Abstract — In this short paper we outline a newly developed system for adverse drug reactions. The purpose of this system is to alert users when to take their medication and to supply information about the drugs such as conflicts with other medications. The design consists of two devices; a stationary device and a portable device. The stationary device updates information and refills the inventory of portable device. Several iterations of the design process were necessary to achieve the best results for the system. A software simulation of the design was used to test whether the functionality met the requirements and to develop the algorithm for testing drug interactions. After extensive testing of the limitations and restrictions to place on our design, the end result seems to be fairly promising and should achieve its goals with relative ease.

Index Terms -- Data Management, Alarm Systems, Drugs, Tracking

I. INTRODUCTION

A common problem with medication is adverse drug reactions between them. Often people take several different medications at the same time without knowing if there are any harmful interactions. Since medication intake is common among the elderly, our design centered to accommodate the elderly. Several concerns were raised with the design of the device it must be simple to use and visual clarity is necessary for the visually challenged. The device must also carry personal information of the patient so specialists may view it at proper times such as emergencies. As for accessibility the system will also carry and dispense the proper drugs at the preset time. In order for this system to be used properly we assume the user to have some knowledge of modern technology and certain physical capabilities to operate the device. It is also assumed that users do not take irregular shaped or size pills; standard shapes such as spheres, circular or ovals are used to develop the design.

Possible solutions for this issue also exist, which the bases of our design are built. Weekly pillboxes are often used to keep track of pills on a daily bases. Prescheduled alerting devices are used to alert the patient when it is time to take their medication. Our design is basically a combination of these two designs where the device will store and dispense the drugs at appropriate times. Additional functions are also implemented such as, cross drug interactions, dietary interactions, user's personal information and medical history.[2] Most processes are done automatically which makes this design very efficient for everyone. Three basic designs were developed during our early design stages.

Once the final design was chosen we began to design the multiple functionalities that would be implemented into the system. Once all necessary functionalities were set, designing of the physical device and its components began. The components used were chosen based on cost, functionality and efficiency of the part. Testing will also begin at this stage. Since a prototype has not yet been made a simulation of the software will become the milestone for this project. The software will consist of user interaction with the device; such as, selecting alert times, alert tones and displaying appropriate information.[1] Certain drug interactions will be presented as well to show that this device will detect harmful interactions.

II. CONCEPTUAL DESIGN/METHODOLOGY

A. Overall Design

Our design includes two hardware components; docking station and the mobile device.

As for the mobile device, its objective is to be portable and alert users about their prescribed drug schedules and dispense medication accordingly. The docking station is a stationary device that stores medication and manages the automated medication insertion to the mobile device.

The docking station also has a barcode reader to identify the medication that users are taking.[3] Once the computer identifies that medication, it will open the gate for that individual storage compartment and the users can manually insert that medication into the docking station.[4] For the portable device, an alert will be on when it is time for the users to take their medication. Users can press the dispense button and the dispensed pill will then slide into a small slot in the device, allowing the patient to open the cover to retrieve it.

B. Major Components

The system has several few major components: misidentification of medication process, automated medication insertion, drug interaction, storage component, and the dispenser. In the
next section, detailed descriptions will be provided for each component.

III. DETAILED DESIGN

A. Medication Identification

To identify each prescription we use a barcode reader to identify the medication. The scanner works by scanning the barcode symbol and captures the bars and spaces of the barcode and sends it to the decoder where the data will be processed. There are various types of barcode readers, and our design uses a pen style barcode reader [3]. Pen style barcode readers are light and small, which fits one of our constraints for the design. Thus a pen style barcode reader is suitable for our design.

B. Automated Insertion

In order to make our design an automated medication insertion, our design needs to have a docking station and a mobile device. The docking station is a stationary device that stores the medication for the user. Manual medication insertion is required into the docking station. Once the mobile device attaches to the docking station, the docking station is responsible for managing the insertion of medication into the mobile device. The docking station will send a signal to the mobile device to open the correct gate for the storage compartment of the mobile device.[2] The identified pill will drop from the docking station into the mobile device one-by-one at a certain interval so that only one drug will be stored in each slot. Once the transaction is done, the gate for that individual storage compartment will close.

C. Software Interface

The software interface allows the user to change the settings of the device to suit their preference. It also allows users to set their own time schedule to when they prefer to take their medication as long as their set schedule corresponds properly with their prescription. When a harmful interaction comes about the software will detect the cross drug reaction and alert the user of the possible side effects [7].

D. Dispensing Method

The dispensing mechanism of the portable device is belt driven by a step motor. Each time a motor moves an increment enough motion is made to free a pill from the storage. The dispensing mechanism of the docking station uses the same belt drive on to allow a single pill to flow into the device, from a reservoir of pills evacuated from their storage.

E. Milestone

Our milestone consists of a software application solution for our design’s mobile device. The application is created by using Microsoft Excel and Visual Basic for Applications for the front-end and back-end of the software respectively. Ideally, there will be four visible tabs used to provide the patient’s information and allowing for input by the user. The first tab will be used to display the patient’s personal information should emergency situations present themselves. The second tab will be where the user manages their drug regimen. Drop down boxes will be provided for the user to select and choose which drug they are taking. The third tab is an extension of the second tab by listing all known adverse drug reactions to allow the user to see what foods or drugs should be avoided. Lastly, the fourth tab will be for managing the drug schedule. The drugs selected in second tab will be moved here and will show what times the medication will be taken. This part will also be flexible to the user, by giving them the option to pick and choose their own times to remind them of the pill intake.

IV. DISCUSSION

A. Error Analysis

During the process of designing this system we ran into many dead ends where a certain part of the design was not feasible. Many designs ended up being restructured due to limitations in our constraints. Major components such as cross drug identification, drug insertion and drug dispensing were underdeveloped during the preliminary stage.

During the design process some future add-on, were brainstormed. Many of these add-ons are said to be added in the future due to the time constraint on this project. Much functionality such as additional interfaces, GPS tracking system for emergencies and maybe implement ion of liquid form medication storage if necessary.

REFERENCES