand for a device designed to assist blind and low-vision individuals with liquid medication measurement. An estimated 20 million Americans have some sort of visual impairment, 6 million remain visually impaired with correction, and 1 million Americans are blind. The global assistive technologies for the blind and low-vision population market is expected to reach US\$ 2.9 billion by 2030, growing at an annual growth rate of greater than 6.8%. Therefore, the potential market for such a device is significant.

Next Steps

By showcasing See-Rynge at the meetings of local blind advocacy groups, we have identified several points of improvement for our device. This involves improving upon the form factor of the device, expanding its volumetric offerings and fortifying the accessibility features

provided by our companion application. In addition, we hope to further explore the potential for See-Rynge to positively impact other disability communities. From preliminary conversations with leaders of blind advocacy groups and occupational therapists, this device can be very useful among those who face cognitive and physical struggles due to the capabilities offered by both the physical device and its companion application. For example, the measurement tracking and databank features within the application can help those who struggle with memory loss, and the enhanced tactile feedback and user-friendly input methods of the device can assist those with motor challenges. In conjunction with this, we are also **fundraising** to support the costs that follow the development and marketing of this project.

Team

This device was developed by a team of five as part of the University of Pennsylvania's Bioengineering Senior Design program during the 2023-2024 academic year. Today, two members of this team, Chiadika Eleh (a software engineer at Google) and Joey Wei (an integration engineer at Epic) are extremely dedicated to commercializing this device and getting it into the hands of those who need it the most.

Appendix

Figure 1: Labeled CAD Render of device.

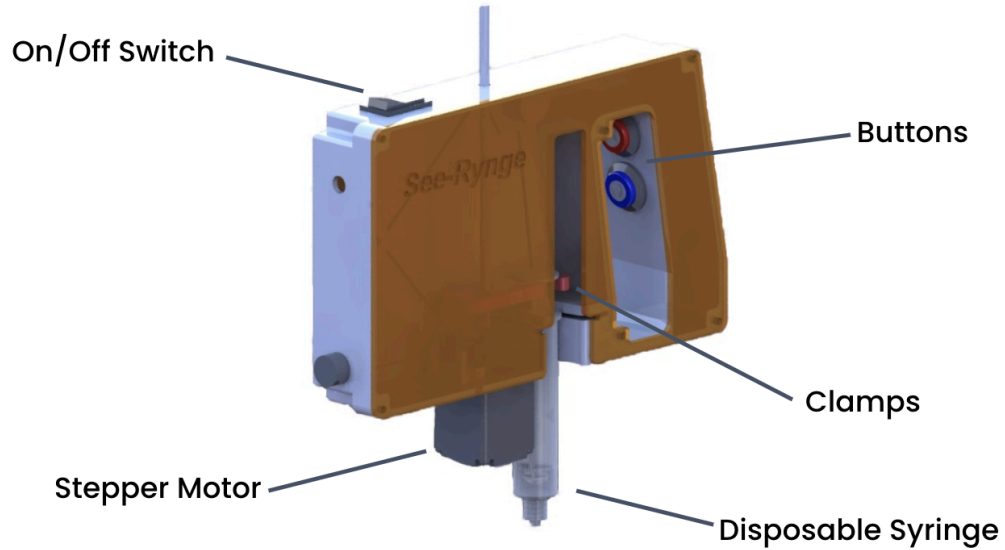


Figure 2: Final application design. a) Landing page and Bluetooth Connection prompt. b) Volume input page. c) Past Measurements Tracker page. d) Databank page with common medications and dosages.

