

EEL 4924 Electrical Engineering Design (Senior Design)

Project Abstract with Block Diagram(s)

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Project Name: **Medication Alarm Intuitive Dispenser**

Team Members:

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Project Abstract:

Our project is designed to assist elderly people in remembering to take their medication. The unit consists of several containers that contain one type of pill or a specified dosage of a pill. Several large buttons control a graphical LCD screen that allows the user to specify a time and a day for an alarm. Once the alarm time is set the user then clicks the buttons located in front of the containers to indicate which pills will drop at that alarm. The system also includes an RFID reader so that only specific people can open the machine to lead pills. Similarly, the RFID reader will also ensure that the correct person takes the pills. The unit also includes several sensors to confirm that the pills have been removed. Lastly, the dispenser is equipped with several selectable sounds for an alarm along with a volume control.

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Introduction:

Application Domain and Problem Description

In the modern world there are millions of Americans that take several medications daily. A 2004 Survey indicated that more than 40% of Americans take at least one prescription drug and 17% take three or more(1). Another set of data shows that 80% of people over the age of 75 take at least one medication and that 36% of this age group will take up to four medications daily (2). The most significant problem preventing the treating of illness is simply remembering to take the medication. In order for a prescription and over-the-counter drugs to be effective they must be taken in compliance with the timing and dosage specified. It is not uncommon for elderly people to have difficulty remembering which medicine is for which particular ailment or even to take any medication due to memory problems and depression which contribute to forgetfulness. A person is most likely to forget their medication on days when their schedule is hectic. There are serious consequences for forgetting to take medications. Some problems include a delayed recovery or even more severe symptoms. More than 80% of hospitalizations for adverse drug reactions in the elderly population are dose related (3).

Invention Proposal and Project Description

The problem presented is difficult, however, Seniors for Seniors has presented a comprehensive solution to medicine scheduling, the Medication Alarm Intuitive Dispenser (MAID). MAID is a pill dispenser with several features. It is designed to be one of the most reliable and cost effective means of adhering to strict pill timing intervals.

Project Features:

Simple, Easy-to-Use and Set Up

MAID is conveniently equipped with a easy setup, a standard **simple wall outlet** will suffice for power, there is no need to tinker and fiddle with difficult to insert batteries. The unit also features a user friendly interface with reactive **large buttons** for easy use. Furnished with a large **graphical LCD screen** it is simple to read text and interact.

Variety and Flexibility

MAID is able to hold up to **7 different types** of medications. Utilizing a simple interface an individual can set **several timers** for different days at different times and specify which pills to dispense at that time.

Secure and Accurate

MAID is secure and accurate. A easy to use **card reader** ensures that the qualified individual will be the only one granted access to load pills into the pill compartments. In addition, the card reader will also confirm the proper individual is there to receive the correct pills in the case that there is more than one machine.

Informative and Customizable

The main priority of the product is to alert an individual to take their pills. The system comes with an **alarm** and **several preset sounds** to use as the warning, allowing users to customize their medical schedule experience.

Reliable and Safe

Finally, to ensure that there is no interference with pets and other animal, in addition to the card reader, there is a dispense button that can only be operated by a person. Finally, intelligently included in the design is a sensor to **confirm** that the pills were removed from the pill dispensing area.

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Existing Market Situation:

There are several different market solutions available for an automated pill dispenser. On the market, however, there does not exist an **intuitive, easy -to-use** and **affordable** solution like MAID.

Med-e-lert Automatic Pill Dispenser 28 Day 7 Day 4 Times (4)



Price: **\$69.95 - 289.95 [Variant Designs]**

Comparison:

Key Product Features:

- Long Duration Alarm
- Pill Removal Detection
- Tamper Proof with lock
- Blinking lights
- 4 Pill dispenses a day

MAID does everything that the above mentioned product does. MAID is superior because it has several different alarms not one. Our product also has pill detection and is also tamper proof due to the easy to use RFID card reader. In addition, our product also ensures the correct person takes the right pills with their identity card. It allows for more than four different times per day if necessary. Finally, our product also includes large light up LED buttons and a huge graphical screen for easy set-up.

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The Electronic Medication Management Assistant: A virtual home pharmacy (5)

Price: \$744.95

Comparison:

Key Product Features:

- Blinking Light and Large Message
- Large Buttons
- Tamper Proof with lock
- Alert if Pills are Not Taken Sent (Monthly Service \$29.95)
- 6 Pill dispenses a day



Tamper Proof e-pill CompuMed Automatic Pill Dispenser (6)

Price: \$844.95

Comparison:

Key Product Features:

- Long Duration Alarm
- Pill Removal Detection
- Tamper Proof with lock
- Plastic Trays for easy loading
- 4 Pill dispenses a day for 1 week

The main concern with these pill dispenser options is that they are expensive. MAID will be a similar solution to these, but without the price. The CompuMed solution also only has 4 pill dispenses and only lasts for a week.

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Technical Objectives:

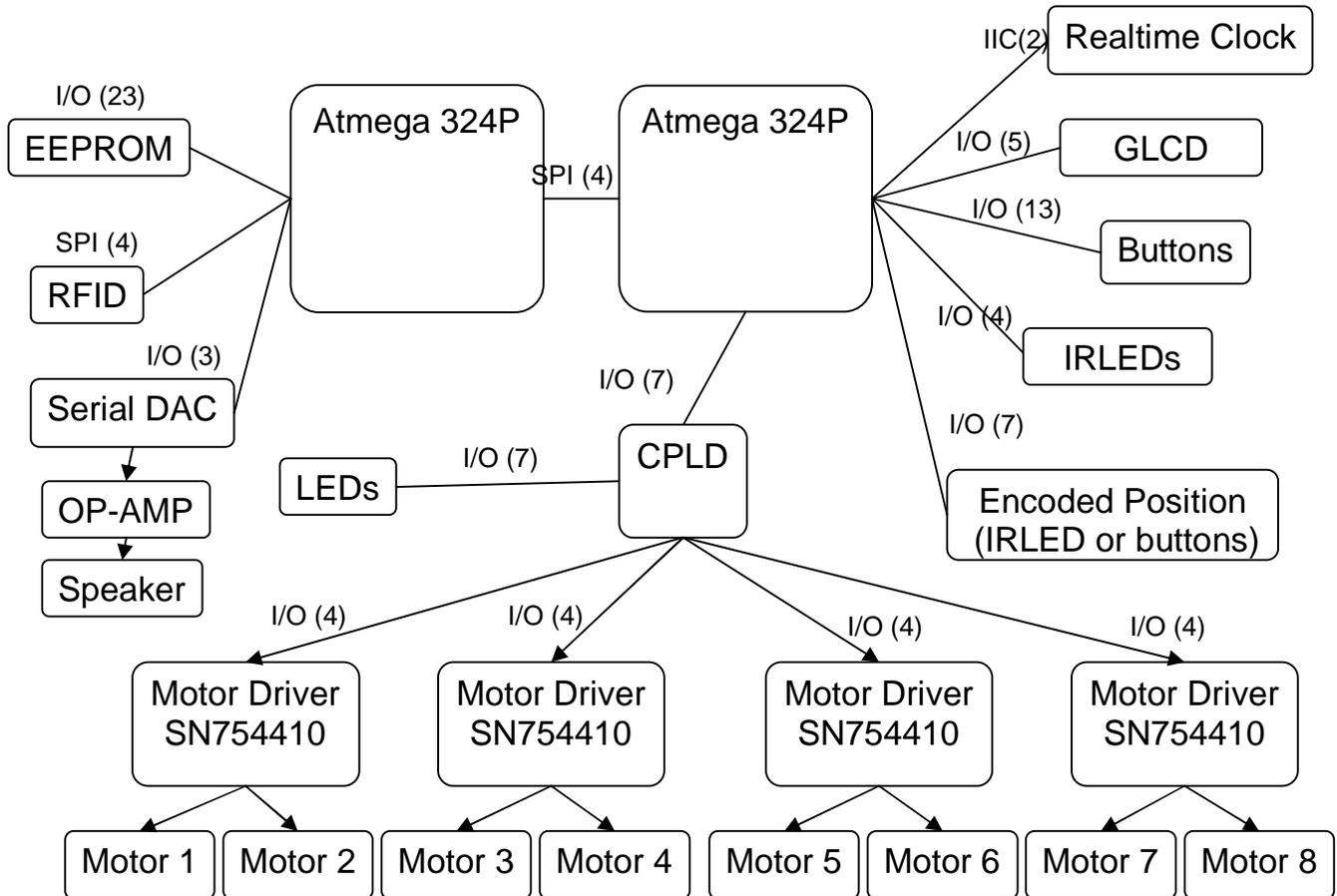
The main objective of our project is to design a system that can sound an alarm at a certain time and dispense the proper medication with RFID confirmation.

- One problem that will have to be resolved is making sure the device dispenses the proper amount. We will need some feedback through an optical encoder, limit switch or use stepper motors.
- The RFID reader will have to read a card and confirm that it is the correct person trying to receive the medication then send a signal to allow the medication to be dispensed.
- One of the Microcontrollers will be connected to a realtime clock and will have to send the appropriate signals to a CPLD and other microcontroller to drive the other peripherals.
- The CPLD will control the motors and handle the LEDs.

Table 1: Estimated Voltage and Current Requirements

Components	Voltage	Current (max)
Atmega324P	5V	.4mA
MSP430	3.3V	220uA
GLCD ST7565	3.3V	400uA
CPLD	5V	300mA
Realtime Clock DS1307	5V	1.5mA (Battery)
Serial DAC LTC1661	3.3V-5V	60uA
op-amp LM741	3.3V-5V	40mA
Quadruple Half-H Driver SN754410	5V	1.3A (Only one motor operates at a time)
RFID reader	5V	120mA
LEDS	5V	200mA (10 LEDs20mA each)
	Max Current	3A

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Cost Objectives:

Table 2: Estimated cost of electrical components

Components	Cost
RFID	\$30
GLCD ST7565	\$20
(2) Atmega324P (\$7)	\$14
(5) Quadruple Half-H Driver SN754410	\$10
CPLD (\$8.4)	~\$9
(13) Buttons	~\$5
(10) LEDS (\$.30)	~\$3
EEPROM	~\$3
Realtime Clock DS1307	~\$1
Serial DAC LTC1661	~\$1
op-amp LM741	~\$1

We expect the price of the electrical components to be about \$100 and the structural components to be under \$70.

References or Bibliography:

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- (1) <http://www.mapinc.org/drugnews/v04/n1730/a06.html>
- (2) http://www.netdoctor.co.uk/health_advice/facts/medicationelderly.htm
- (3) <http://www.livestrong.com/article/206756-about-the-elderly-forgetting-to-take-medications/>
- (4) <http://www.amazon.com/Med-lert-Automatic-Dispenser-Times/dp/tech-data/B002B51358>
- (5) http://www.lincme.net/features_medical.php
- (6) <http://www.cadexwatch.com/compumed.html>

Materials and Resources:

Our critical needs are the expensive listed electrical components.