



A Smartphone Enhanced Autonomous Pill Dispenser In Hospital

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Abstract-

Misuse of the medication among the elderly has become a big issue in healthcare industry. This idea is primarily for the convenience of the patients in the hospitals. Especially for those who have been prescribed several different medications at once, and for a prolonged duration of time. There is a chance of easily taking wrong medicine on same time or the caretaker may not give the medicines at scheduled time. Hence, to solve this issue, we develop a prototype model of pill dispenser equipped with an alarm system via smart phone notification, with the aim of a smart low-cost pill dispenser with ergonomic design especially to the patients in the hospital. The combination of a BDL motor, Arduino microcontroller and an android application to control the medication dose. An alarm system is implemented on the dispenser to give a notification to the patient and a notification is sent to the phone and even in that, till the pills are taken by the patient, alarm beeps on the phone continuously.

Keywords—Pill dispenser, medication misuse, microcontroller, alarm system, android application, motors, IR sensor, LCD display, Internet of Things .

I. INTRODUCTION

Patients being admitted in the hospital have to be provided with an appropriate medication to ensure a quick recovery. Usually in the hospitals it is the responsibility of the nurses or other caretakers to keep a tab on the medication of the patients according to the doctor's prescription. Elderly people or people with chronic diseases take numerous pills per day for their illness. Unfortunately, those who have been prescribed several different medications at once, and for a prolonged duration of time, they tend to forget to take their medicine on time, or they easily taking wrong medicine on same time. This may lead to bigger issue of medication misuse, especially among the elderly patients. It is very crucial for them to take the medication as per the prescribed dose and duration. As there is a possibility of forgetting to take the medication on time, nurses are entrusted with this task. To lessen the human intervention when there is no need of it and to reduce the medication errors, a pill dispenser is a good solution. The basic idea is to develop a pill dispenser which can automatically separate a pill from its similar lot and provide it to the patient with minimal problem of overdose.

II. RELATED WORKS

The usage of pill dispenser is a most common method to remind people about their

medication schedule. The most widely used type is plaid-based pill box. It is used to put medicine with a schedule such as daily pill box, weekly pill box, weekly four times pill box etc. Besides, pill dispenser also helps the patient to remind themselves to take right medicine on time. In the market, there are various types of pill dispensers that have been produced by different companies. For instance, GMS MED-E-LERT automatic pill dispenser, EPill electronic dispenser, E-Pill's tamper proof automatic medication dispenser, and Philips medication dispensing service. The available pill dispensers in the market only consist of built-in alarm for medication time notification. It is difficult for the elderly patients to hear the alarm due to the accelerated hearing loss, and especially when the pill dispenser is placed far from them. Recently, many modifications on the pill box have been done by other researchers. For instance, an electronic pill box called Med Tracker[3] can record the time of medicine taken from the box. [4] discussed about an eye blinking sensor. Nowadays heart attack patients are increasing day by day. "Though it is tough to save the heart attack patients, we can increase the statistics of saving the life of patients & the life of others whom they are responsible for. An intelligent pill box as reported in [5] proposed a medicine bag system with notification system using the Skype application. There is even a pill dispenser to remind the patient



to take medicine through the popup notification on the smart phone. But there is no where a dispenser with a clear idea of how to segregate from a bunch of similar pills based on the time of the medication, which set on the smart phone.

III. REQUIREMENTS

- mobile
- wifi/Bluetooth module
- LCD display labels
- Arduino microcontroller
- A solid cylindrical rod
- circular container with slots
- BLDC motors.
- IR sensor
- alarm clock
- storage container

A. DETAILS OF THE PROPOSED PILL DISPENSER:

This pill dispenser has set of 10 slots of pill containers in a circular arrangement around a solid cylindrical rod. Each pill container has a set of same of pills as prescribed by the doctor. Medicines are mostly categorized into solid-type (pill), powder-based, and liquid-type medicine (syrup). Majority patients will choose the solid-type medicines because of their more tasteless and easy to swallow. The number of the pills required by the patient for the time he is to be in medicated are placed in each slot. The pills of varied sizes can be placed in the slots. The architecture diagram of the dispenser is given in fig. 1.

The details of the dosage of the pills is fed into the mobile application by the caretaker of that particular patient. Along with it, the time at which the medicines should be taken has to be recorded. There should be database of the size of the pills used in the hospital prior to use of the dispenser. So on the mobile app these details of the size of the pill are automatically stored as soon as the type of medication is entered. To protect from unwanted access, the dispenser is to be kept locked and a QR code present on the dispenser is scanned on phone to change any details of the medication on the application.

When the tablets are to be received then the digital label gets a signal as to which lot of tablets are to be given then the motor controller works accordingly to move the sliding door of respective pills from each slot and they are made to fall on a storage container present below the pill container along the solid cylindrical rod. This storage

container can be rotated along the rod. So the pills fall in this storage space and by rotating of the storage container manually, the pills are taken.

The patient is notified about his medication by an alarm fixed on the storage container. Till the patient empties the container, the alarm keeps ringing. Along with this the phone also rings continuously if the pills are not taken after 10 minutes.

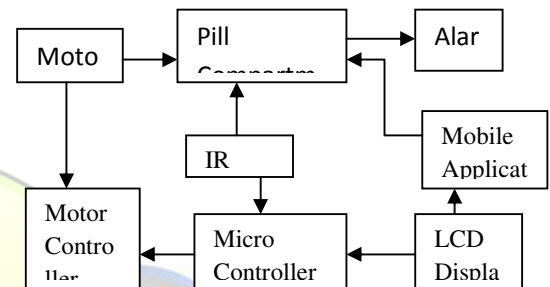


Fig. 1 Architecture diagram of the dispenser

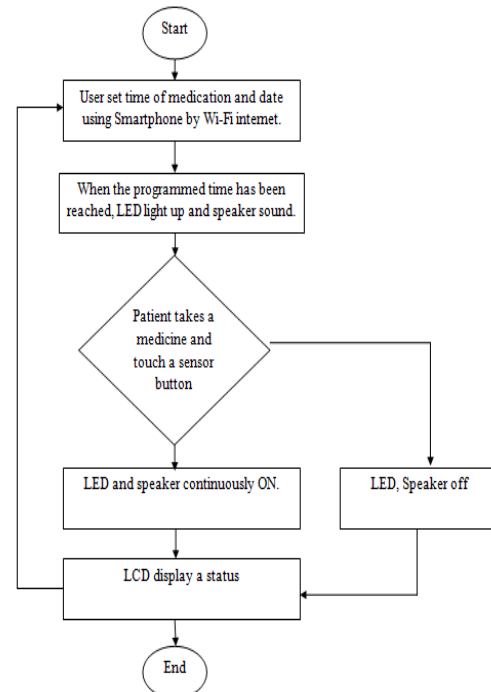


Fig. 2 Working of the dispenser.

B.DESIGN OF THE MOBILE APPLICATION:

In this using any language preferably Java, backend scripting of the application is created where the patient's disease, type and quantity of the pills to be administered are saved. There is QR



code present on the pill dispenser and only when that code is scanned using the phone, we can actually put or edit the dosage and time. As soon as the pill names are entered, from the database which contains the details of the tablets, size of the pills are to be automatically saved. According to the order in which the pills are entered, the tablet name on the digital label automatically gets saved via Bluetooth or wifi. During the particular time of medication, the notification is sent to the phone and if the pill is not taken within 10 minutes alarm beeps continuously on the phone till the medicines are administered. During the time of medication the LCD label is selected as per the data on the mobile and that particular label is operated on by the Arduino and motor.

C. DESIGN OF THE PILL DISPENSER:

As already mentioned it has 10 slots of pill containers each slot representing the set of same pills. Acrylic material was chosen to design each compartment inside the box. These slots are arranged in circular manner around a rod. A total of ten slots indicates that 10 different types of pills can be taken in a day. The pills are kept wrapped in their foils to prevent any contamination but they are cut into individual size and placed in the slot. The quantity of the pills is based on the prescription as given by the doctors. These slots are fully covered without any opening other than a sliding bottom. Each of the slot has a LCD digital label placed on their top. According to the label the pills are arranged in the slots. Working the LCD label is given later. So at the required time the label matching with the prescription in the mobile is activated by turning the sliding doors at the bottom of the slot.

This LCD label is connected with Arduino through which the sliding of the bottom starts. For this sliding operation to occur we can use brushless dc motors help in the smooth sliding of the bottom in four sides based on the size of the pill present in that particular slot. As the pill size is taken into account, the chances of overdose are reduced by a significant amount. But if the size of the slide opening is constant then there is chance of pills not present above the slide. To overcome that issue we have set up an IR sensor (which is used to count the number of tablets present on the compartment) which is connected to the motor controller through which the motor is given signal to increase the size of the slides depending on the pills present in the slot. When the number of pills are getting reduced in the compartment then the slide has to open more to let the remaining tablet to pass through it. Then the required pills fall from their respective slots at the same time. Till the pills are emptied from the

storage container the alarm on it beeps to remind the patient to take pills. And even in the Smartphone the alarm beeps continuously till the pills are taken after a time lapse of 10 minutes. By this, if the pills are still not taken on time then the caretaker can personally come and look into this. The overall process is given in the flowchart is given in fig. 2.

D. ADVANTAGES

1. Similar pills are placed together in the same slot and in the quantity required for the a complete period of medication so as to remove the tiresome process of refilling
2. The problem of overdose is removed by introducing sliding bottom in each slot
3. To eliminate the issue of receiving pills when their number is less, IR sensor is used to increase the passage area of the sliding bottom.
4. This system differs from the existing built-in alarm pill dispenser, as the notification can be received by nurse through Smartphone.

IV. CONCLUSIONS AND FUTURE WORK

The paper presents an original idea for an automatic pills dispenser. While the current prototype of the Autonomous Pill Dispenser shows promise and consistent ability to trap and release medication, there are certainly improvements that can be made for future iterations of the original model.

Though the problem of overdose is solved and notifications along with alarm are obtained on the smart phone. There is still a setback, which might take place when the quantity of the pills is being reduced then the pills may not be present directly over the passage, then the size of the slide opening has to be decreased. But in this there is a possibility of more number of pills coming out because of increase in the size of passage.

In addition, there are real-world challenges that patients would face when using the current model. While the gap between when the pill is released versus when it is actually released is minimal, but it still allows room for error.

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ISSN 2394-3777 (Print)

ISSN 2394-3785 (Online)

Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)

Vol. 4, Special Issue 19, April 2017

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