



IMPLEMENTATION OF MEDICATION REMAINDER DISPENSER MACHINE

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ABSTRACT

It is very important to give medication to the patients or the aged on the right time. Automatic Medicine Dispenser with Scheduler is designed for users who take medications with less professional supervision. It relieves the nurses or caregivers of error-prone medication of administering wrong medicine at the wrong time. The major components of this Automatic Medicine Dispenser with Scheduler are an Arduino Uno interfaced with a personal computer, relay modules, high power relay switches, LED indicator, buzzer or alarm system, a web camera, and three test tubes used as pill container and dispenser. The overall operation is to help the nurse to set the scheduled time on the computer to dispense one or multiple pills at the right time. The buzzer with a beeping sound, is used to provide indication that the pill has already been dispensed. The camera serves as the eye of the nurse; it makes sure that the medicine has been taken by the patient. The device features an automatic as well as manual dispensing of medicine. The main objective is to keep the device simple and cost efficient. The software used is reliable. Every patient can benefit from this device as it avoids medication non-adherence.

The Problem and Its Settings

For most of us, medication would mean taking a couple of Paracetamols or an occasional antibiotic or a few pills, followed by a glass of water to wash them down. But for some people with complicated illnesses or those with severe medical conditions, medication becomes a complex mixture of pills taken at indicated times during the day with various instructions that needs to be followed.

Many of these patients may also suffer from varying levels of cognitive impairment that makes remembering when and how to take these medications very challenging.

Medication non-adherence is a serious problem that can occur for several reasons. There is a possibility that a patient may have taken their medicines at a wrong combination or perhaps they have taken these medicines at the wrong time of the day. Not adhering to the instructions on how to take the medicine is also plausible. They may even use medicines that should not be taken at all.

Patients have several options to help manage their medication. They may start with a simple pill box. But as the medication regimen becomes more complex, they may need a little reminder on when to take the said medicine. As their cognitive function declines, patients begin to seek the help from caregivers, either a family member or a professional health care provider. Eventually, many patients in hospitals or nursing homes are helpless. This study focuses on ways to cope with these situations through the introduction of the Automated Medicine Dispenser with Scheduler. This project aims to provide a solution that will surely give caregivers, and more importantly the patients, a peace of mind. This project aims to provide convenience in the dispensing of medicines on a scheduled basis.

Statement of the Problem

Our aim is to develop an Automated Medicine Dispenser with Scheduler that would be able to dispense medicines automatically within the prescribed schedule of medication. This is to eliminate medication non-adherence. The entire system is dependent on the data that is entered on the user interface of the project. This project also aims to design and develop a device that operates automatically and manually in dispensing medicines for the patient.

In particular, the study aims for the following:

- To innovate existing medicine dispensers.
- To automatically dispense medicines at a prescribed/scheduled time.
- To manually dispense medicines if it is urgently needed.
- To give patients an easy access on medicines in cases of emergency.
- To avoid erroneous admission of medicines to patients.
- To lessen the tasks of nurses.
- To electronically save confidential information of the patients and the medical team.

Objectives of the Study

This project aims to create a device that will help the medical team, the patients and the patients' attendants in taking their medications on time. Furthermore, the following are the objectives of this project:

- To control the solenoid using relay switches for the automatic dispensing of medicines
- To implement the circuitry that would control the dispenser both automatically and manually in cases of emergency
- To design and implement an electronic alarm system that will notify the patient when the medicine is dispensed
- To design and develop a user interface that will gather all the necessary information about the patient's medication regimen in order to avoid erroneous admission of medicine to patients as well as to save confidential information of the patient and the medical team
- To design and develop a software using Arduino IDE version 1.6.5 that will perform the task of reading the inputted data from the user interface
- To provide a surveillance camera that serve as an eye of the nurse on the patient's room in order to lessen the nurse tasks

Significance of the Study

Erroneous and delayed medication of a patient is one of the identified causes that kill thousands of people. This is according to the results of a survey regarding the requirement in the centres for Medicare & Medicaid Services (CMS) Conditions of Participation Interpretive Guidelines to administer medications within 30 minutes before or after the scheduled time. The survey collated the responses from almost 18,000 nurses. It concluded that changes to drug delivery methods and gradual increases in the complexity of care, number of prescribed medications per patient, and number of patients assigned to each nurse, made the long-standing CMS "30-minute rule" troublesome. Further, the nurses feel that the rule is unsafe, impossible to follow, and often unnecessary from a clinical perspective.

According to the House Bill No. 5780 introduced by Honourable Juan Edgardo M. Angara, Filipino nurses and doctors are having a hard time attending to their patients based on the Philippine General Hospital (PGH) nurse to patient ratio of 1:15-26 per shift while Davao del Sur has a province-wide ratio of 1:44-45 per shift.

This ratio is quite alarming and needs to be given extra attention to ensure quality health care.

The following group of people and/or institution will benefit from this project:

Patients and any sick family member at home, they will have an easy access to their medicines; the dispenser would be within their reach and can be dispensed manually or automatically.

Nurses, doctors and other personnel who attends to the sick and disabled, they can focus more on other things since the giving of medicines on time will be done by the automated dispenser.

Hospitals and Homes, in this manner, the institution can lessen the labor of their attending personnel. They can focus and spend more on other matters, i.e. **implementing the said project.**

Scope and Limitations

The scope of the project involves the assembly of the graphical user interface, the construction of the mechanical components, the design and implementation of the electronic circuitry for the automatic dispensing of the medicine and the development of the software running on Arduino Uno to achieve the required tasks, that is, to automatically dispense medicine on the pre-set schedule.

The design has the following limitations:

- Only medicines with circular shape and diameter are fitted in the design of the project's pill container.
- The project cannot track the exact number of medicine left on the dispenser.
- The project's pill container is limited to 30 tablets per container only.
- Improper alignment of medicine pill on the container will result to dispenser malfunction.

Review of Related Literature

Most of the services that we experience in our society are now automated and time dependent. Especially when it comes to medical services, where time is the most important aspect, a little delay would result to either positive or negative consequences. Proper health care is a main concern in our society since our immune system gets weak at times, which makes us prone to different illnesses or diseases. We are responsible in taking care of each of our own family members.

But it is somehow difficult for us to be available at all times to look after the ill ones and working people with health problems usually fail to remember to take their medication on time. As the cost of in-home medical care rises, it is better to think for another remedy.

As innovators and inventors, the researchers have focused in improving the medication system which will resolve the above mentioned medical matters. With the advancing technology, new devices that can lessen the medical problems are now obtainable. We can also change the estimated lifespan of many Filipino people from 65 year old to more than 75 year old through ingenious and skillful individuals. To have an innovative system for medication, we have devised the Automated Medicine Dispenser with Scheduler with the help of the following fabrication of medical dispenser concepts.

Automated Dispensing Cabinet

This device is computerized drug storage or a cabinet designed for hospitals. Automated Dispensing Cabinet allows medications to be stored and dispensed near the point of care while controlling and tracking drug distribution. It is also called unit-based cabinet, automated dispensing device, automated distribution cabinet, and automated dispensing machine.

Automated Dispensing Cabinet is more than an automated teller machine for drugs. It reflects how design advances, as well as, specific technologies, such as barcode scanning and clinical decision support, which can improve medication safety. Over the years, Automated Dispensing Cabinet has been adapted to facilitate compliance with emerging regulatory requirements such as pharmacy review of medication orders and safe practice recommendations.

Automated Dispensing Cabinet incorporates sophisticated software and electronic interfaces to synthesize high-risk steps in the medication use process. These unit-based medication repositories provide computer controlled storage, dispensation, tracking, and documentation of medication distribution on the resident care unit. Since automated dispensing cabinets are not located in the pharmacy, they are considered “decentralized” medication distribution systems since they can be found at the point of care on the resident care unit. Tracking of the stocking and distribution process can occur by interfacing the unit with a central pharmacy computer. Though the pharmacy community has been utilizing automation technology since the 1980s, companies and private individuals are constantly refining and improving the Automated Dispensing Cabinet to meet the changing needs and health standards in the industry.

The researchers have conceptualized a system flow of the Automated Medicine Dispenser based on the computerized medication distribution system of the Automated Medicine Cabinet. The process is from the idea of tracking, controlling, monitoring and documenting the distribution of the prescribed medicine. For tracking and controlling, the team will use a microcontroller that will interface to the master computer. The microcontroller will be programmed to meet the desired output and it will also be interfaced with the master computer. In monitoring the distribution, the researchers came up with the idea of using a closed-circuit television (CCTV). The monitoring will be administered by the nurse on duty. And for the documentation, the patient's profile and medication information will be stored in a database.

Automated Dispensing Machine

Automatic Dispensing Machine (ADM) or Automated Drug Cabinet is a computerized drug storage and dispensing device used in the health care settings like hospitals and nursing homes. ADMs are located at the point of care, e.g., the ward, ICU, ED, rather than in the central pharmacy.

An ADM functions as a decentralized distribution point in the hospital pharmacy system and is interfaced with the main medication information systems. The ADM provides proper storage, inventory control and security for pharmaceuticals at the point of care, and can only be used by authorized users who are authenticated by passwords and biometric measures such as fingerprint readers. After being validated, the clinician must select the correct patient and medication before the cabinet will open and dispense the requested medication(s).

Safety and confidentiality of the patients profile is important. Automated Medicine Dispenser should have a password on the main medication information system. Only the authorized personnel shall be able to view the master computer and has the right to change the information that has been recorded. For the validity of the information, the authorized personnel will select the correct medicine that was prescribed by the doctor before setting the schedule for medicine dispensing.

FLOJET Bottled Water Dispensing System

This water dispensing system is designed to pump purified water from a commercially available 5-gallon purified water bottle. The system will deliver the water under pressure to the individual's drinking water faucet, to the water inlet of a refrigerator, and to certain commercial coffee and/or tea brewers.

When the suction wand is inserted into the standard 5-gallon bottle, it will activate the float switch on the end of the wand and turn on the pump. The same float switch shuts off the system when the bottle is empty. The wand has a built in back-flow preventor valve that prevents water in the system from flowing back into the bottle, or spilling while changing bottles.

The heart of the system is the pump module that automatically adjusts the flow and pressure to fill an appliance or faucet and stops automatically. The system is also equipped with an automatic thermal cut-off device for additional protection. Pushing the medicine from the container is the main operation of the solenoid on how to dish out the medicine from the inside. The researchers already made provisions for the errors that may occur during the distribution process. Like the back-flow preventor valve that prevents water from flowing back into the bottle, the team established the idea of putting a manual selector at the dispensing machine for troubleshooting in cases of jammed medicines. Pushing this button will jerk the jammed medicine and the dispenser will be able to resume to its normal operation.