



# Pill Popper Pro



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# Use Case



## Problem with Existing Methods:

- No way to easily verify if a daily pill was taken at the correct time or quantity
- Insecure access for unintended users
- Often inaccessible for individuals with poor hand mobility
- No easy prompting for the patient to know when to seek a refill of the prescription
- General disorganization due to multiple separate bottles

## Solution: Automated pill dispenser with a connected app

- Pill Popper Pro allows users to easily enter their daily pills and dispense them
- App records whenever a user takes their medication and alerts them when a refill is due

**ECE Areas:** Web-App Development, Embedded Systems, Robotics, Control Systems, and Signal Processing

# Use Case Requirements

Requirement	Metric	Justification
Correct pill dispensed	100% of the time	Ensures patients receive the right medication at the correct time to prevent adverse effects
Correct dose dispensed	100% of the time	Ensures correct number of pills per dose based on the prescription to prevent overdose or underdose
No. of compartments	6	Based on medication intake statistics, ensuring sufficient storage for the average elderly patient (5+ medications)
Pills per compartment	±30 pills	Reduces refill frequency, ensuring a 30-day supply for most prescriptions
Notification timing	<60s of scheduled time	Ensures timely medication reminders, but allows for user mobility
Dispensing delay	<10s of user activation	Users should quickly access medication once near the device
Pill dimensions	1mm-22mm	Considers size of most standard prescription pills

# Use Case Requirements - Considerations



- Safety and cleanliness of the device
  - Compartments use medical grade plastic, removable pill tray that can be cleaned, covering to prevent tampering
- Ensure timely consumption of medication
  - Use weight sensors to track dispensing of the pill and the user consumption of pill
- Tracking timely consumption when user is mobile
  - Since the device is not portable, if the user is not near the device, there will be a notification sent 10 minutes after scheduled time
- Preventing incorrect dosage
  - Dispensing activated by the user, user would need to approve the dispensing of medication

# Technical Challenges and Risk Mitigation



Technical Challenge	Risk Mitigation
Unexpected complications	Extra time built into the schedule
Dispensing the correct medication with the correct dosage at the correct time	Pivot to 7 daily containers, rather than 6 pill compartments
Detecting the correct dosage with the weight sensors	Pivot to 7 daily containers, rather than 6 pill compartments
UI works properly across all devices	Adjusting and testing UI viewport via web browser
Dispensing the pill at the correct time, specified by the web app's release button	Testing how component pairs work together before integrating the entire system

# Solution Approach

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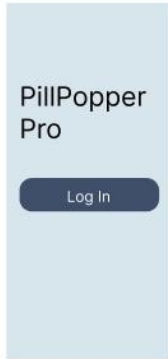
How technologies will be used to meet the Software Design Requirements:

- Creating the Basic Web application page structure and basic functionality.
  - HTML, Javascript, Django
- Styling the Web application
  - React and CSS
- Account Management
  - mySQL and OAuth
- Databases for Pill information
  - mySQL
- Reminder System
  - Javascript
- Web Application deployment
  - AWS EC2

The MySQL logo, featuring the word "MySQL" in a blue and orange font with a trademark symbol.The AWS logo, featuring the word "aws" in a dark blue font with a yellow arrow underneath.

# Solution Approach

log In



iPhone 1...



Dispense



Pill Tracker



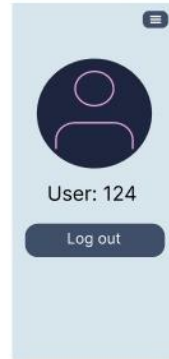
Pill Box



Add new ...

The "Add a New Pill to Slot three" screen includes three input fields: "Pill Name", "Quantity", and "Times Taken Daily". At the bottom is a dark blue button labeled "Add Pill".

Account



# Solution Approach



## Processing & Control

Raspberry Pi 4 Model B

- Receives dispense commands from web app
- Controls servo motors and sensors

## Dispensing Mechanism

MG996R Servo Motor

- Rotate the gate to release the pill

Medical Grade Plastic Storage Compartments

- Store and refill pills

Rotating Disc/Gate

- Allows for pills to release when dispensed

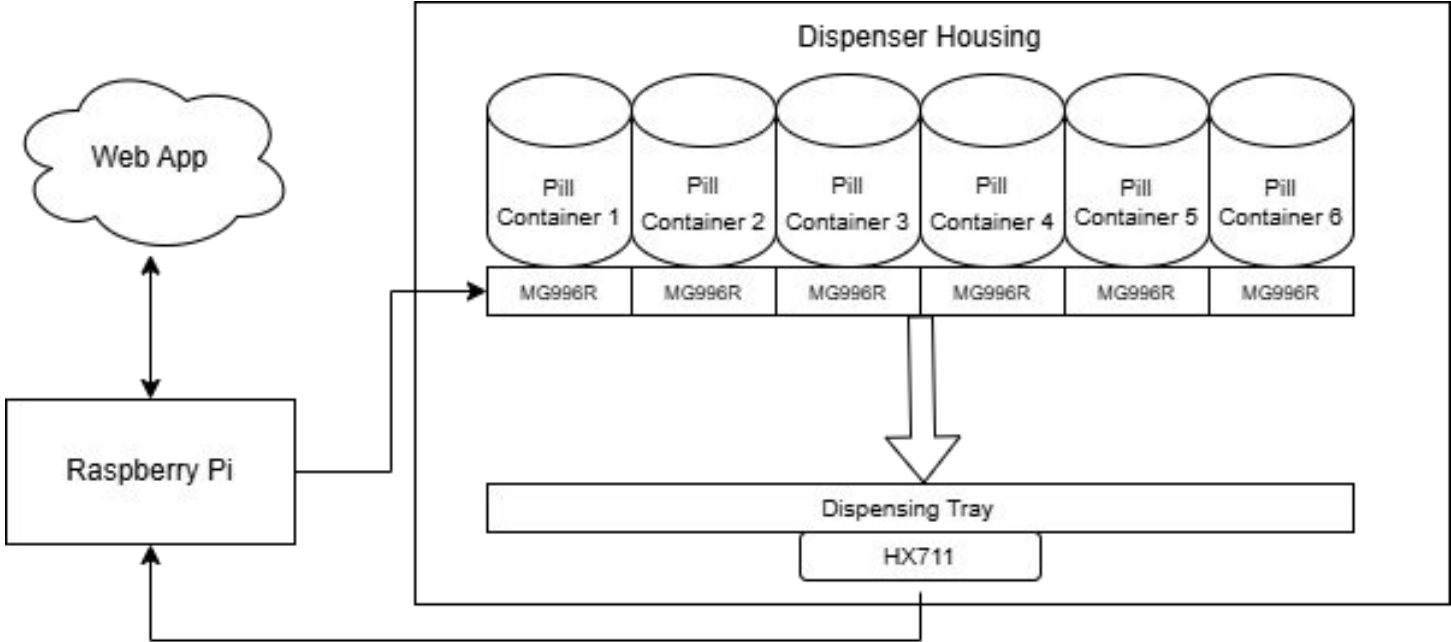
## Verification & Tracking

HX711 & Load Cell

- Precision weight sensor to detect pill dispensing/user consumption



# High-Level Diagram



# Testing Verification Metrics



Requirement	Method	Target
Correct Pill + Correct Dosage + Correct Time	Repeatedly dispense a specific pill and dosage	100% success rate across all trials
Adaptable UI	Adjust web browser viewport to specific phone model dimensions	Complete all web app tasks successfully with accurate displays
Product Ease-of-Use	Simulating limited hand mobility with tape and opening the device	Average ease-of-use score of $\geq 3.5$ , given 1 is unable to complete and 5 is complete with no discomfort
Connectivity between Devices	Unit test across pairs of components	Motors moving at specified intervals, receiving "Hello World", etc.
Weight sensors	Weighing each pill, in 4 different dosages, 19 times	Distinct weight ranges among the different dosages

# Tasks and Division of Labor



Taylor	MM	Aneesha
<p>Github Creation/organization, App Config: Home screen, Pillbox, Pill-form, Pill dispenser, Interactive App Style possibly using React, App Config: Login, Pill tracker, account, MySQL database creation for user accounts, OAuth for user accounts addition, EC2 deployment and domain registration, Pill box/pill info testing/fixing, and Screen size testing/fixing.</p>	<p>Device bluetooth connection for dispensing and weight verifying, Install weight sensor physically, MySQL database creation for pill information, Form Creation - Django for pill information, Pill notification at time, Pill refill notification, Notification testing/fixing, Cross account testing, and Other software testing/fixing.</p>	<p>Hardware Schematic/design w/ all parts and order components, Build Pill device holder and dispenser, Dispensing pill code, Pill dispensing weight verification code, Pill Box dashboard updating, Pill tracking dashboard, Dispensing testing/fixing, Dashboard testing, and Other Hardware testing/fixing.</p>

# Gantt Chart

