Automated Pill Dispenser (Pillsnap)

ECE445 Project Proposal-Spring 2020

Team 66

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1. Introduction

- ## 1.1 Background

  Taking medications as instructed and punctually can be a hard task for patients who need many kinds of medicine, especially for senior people with memory problems. According to the National Survey on Drug Use and Health, most of the people in America took the drugs as prescribed, but 19 million people misuse their drugs. They often get drugs from their friends or relatives and took more than their doctor had prescribed [1]. Given the number of different types of medicine, it is often difficult and troublesome for the patients to keep track of the correct dose and consumption time for each type. It is also very common that many old people need notifications to remind them of taking the pills.
  There are some companies trying to build the pill dispenser to solve this problem and make profits. However, it costs a lot of money and many people might not be able to afford that. For instance, The Hero Health Pill Dispenser is one of the most popular products on the market, but it sells for $99.99 and a membership fee (including app and some other services) $29.99 per month.
  We will try our best to lower the cost as much as possible. At least, we want our app services to be free for all the users since people are likely to prefer the free software services that come with the devices they buy.

- ## 1.2 Objective

  We want to design an automatic pill dispenser that can alert the user to take medicine on time and automatically dispense the correct type and dose of the pills. It will also show the instructions for those pills on a screen. To make the dispenser user-friendly, we plan to develop a mobile application for registering/keeping the information of the medicines and setting dose and consumption time. It can also send notification to the user at the set time. Ideally there will be different profiles for different users for easier family usage. The goal of this pill dispenser is to make it more convenient for people who need to take different kinds of medicine regularly without memorizing the exact dose and consumption.

- ## 1.3 High-level Requirements List

  - Be able to provide 3.8V, 5V(+/-5%) voltage for motors in the mechanical system.
  - Be able to keep track of the correct mapping among pills, chambers and dispensing information. Can send correct dispensing signals.
  - User should be able to setup the dispenser and register medicine information through the mobile app.

2. Design

- ## 2.1 Block Diagram
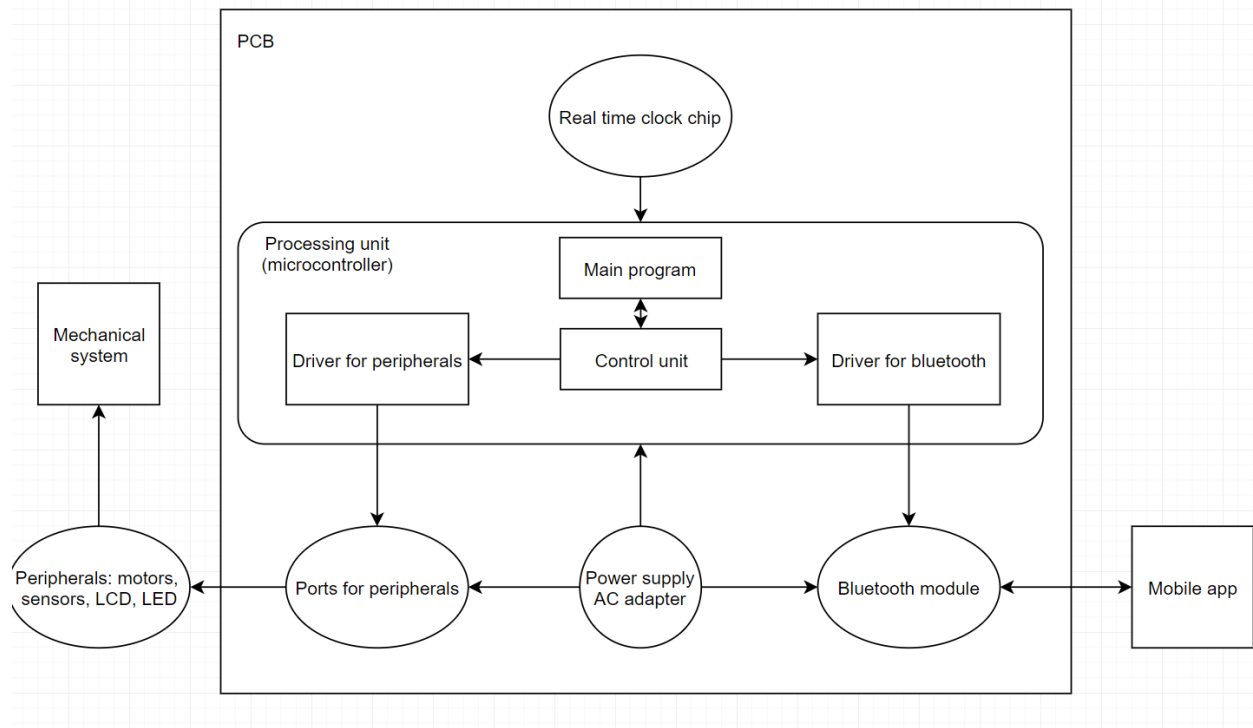
- ## 2.2 Physical Design
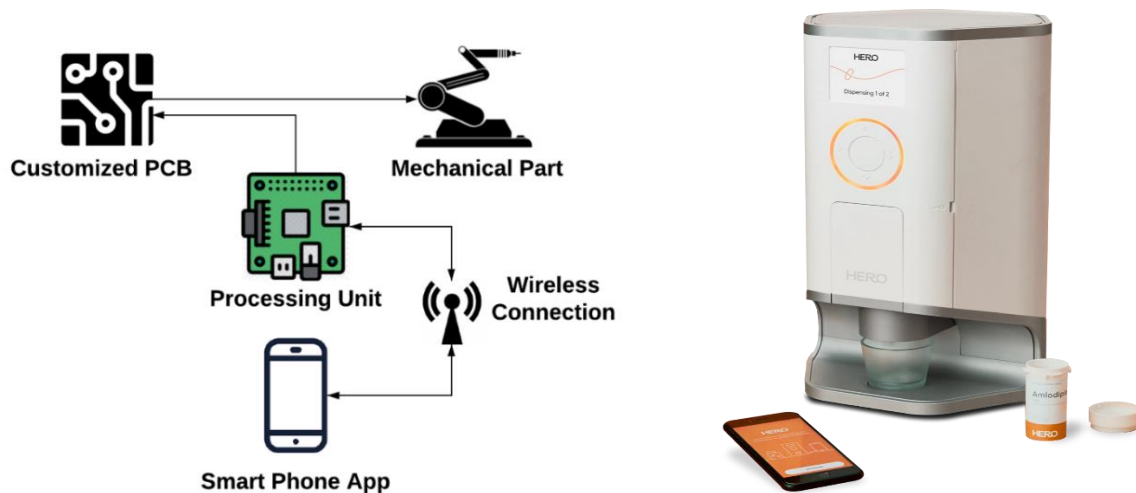
- ## 2.3 Functional Overview

Application for Phone – The app is used to set the medicine-related problem for the user and notify the user when the medicine time is up. This part contributes to the whole project as a main incentive to make the machine useful. It will output the dosing information to the processing unit and receive alert information from it to generate notification.

Processing Unit – The unit is used to control all the other parts of the system. It is the central part for the project since it will interact with the mechanical machine and the smart phone application. As set by the user, the unit will trigger the control signals for the mechanical part and send a notification to the smart phone app via wireless module.

Control System – This is a customized PCB. It acts as a bridge between the electronics and the mechanical part. It will generate control signals for the mechanical part according to the Processing Unit.

- ## 2.4 Block Requirements

  - ### Application for Phone
    The app is the key to inform the user of any update or status. Our current plan is to build an iOS app connected via Bluetooth/Wifi protocols. The user will have to set the dosing information through the app. Then the message will get transmitted to our processing unit via wireless protocols. Besides, the app will also listen from our processing unit for any update of pill dispensing or notification.
    Requirement:
    > 1. The app should be able to display notification with the correct dosing information at the right time.
    > 2. The app should be able to set user's profile including dosing information, pill kinds and etc.

  - ### Processing Unit
    The processing unit consists of three parts: main program, control unit and driver unit. The main program will run the user's setting. When it's time to take the medicine, the main program will send a signal to the control unit with relevant dosing information in order for the mechanical part to work (control unit's details need further specification by ME team). The driver unit will also receive the dosing information from the main program so that it will send a notification to the smart phone app via wireless module. Moreover, the driver unit is responsible for driving other peripherals such as LCD display.
    Requirement:
    1. The processing unit should be able to generate correct and sufficient control signal at the right time.
    2. The processing unit should be able to send information to the smart phone app and receive setting information from it.

3. The processing unit should be able to drive possible peripherals such as LCD display (specific elements pending on design by ME team).

- Control System

  The control system (customized PCB) will get the signals from the processing unit so that it could generate analog signals based on the inputs. Then it could power the mechanical parts with the needed voltage. The pin quantities for 5V and 3.8V respectively are unknown for now (other details waiting for ME team to confirm).
  Requirement:

  1. The control system should be able to drive the mechanical part with its 5V/3.8V output from its power supply (waiting for ME team to confirm).

- **2.5 Risk Analysis**

  The control system is a very important risk to the accomplishment of our project. It controls the mechanical units of the components. Since we do not have experience with PCB before, the design might take us a lot of time to debug the circuits.

  Besides, the interface with mechanical engineering is also very significant to our project and that could also be a potential risk. Our control unit and logic rely on their final design and dispensing mechanism. We will try our best to communicate with their team and figure out how to integrate each part together, in order to make the whole system work.

3 Ethics and Safety

There might be some potential safety problems with our projects. If the pill dispenser doesn't give pills at the proper time, it could be detrimental. Besides, little children might also find this device very interesting. They might take the pills as sugar and that could possibly have a negative effect on their health.

If this dispenser is exposed in a moist room, that will cause damage to the circuits. In order to avoid this, we need to tell the user to keep this device in dry area.

We thoroughly went over the 10 ethics mentioned on the IEEE Code of Ethics and we firmly believe that we will obey the rules of these ethics.

1. "to hold paramount the safety, health, and welfare of the public, to strive to comply with ethical design and sustainable development practices, and to disclose promptly factors that might endanger the public or the environment;" [2]
   - Our project will not affect the safety of the public. It uses electricity as its main power supply, so it will not have a negative effect on the environment.
2. "to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;" [2]
   - Our project will not have conflict of interest and even if the conflict exists, we will inform the affected parties.

References

[1] Harris, Richard. "Federal Survey Finds 119 Million Americans Use Prescription Drugs." NPR, NPR, 8 Sept. 2016, www.npr.org/2016/09/08/493157917/federal-survey-finds-119-million-americans-use-prescription-drugs.

[2] Ieee.org, "IEEE IEEE Code of Ethics", 2016. [Online]. Available: http://www.ieee.org/about/corporate/governance/p7-8.html. [Accessed: 29- Feb- 2016].