

Executive Summary

The objective for HELPOLOGY was to create a second-generation prototype for an Automated Medicine Dispenser as detailed in U.S. Patent Application 18/463823. To improve on the first-generation design the team used SolidWorks simulations, optimized material selections, and improved the code base to have a fully functional version of the device ready for the patent holder Ms. Minhchau Le to use to defend her patent.

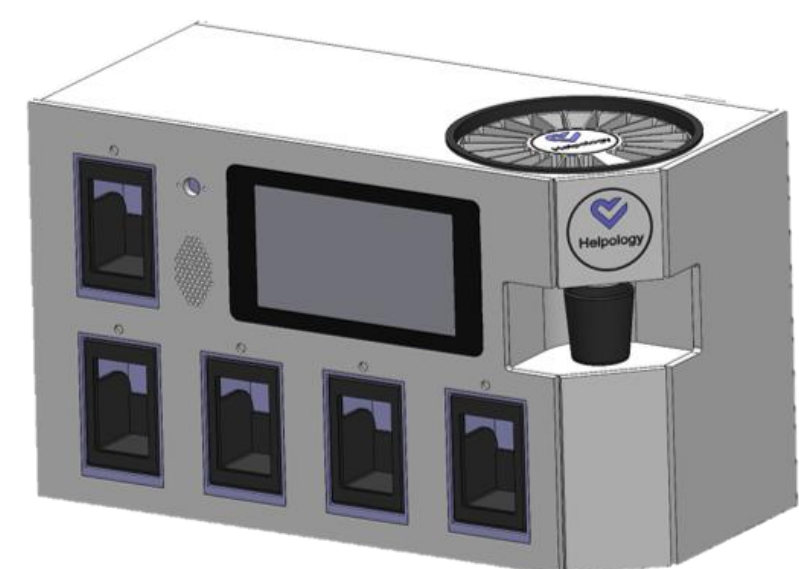


Figure 1. Medicine dispenser CAD

Background

The function of the automated medicine dispenser is to ensure elderly patients who have hearing, eye, memory problems, or other cognitive issues take the correct dosages of medicine at the correct time even when a caretaker is not present. The functions that differentiate our medicine dispenser from those commonly found on the market are eyedrop compartments one of which is cooled ensuring that patients can store and take medicine other than just pills. The main goals of were to meet the cooling requirements of 8° Celsius in the cooled compartment, to reduce the size and weight of the whole box, and improve patient and caretaker experience.



Figure 2. Improvements Plan

Technical Requirements

The initial feedback our client gave us was that the dispenser was heavy, the screen wasn't large enough for patients to interact with, and carousel catch cup was too hard for people with motor skills to grab. Technical requirements that required improvements were the temperature was only able to reach 12° Celsius. Additional development was required to program the individual components to perform tasks at designated schedule times.

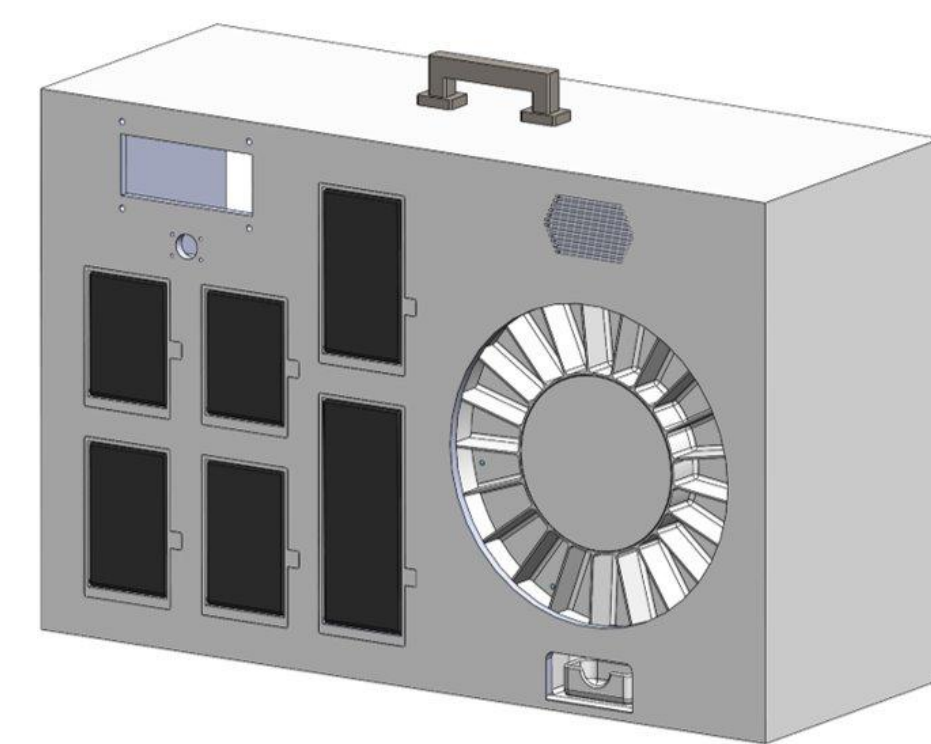


Figure 3. Initial dispenser design

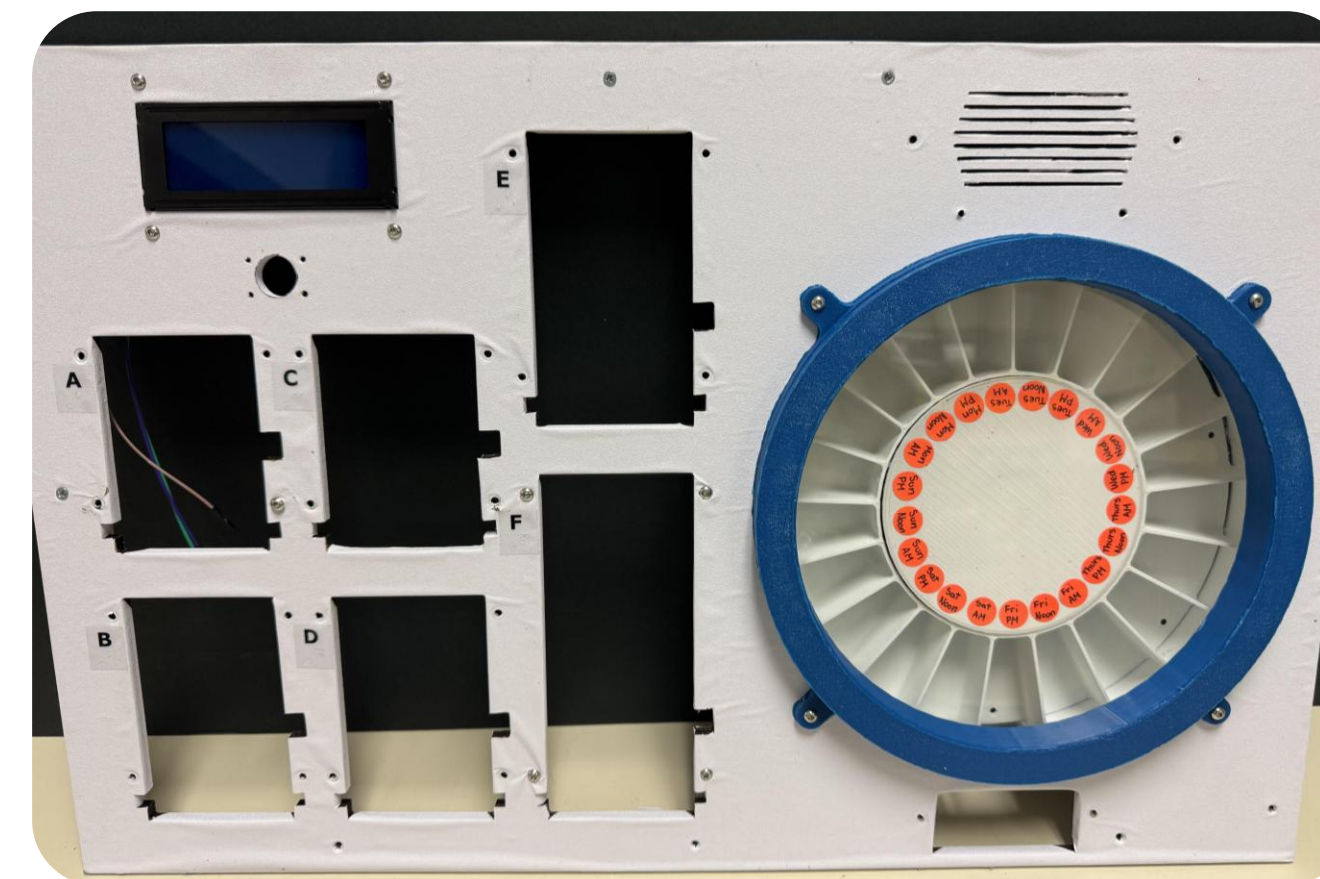


Figure 4. Initial Physical Design

Improvements

For improvements on weight, size, and increase the catch cup size the carousel was rotated to sit on the top of the box and with increasing the depth of the compartments allowed for an increased catch cup area this solution also allowed for the implementation of a magnet to reduce the need for precise motor functions.

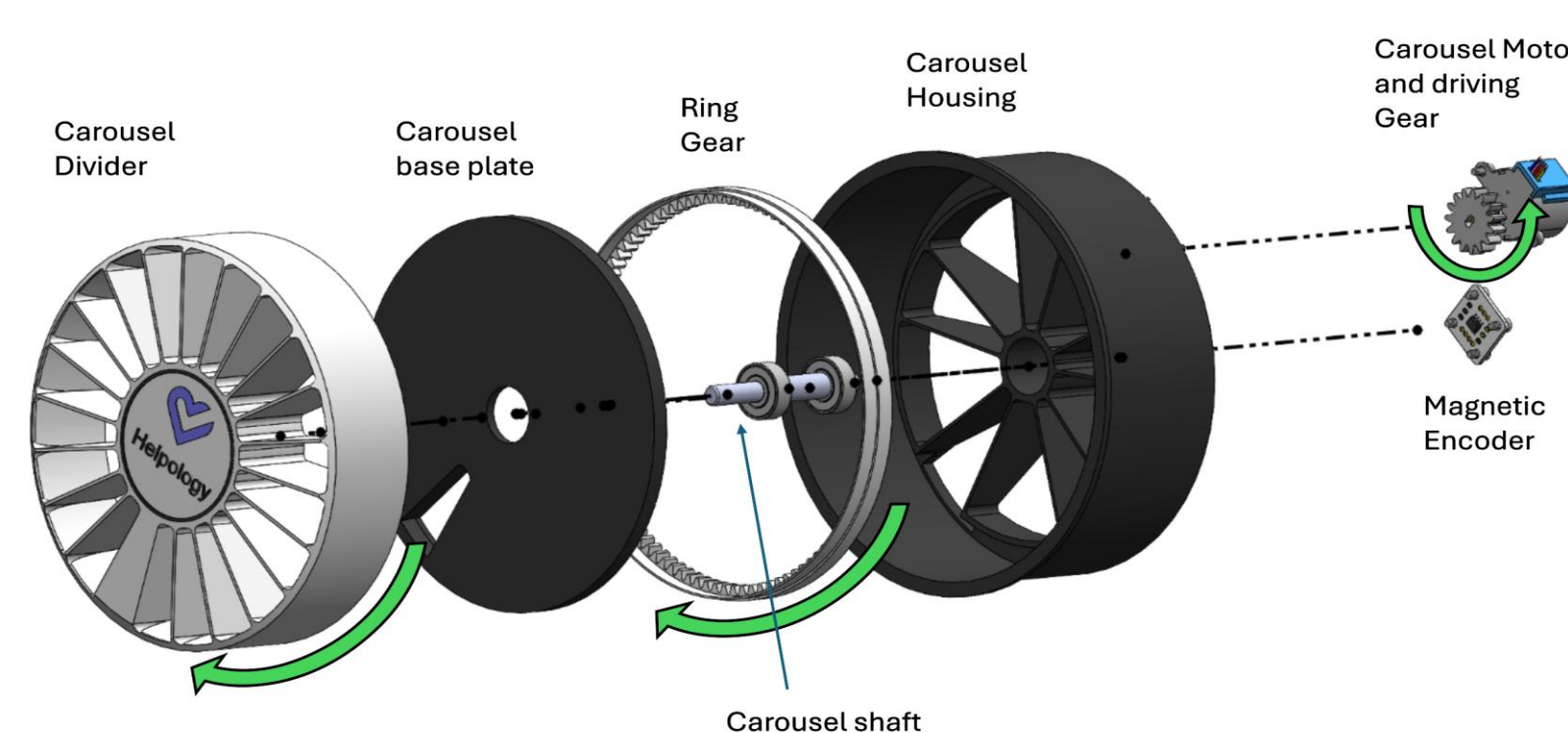


Figure 4. Carousel design

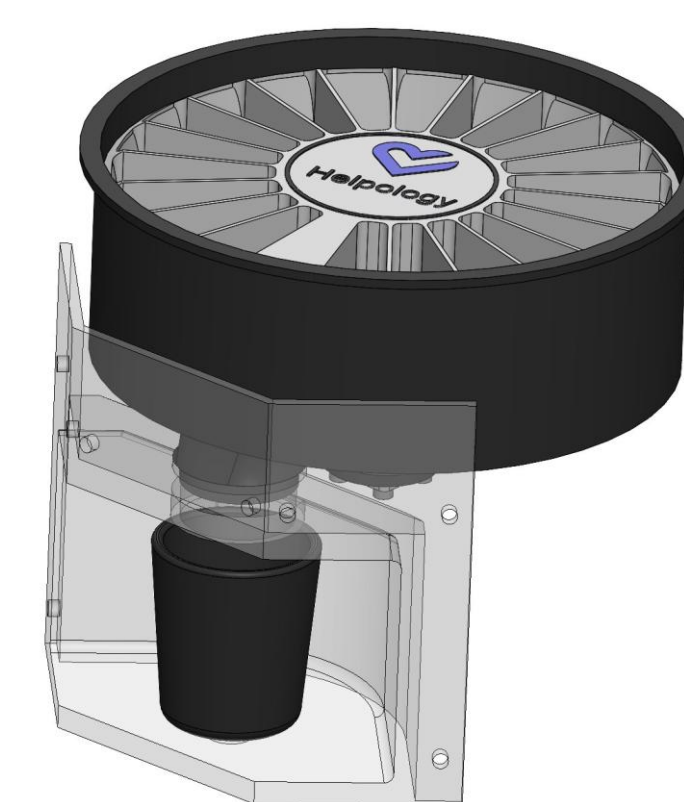


Figure 5. Catch area design

To reduce the cooling requirements, the size of the door compartments were reduced and a CFD simulation was run using a recirculating system showing that the box was capable of reaching the desired temperatures. During physical testing, the compartment was able to reach 7.5° Celsius within an hour of run time.

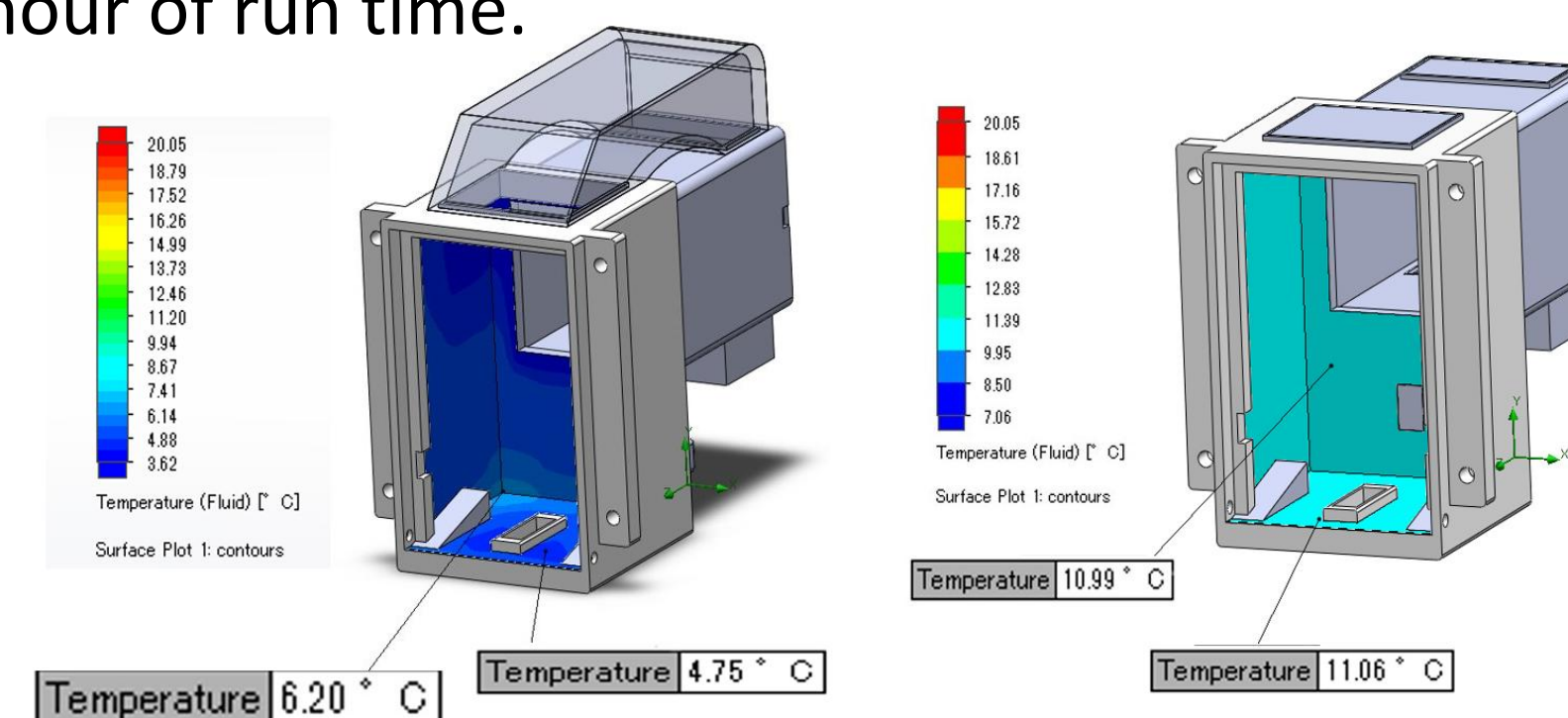


Figure 6. SolidWorks Flow Simulation

Improvements

A linear voltage regulator was added to prevent voltage spikes that could fry components. Diodes were added to the relays controlling the solenoids to ensure no back emf was produced. An RTC was installed to maintain the proper time when no wifi connection is available.



Figure 7. Current Physical Design

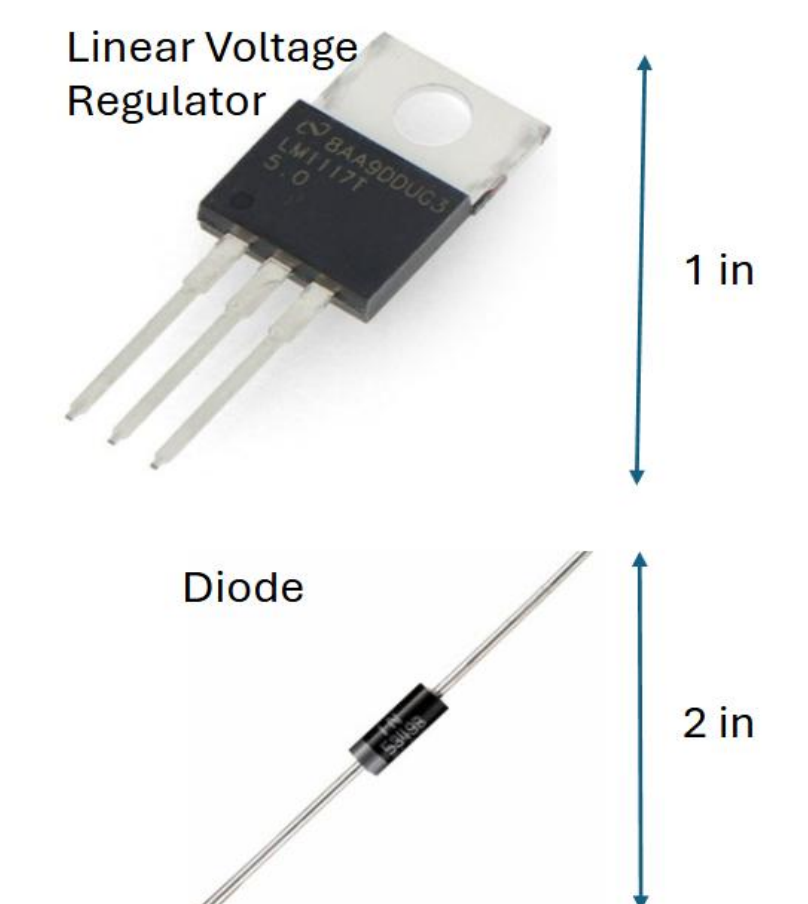


Figure 8. Added Electrical components

The U.I. was created with the patient and caretaker in mind making sure to have the text and touchscreen be large and easy to read, touch, and understand. The main goal was for the input process to be intuitive for the caretaker and the information displayed important for the patient.

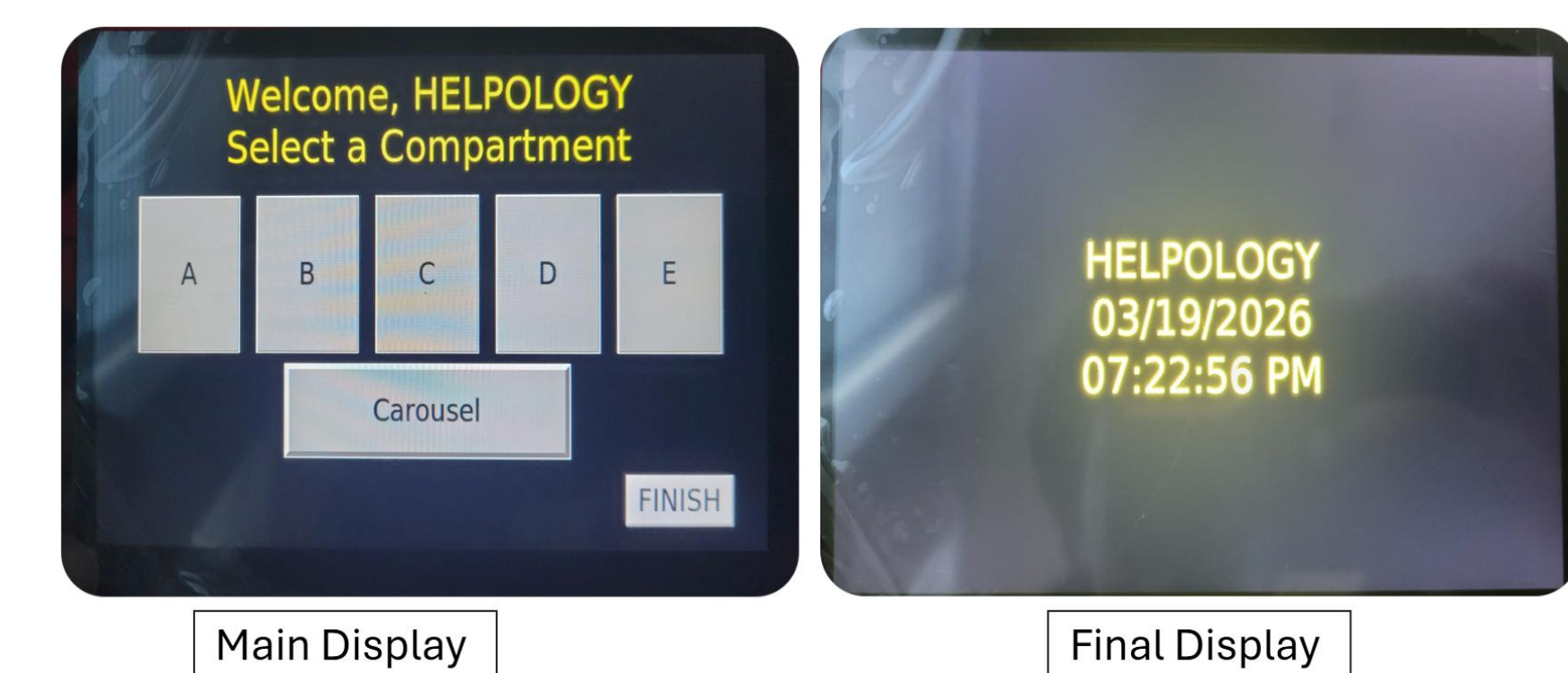


Figure 9. Touchscreen User Interface

Conclusions

Various improvements in physical design, electrical wiring, and programming have enabled the medicine dispenser to be a standalone device fit to provide medicine to patients with various challenges.

The team would like to acknowledge out Faculty Advisor Dr. Raul Fernandez, our Sponsor Ms. Minhchau Le, and our Electronics and Cooling Advisor Dr. Thomas Allsup

References

1. Le, M. (2025). *Dispensing system* (U.S. Patent Application Publication No. US 2025/0082546 A1). U.S. Patent and Trademark Office.