Adverse Drug Reaction Reduction and Medication Tracking System

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***Abstract* --- This paper presents an adverse drug warning and medication dispensing system. The design of this system includes a pill box capable of storing and displaying patient-specific ADR information and warnings. The system is also capable of alerting the user when medications are to be taken through audible and visible displays.**

***Index Terms* -- Adverse Drug Reaction (ADR), Drug Regimen Tracking System, Medication Dispensing Unit, Portable Medical Device.**

I. Introduction

There is currently a need for an adverse drug reaction reduction tracking system. Adverse drug reactions occur as a result of interactions between medications, dietary supplements or food and beverage products. The new system design must; (1) alert users to possible ADR's, (2) hold and dispense medications at appropriate times, (3) allow easy access to the patients current drug regimen (4) be easily updated with the most current medication information. The need for such a device exists because there is currently nothing as described above on the market. The devices that do exist are used exclusively for dispensing medications and there are no ADR warning systems currently in place. Our system design combines the ADR warning system and medication dispenser into one compact unit. The warning system can potentially avoid many illnesses and even deaths due to ADR's. When designing the system there were several concerns that arose during the design process. Since the majority of the consumers using the product will be elderly, ease of use and overall weight were two major factors for consideration. We minimized the total weight of the device by reducing the number of components and opting to use a light-weight but durable construction material. Designing a system that is easy to use, involved programming the software so that user input would be minimized. A simplified prototype of this design will be displayed and presented on April 2, 2007 It will include a pill box with LED's and a speaker to alert the user to take medication. The prototype will simulate a medication dispenser and prompt for appropriate user interaction.

II. Conceptual Design/Methodology

A. Overall Design

Our final design includes a rectangular prism with twelve medication compartments. These compartments are constructed from clear plastic to allow the user to identify when a refill is needed. Each compartment has a green LED that illuminates when the user is to take medication from that section. An audible warning from an onboard speaker is also used to alert that user at the prescribed times. There is an angled liquid crystal display located at the top of the device that displays patient specific medication information and allows for user interaction with the use of push buttons. When new medications are prescribed, the device can be updated through a USB module. Power is provided through a rechargeable battery cell which allows for portability.

B. Major Components

The interaction of the components can be seen in Figure 1 below.

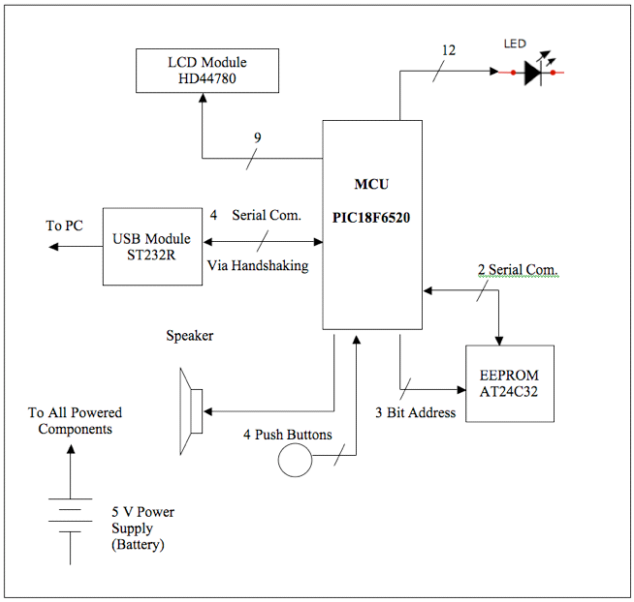

Figure 1: Component Interaction

III. Detailed Design

A. PIC18F6520 MCU

The microcontroller unit (MCU) handles the times and dosages. It notifies the user when medication is to be administered through the use of both visible and audible signals. The MCU also handles interaction and data transfer between the system components. This unit is a 64-pin microcontroller that allows for 32K of program memory, with 52 I/O ports, running at a maximum speed of 40 MHz [1]

B. ST232R USB Module

The universal serial bus module is used to connect the device to a computer for medication updating purposes. This module is an asynchronous serial data transfer interface that is capable of USB 2.0. [2]

C. AT24C32 EEPROM

Information on the medications is stored in the EEPROM. This includes their dosages, reaction with other medications, and reactions with common drugs and liquids. It is a serial EEPROM that uses a bidirectional serial transfer protocol, with 32K available organized as 256 pages of 32 bytes each. [3]

D. HD4470 LCD Module

A large 20x4 character LCD display was chosen, as it allows for more information to be displayed on the screen. This results in less scrolling with the up and down buttons to review information. The large screen can also be used to display more text, so the elderly users may easily read it. [4]

E. Plastic Casing

The pill box has a twelve compartment casing made of light-weight high density polyethylene which houses all hardware components. The dimensions of the casing are 27.5cm long, 12.35cm wide, and 3.6cm deep. [5]

F. Power Supply

The power supply is a lightweight 5000 mAH NiMH rechargeable cell. [6]

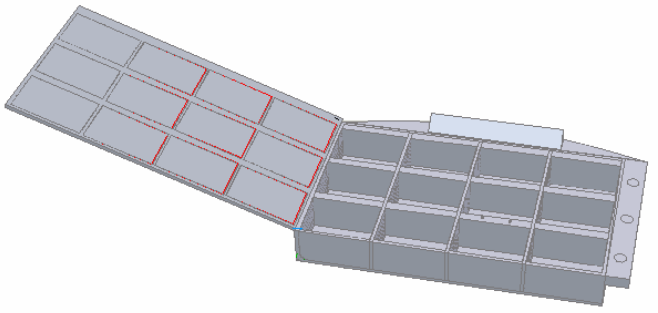

Figure 2: Physical Diagram of Pill Box

IV. Discussion

From the need for an ADR warning and medication dispensing system our pill-box design was formed. Based on the criteria outlined in the letter of requisition, a light-weight and user-friendly device was designed primarily for an elderly demographic. When designing a device it is important that the target demographic is considered. We learnt this through the design process by initially choosing a plastic based on strength and cost attributes and ignoring the material weight. Minor components not included in the initial budget produced higher overall cost than first anticipated. Organization and interfacing of the major components was time consuming and was not included in the preliminary design report. Recommendations for future warning and dispensing systems would include; review the database updating system and consider new technologies, base the MCU model on all other components.

V. Conclusion

By designing an ADR warning system, medication-related illnesses and deaths can be reduced and potentially eliminated. A light-weight, easy to use and cost effective device will allow users to manage their drug regimen without the concern for adverse drug reactions.

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