

Medical Pills Dispensing Unit

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Abstract – In the healthcare industry, non-adherence to medication doses and schedules poses a serious problem with reduced ideal treatment outcomes and higher medical expenses. This kind of problem is more predominant in case of elderly persons, physically challenged persons and others who depend on the help of care takers. The goal of this work is to design and assemble a device that enhances the medication adherence and provides a patient-centred healthcare. Therefore, an automated medical pills dispensing unit is designed and assembled which is to address the two major issues of missing the schedules and variation in doses at each scheduled time. This design of the dispenser unit is useful to dispense a good number of drug formats, like pills, capsules, and syrups. It is interactive type, so that the end user may modify the schedule and doses quickly making it a user friendly unit. With this device, the medication delivery is relatively more accurate and as per schedule, leading to reduction in the burden of responsibility on the care takers and with least or no dosage errors. Sensors in the device keep a track the quantity of medicines, so that medication is as per prescription and schedule not affecting the treatment cycles.

Keywords – Automated Medicine Dispenser, Medication Adherence, Patient Centric Healthcare, Automation, User Interface.

I. INTRODUCTION

As per the available data, a large group of people are suffering from neuro-related disorders like dementia and Parkinson. Based on the survey done in 2001 [1], 25 million people are suffering from dementia. This number may double in every 20 years. Further, the number of people suffering from dementia in various countries is also on the rise. For those who are assisting these patients, like family members, relatives and a hired person it is a challenging task. Larger attention is the demand on the care takers. Care takers tasks include bathing, feeding, giving medicines and general maintenance of the premises. Healthcare, good medication administration is essential for the health and wellbeing of patients. Chronic illnesses in people demands a good management of medications. Patients suffering from chronic illnesses, are subjected to strain as these patients face difficulty in taking the medicines on their own, and at the right time as per schedules. Non-adherence to scheduled medication is a major cause of concern as it leads to poor or bad results of treatment, and leading to further hospitalisations which in turn increase healthcare expenses. Therefore, there is a need of a solution that ensures that patients are administered regularly the prescribed medicines, whether in pill or syrup form maintaining the treatment regimens. The present work is regarding healthcare device which is patient-centred and an automated medical pill dispensing unit is designed, assembled and tested for performance of the same. In this design an automated unit with suitable sensors and very user friendly gadget that helps in medication management schedules and doses which ensures adherence to medication cycles. The dispensing device is a simple, effective, and safe device for dispensing the pills at the schedule time and of prescribed quantity. The unit is an automated medical pill dispensing unit with flexibility for various medical pills sizes, varieties and schedules. This dispensing unit construction and operation, are simple with ample automation. The device is a user friendly unit and allows ease of repeated programming, and safe with minimum dose errors. This device built with an intention to improve patient condition and lead to more resilient and simple healthcare system. Clearly the objective of this device is to improve medicine administration and distribution in terms of efficiency, accuracy, and safety. This device handles a number of issues like administration and management of medications with cost effectiveness, patient safety, accuracy, and drug schedule adherence.

In 1960, the automated drug distribution systems was developed for drug distribution, also known as unit dose systems (UDS). Earlier multiple dose system (MDS) was replaced by this UDS. With MDS nursing of persons involves a huge responsibility in the entire medication system, and involves administering a large number of doses per day of medicines besides huge paper-work, inventory control and dose preparation. UDS on the other hand, has individual labelled packets of medicine doses as per the prescribed schedules. These doses are ready to administer to the patients

with no waiting time [3]. UDS results in reduced errors, very less wastage of medication and apt usage of nursing time [4]. UDS is useful right from the physician prescription entry to hourly dose administration, computer-assisted. Many medical care systems adopted this which included computer-assisted physician order entry, packaging and sorting of drugs in the pharmacy, delivery by a robotic arm, to stand-alone nursing-unit based cabinets and the generation of reports and forms. Medication error is a major issue that affects the success and failure of automation in pharmacy, along with cost saving and the efficient usage of nursing and pharmacy time [5,6]. Reducing medical error always an incentive in the area of automated drug dispensing. Non-adherence to manual instructions leads to failures in usage of these devices and the all the designs must obviate a demand for an expert support. A simple training procedure and ease of operation are essential for any such unit design.

II. PROTOTYPING OF THE SYSTEM

As a first attempt design and assembly of a unit with provision to deliver single type and size of medical pills is done. A pile of pills are placed in a column of the unit. A disc at the bottom of the column is used to keep the pills in the column. As the disc is rotated through the set angle, a hole in the disc is aligned with the opening at the bottom of the column. Thereby the pill is delivered by gravity into the tray below. Disc is rotated using a servo motor of very less torque capacity through the set angle for a pre-decided time. After the set time, the disc is rotated in reverse sense by the servo motor to close the opening at the bottom of the column. The of opening and closing depends on the medication schedule. For example, a medical practitioner prescribes, say a pill each for hypertension at a fixed time range in the morning and evening, the delivery of a pill happens at the set time and only one pill is delivered. Also, the delivery of the pill is twice a day at set time range. Thus the disc rotates for a short span of time and releases a pill and closes quickly, so that additional pill is not dropped. Further, as soon as a pill is dropped, the patient should be cautioned immediately. For this, a green LED is used to indicate the delivery and a buzzer is used to caution with a loud sound. Further, if the pill is picked by the patient and remains in the tray after a set time, another red LED glows and the buzzer sound enhances and keeps blustering till the pill is removed from the tray. Thus, ensuring that the patient takes the medicine at the right time. It has a few parts and the assembly is simple and compact. A battery is used to run the servo motor and a micro controller is used to control the activities like rotating the disc to and fro, glowing both red and green LEDs at the required time, activating the buzzer and sense the presence of tablet in the tray and send signals to LEDs and buzzer. The casing is modelling in solid works software and the same is 3-D printed providing appropriate allowances and surface finishes. The surface finish should be such that the pills remain the column and drop without getting struck in the column. All the components are assembled and tested for the performance of the unit. In the fig. 1 is the components of the pill dispensing unit. Shown in fig.2 is the assembled pill dispensing unit.

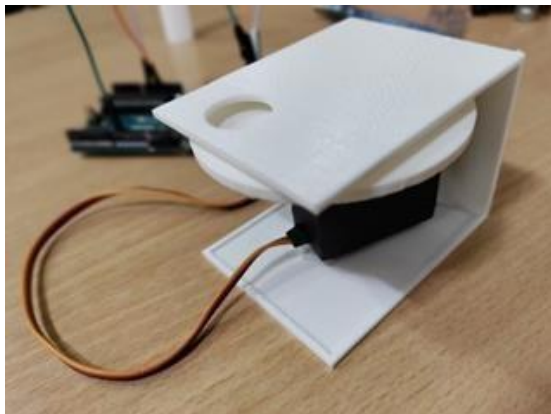


Fig.1. Components of Pill dispensing unit



Fig. 2. Assembly of Pill dispensing unit

VI. CONCLUSION

With this unit good saving in time is ensured and efficiency of nursing is improved. Pills of different sizes and shapes can be accommodated in this unit. The timing for running the servo motor is varied to suit different time schedules. The size of battery unit is small and has the advantage of occupying very less space making the unit a compact one. However, smaller battery also comes with less battery time and leads to replacement often. Work is in progress with regard to this aspect. Since, right now the device has one column, it can accommodate only one type of pill. Work on designing a unit with multiple columns, at least four is in progress. The functioning of the unit is satisfactory.

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