

Medicine Dispenser Design Review 0

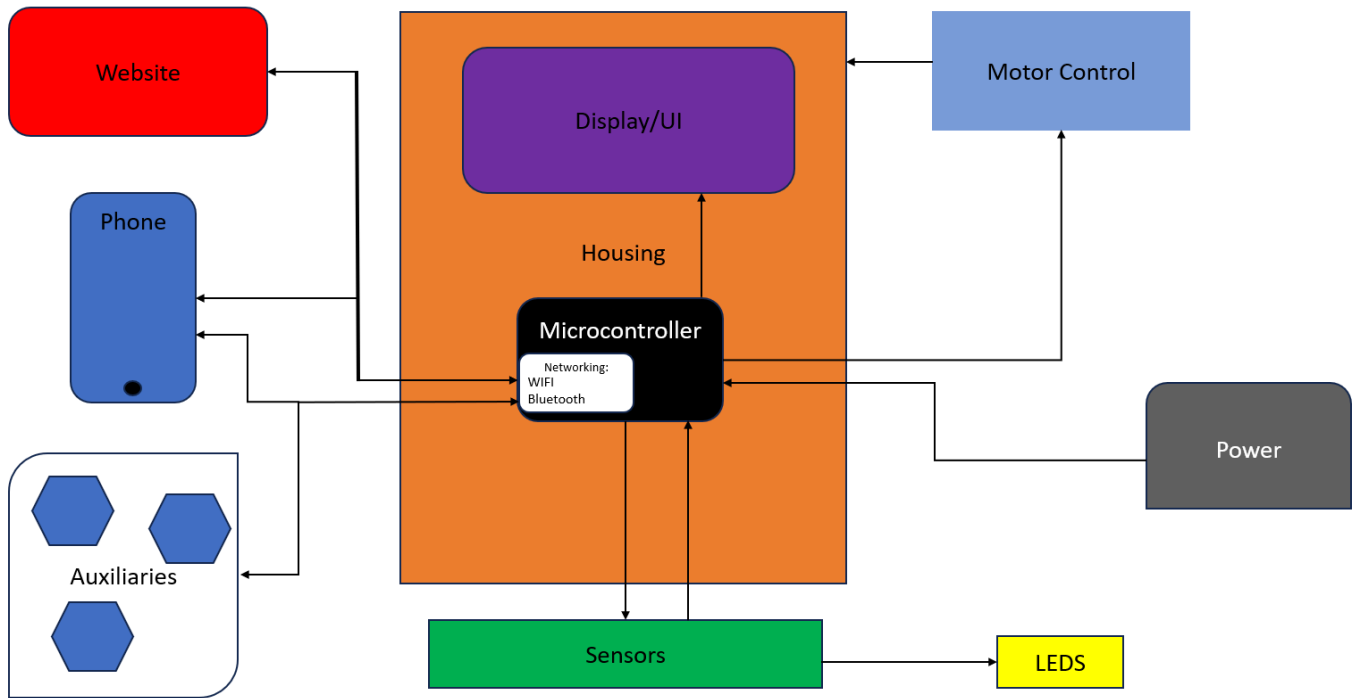
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January 22, 2024

System Block Diagram



Subsystem Requirements

Housing

The housing system will include several CAD components. A funnel wide enough that all three conveyor belts tip over into it. The tube or slide at the bottom of the funnel will need to be smooth to prevent pills being stuck in place. The housing of the medications will have a way to manage the wires inside the containers. Another part of the housing system is the motors that will control the conveyor belts. These motors will be controlled so that only the desired boxes get tipped over while dispensing the medication. Also, the housing subsystem will need to ensure the timely delivery of medications. To accomplish this task, this system needs to have constant power. The housing subsystem will work toward the accomplishment of the following general product requirements:

- Dispense Medicine On Time
- Constant Power

This subsystem will likely take several iterations to determine the best design for consistent and timely medicine delivery. It will also require the ordering of motor parts which are readily available on multiple sites.

Network

The network subsystem provides connectivity from the microcontroller to other components. This subsystem incorporates an interface designed specifically for prescription-related interactions. It provides input and reminder overrides, prompting users to modify and customize

their prescription details as needed. Users also have the ability to adjust basic settings, ensuring a personalized experience tailored to their medical needs. The system further supports multiple repetitive reminder functions, ensuring that users receive timely notifications for medication intake. Additionally, the subsystem is equipped to dispense medicine on time, enhancing adherence to prescribed schedules. Also, the network subsystem will assist with the display of comprehensive drug information at the time of medicine intake, providing users with essential details about their medications. Importantly, the network subsystem ensures the timely conclusion of reminders following medicine intake, contributing to a seamless and effective prescription management experience. This subsystem will aid in achieving all general system requirements as it creates the connectivity between all parts of the system. The current testing can be done with the ESP32-C3's bluetooth capabilities.

Auxiliaries

This subsystem integrates light (LED) to serve as a visual indicator for repetitive reminders. The use of LEDs allows for clear and noticeable signals, ensuring that users receive timely and distinct notifications for recurring reminders associated with medication intake. Simultaneously, audio elements, presented by bluetooth speakers, enhance the reminder system's effectiveness. The speaker produces audible alerts that reinforce the visual cues provided by the LED indicators, catering to users with varying preferences. Furthermore, Computer-Aided Design (CAD) proves instrumental in optimizing the placement of these auxiliary components, ensuring an efficient and cohesive system for delivering multiple repetitive reminders. This subsystem will complete the following general product requirements:

- Multiple Repetitive Reminder Functions

This subsystem will require ordering LEDs and a speaker component both of which are readily available through multiple sites.

Website

This subsystem will be required to take in the medical data and settings preferences from the patient or their caretaker. The website will also be required to have some level of security so non-authorized individuals cannot access it. The subsystem will be required to have an option to override the reminders. The subsystem will be required to connect to the internet to be able to connect to the microcontroller. In achieving these requirements, the subsystem will complete the following overall product requirements:

- User Interface for Prescription Input and Reminder Overrides
- Ability to Adjust Basic Settings including Prescriptions

This subsystem will not require any components to be ordered and will primarily be web design based.

Sensing and Controls

The sensing and controls subsystem will primarily contain the inputs and outputs on the main housing element. This will include a pad sensor and the LED display. The largest component of this subsystem will be determining which sensor is best suited to determine if the medicine is in the tray or not. Some current considerations include an image sensor, IR sensor, or laser beam break sensor. The main requirements of this subsystem are to accurately determine if there is

medicine in the tray or not and display information regarding the medicine to be taken. This subsystem will directly work to complete the following general product requirements:

- Show Drug Reminder Information at Time of Medicine Intake
- Timely End of Reminders Following Medicine Intake

This subsystem will require components to be ordered. Primarily a 4-5” LED screen with SPI capabilities of which multiple models seem to be in stock and can be shipped immediately as well as sensors including: an IR sensor, an image sensor, and a laser beam break sensor. There also appear to be multiple options of in-stock sensors for each of the sensor types.

Plan of Action

- Week of January 22nd – Design Review 0
 - Pick and order necessary components
 - Housing subsystem: Create sketch of housing
 - Network subsystem: Research networking within embedded systems
 - Auxiliary subsystem: Research available bluetooth speakers and select displays
 - Website subsystem: Plan and create outline of website, identifying components and user flow
 - Sensing and Controls subsystem: Determine which IR, camera, laser break, LED screen and find test code for each component
- Week of January 29th
 - Housing subsystem: Detail sketch with dimensions to work off of in CAD
 - Network subsystem: Begin bluetooth programming and look into WiFi
 - Auxiliary subsystem: Determine connectivity for bluetooth speakers and display. Research code to play speech audio and display text on the display
 - Website subsystem: Start building user interface and implement basic settings UI
 - Sensing and Controls subsystem: Compile connections (including power, ground, decoupling, and other essential supports with values) and write up sensor and control subsystem components
- Week of February 5th – Update meeting
 - Housing subsystem: Begin CAD of housing. If motors have arrived characterizing for the conveyor belts
 - Network subsystem: Continue programming for bluetooth and WiFi
 - Auxiliary subsystem: Test code to see if it produces the correct audio and visual for the reminders
 - Website subsystem: Begin React components for inputs and basic settings
 - Sensing and Controls subsystem: Get all the sensors and the LED screen working with basic code
- Week of February 12th
 - Housing subsystem: 3D print medicine boxes and decide how to mount them and how to connect the motors
 - Network subsystem: Finish programming and test

- Auxiliary subsystem: Continue testing and debugging
- Website subsystem: Integrate backend for storing the data as well as user authentication
- Sensing and Controls subsystem: Finish test code and begin tests to see accuracy of recognizing if small pills are in the area
- Week of February 19th – Design Review 1
 - Housing subsystem: Continue CAD of housing
 - Network subsystem: Debug and test
 - Auxiliary subsystem: Continue to test and debug
 - Website subsystem: Continue backend integration and security testing
 - Sensing and Controls subsystem: Continue to characterize sensors and determine which is best for recognizing pills
- Week of February 26th
 - Housing subsystem: Connect conveyor belt to the motor for control of medication dispensing
 - Network subsystem: Add features
 - Auxiliary subsystem: Continue testing and debugging
 - Website subsystem: Set up a deployment strategy to be able to showcase
 - Sensing and Controls subsystem: Finalize which sensor or combination of sensors will be best for sensing pills
- Week of March 4th – Design Review 2
 - Housing subsystem: Activate motor to show the dispensing of medicine from the conveyor belt
 - Network subsystem: Demonstrate that the board will be able to connect to bluetooth and WiFi
 - Auxiliary subsystem: Show that audio clip of words can be played by speakers and visual display works
 - Website subsystem: Demonstrate website for medication information input allows for input of information
 - Sensing and Controls subsystem: Demonstrate that the sensor can sense the presence or absence of medications.