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# Medicine Dispensing Unit

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***Abstract* – In a joint family system, elderly people wellbeing is taken care of by the younger ones of the family. Where as in the modern nuclear family system with the availability of a limited number of family members, dependence of aged persons or less abled persons is more and mostly on the help from these limited number of family members. Further, the kind of support these ailing persons get is limited with a few and busy family members. If an automated device which is very easy to use is made available, these ailing or aged persons may carry out their tasks conveniently to some extent at least. Of many daily requirements like moving them from one location to another, helping in completing the daily chores, take food etc., one such requirement is to administer medicine of prescribed quantity and at the scheduled time on daily basis. At present an accurate, dependable and efficient device for such purposes is not available. With regular dependency of such persons on their family members many times in a day, an automated device with least manual interference is of great use for such persons. In the present work, an automated, cost effective, reliable and efficient medicine dispensing system especially for syrups is designed and assembled. This prototype is aimed at dispensing desired, yet varying quantities of syrups, with a delivery accuracy of a few millilitres (ml) as per the prescription. In this work design of a device, simple and convenient to operate and user friendly with a few simple steps to operate is presented. Further, this device is operable by a light weight battery.**

***Keywords* – nuclear family, medicine dispense, drug testing, battery**

## I. INTRODUCTION

In a joint family system in earlier days, where in a group of related people live together under the same roof, aged people wellbeing is taken care of by the younger ones in the family. In the present modern nuclear family system only a limited number of family members, ages people who are less abled in one or the other way, have to depend on a few in the family. This dependency is more when there are ailing persons in the family and the available family members are a few who are busy with their work schedule. If an automated device is made available for such people, which is easy to use, these people may carry out certain tasks conveniently, if not all. One such requirement is to dispense a medicine in syrup form of prescribed quantity and at the proper time without missing the schedule. As such accurate, dependable and efficient devices for such a purpose are not readily available in the market at present. These persons need to depend on their family members and it may be a challenge for the family members too. An automated device that can obviate the manual system is of current requirement as opening the lid of the bottle, pouring in to a measuring flask or cup without spilling and of course not missing the schedule are the required steps in taking a medicine by aged persons.

For a long period, automated flow control system has been in high demand, largely because of its ability to drive efficiency, reduce errors in delivery rates, and improve the uncertainties of general flow operations of liquids. Demands like high production rates and safety concerns have resulted in a need for automated devices, which are replacing the manual devices. Manual effort is minimised by using these automated devices. Sophisticated machines with advanced technology including automation are put to use in every wake of like and most of the fields of industry to enhance the output, efficiency and accuracy. To quote a few, pharmaceutical industries, clinical laboratories, environmental applications, chemical, food and beverage industries depend on these automated machinery and devices [2]. Preparation of samples for testing in chemical, food and pharma industries is very critical and highly important. Correct quantity and reliable dispensing of proper volumes of ingredients before mixing them is essential for the quality of the end products. As in most of the cases a syrup or a chemical is to be delivered, use of automation to supply fluids of measured quantity is the need of the hour which has to replace manual methods which inherit errors. The device which serves such a purpose must deliver right quantity of fluid with a precision up to a few millilitres as decided. This flow control system is required to regulate the flow rate or pressure or both of liquid of interest.

In the present work, an automated, cost effective, reliable and efficient medicine dispensing system especially for syrups is designed and assembled. This prototype is aimed at dispensing desired, yet varying quantities of syrups with an accuracy of a few millilitres (ml) as per the prescription. The designed device is very much useful in house hold applications for patients and also in different pharma laboratories for dispensing and filling different volumes of fluids during their drug testing procedures. The aim of the work is to design the device that very convenient to operate and user friendly, with a few simple steps to operate the device. Also, this device is operated by simple replaceable power source, a light weight battery. The objective of this automated medicine dispensing device is to enhance the accuracy, efficiency, and safety in addition to ease of operation.

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This device is designed to address various challenges in medicine management and delivery, including accuracy, patient safety, adherence to medical schedules, efficiency in maintaining the schedules, controlled access and cost effective.

## II. LITERATURE SURVEY

Based on the unit dose systems in use during 1960 plus years, an automated drug distribution systems (ADDS) was built for industry in United States of America [2]. Multiple dose drug distribution (MDDD) systems were replaced by ADDS. With MDDD systems service persons like nurses had to administer a good number of doses of drugs as per prescription in a day, maintain the schedules in schedule books involving a good amount of paper work, dose preparation and of course had to have a control of the inventory of the drugs. Whereas MDDD systems enables the nurses with well scheduled, ready to administer, individually labelled and packed doses. Using MDDD system, errors in administering the medicines, wastage of medicine due to mishandling, inappropriate use of nursing time were eliminated. Automated drug delivery makes life very simple and right from the prescription by the physician, then entry of details like hourly dosage details, and administering the right dosage [3]. The pharmacy automation is lead to automated drug dispatching to dispensing systems in healthcare units. An automated drug dispensing system [4] must include systems which include computerised order entry, packaging and sorting of drugs in the pharmacy, delivery of the drugs as per the order by robots and the automatic generation of customised forms for records. The success or failure of an automated pharmacy system is influenced greatly by the medication error [5-12] plus the savings and efficiency of nursing. The major issue is obviously the error in administering the drug of right quantity, quality and as per schedule. Thus both in academics and health care units, the need of the hour is an automated drug dispensing device. These devices must address the two major aspects, a significant decrease in drug usage and cost reduction. If a health care unit wishes to reduce the financial burden by reducing the unproductive man power usage, this may be one of many solutions. An automated drug dispensing significantly reduces medical errors in addition manual power saving. Number of instructions are less and a quick service system. Easily operable by even by elderly persons without the interference of others. Use and maintenance of these automated drug delivery systems are very convenient

## III. PROTOTYPING OF THE SYSTEM

In the present work, a Peristaltic Pump [13] commonly found in domestic applications is used to pump and deliver the syrup of drug. By restitution the fluid is restored back in to pump by repeated compression and expansion. A peristaltic pump is operated by an in built motor with two ports and syrup is sucked from one end and delivered through a second end. A peristaltic pump doesn't have valves, seals and glands and it is relatively inexpensive to maintain. Also, these can handle a wide variety of fluids. These pumps have reasonably good resistance to abrasion and permits the easy flow of viscous media. Thus, a peristaltic pump is very useful for a syrup dispenser device. A peristaltic pump is shown in figure 1.

Fig.1. Peristaltic Pump

This peristaltic pump is run by an in built motor, with a motor driver circuit board and speed and direction motion are efficiently controlled. A 5 V to 35V battery with a peak current of 2A is the power source. A micro controller is used to operate the unit. A mini push button is used to start and stop the pumping of syrup and flow of syrup is through two pipes of suitable length. The flow rate through the pipes is controlled by the micro controller as per the code put in the controller. The housing for the entire unit houses the microcontroller, battery, pump cum driver and syrup bottle. To build this unit

one syrup bottle size is used in the design. The Medicine dispensing unit components assembly is very compart as shown in figure 2.

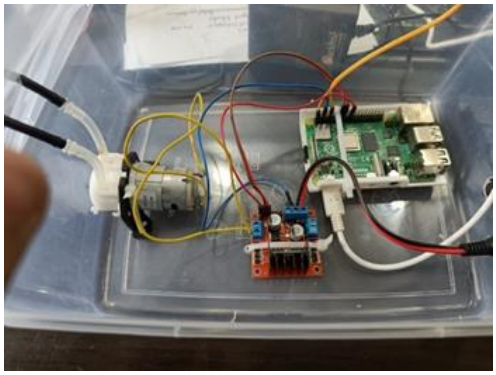

Fig.2. Medicine Dispensing Unit components

The dispensing unit housing is modelled using Solid works software and 3D printed. All the parts of the assembly fixed in the housing and circuit connections are made. A code to operate the unit automatically with a simple switch is uploaded into the controller board and the pump dispenses the syrup as per the set quantity and flow rate. A pipe from the pump inlet end is inserted in syrup bottle and the second pipe attached to the outlet end of the pump. This outlet pipe delivers the syrup of prescribed quantity in millilitres into a measuring cup. The flow rate of the syrup from the bottle into the cup is monitored using communication from controller to a suitable monitor. A light weight 12 V battery is used to run the motor. The functioning of the unit is tested a good number of times to verify and compare the flow rate and actual out flow of the syrup. A push button is installed, which actuates and de-actuates the device. An LED and a buzzer are also included in the circuit to indicate the start and end of the syrup flow from the device. The total volume of the unit is 12 Cm X 6 Cm X 8 Cm. Picture of the assembled unit is shown figure 3. A regular rinsing of the unit is advisable with warm water. In case of rinsing the syrup bottle is replaced with a container of hot water. Rinsing two or three times after using one type of syrup is recommended and rinsing is very simple and quick. Tested well for the quality of rinsing too.

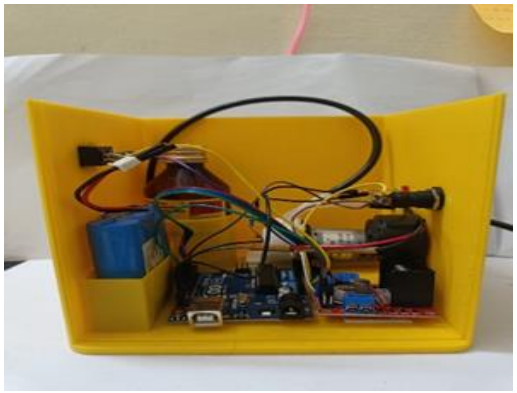

Fig.3. Medicine Dispensing device

## IV. COST ANALYSIS

The cost analysis of the device is given further. The total cost of the device is Rs. 2500/-. The cost of the dosing pump is Rs. 500/-, cost of the micro controller is Rs. 800/-, cost of the motor drive plus connectors plus battery and battery charger together is Rs. 400/-. The casing modelling, 3D printing and assembling cost is Rs. 800/-. Syrup cost is not included in the list. If an adapter is used the cost of the adapter for 12 V power supply is Rs. 500/-. Then the total price will be Rs. 3000/-.

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## V. RESULTS

A graph is plotted between time taken by the system to dispense different quantities of fluid. The relation between the volume delivered and time to deliver is found to be linear almost. This is clearly a suitable performance of the device.

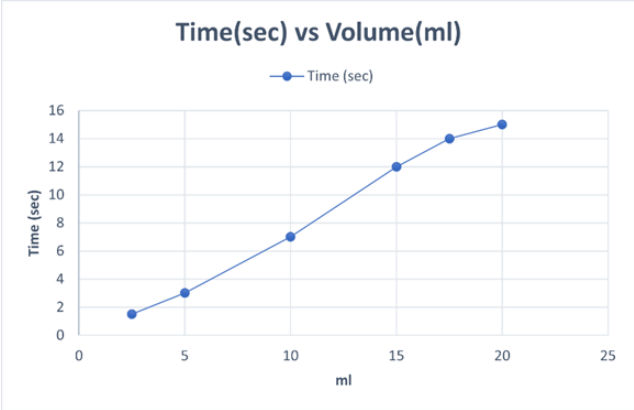


Fig.4. Time v/s Measured volume

## VI. CONCLUSION

In a nucleus family set up dependence of aged persons or less abled persons is more and mostly on the help from the limited number of family members. Also, the kind of support available is limited. An automated unit which is very easy to use is of great help to such ailing or aged persons in order to carry out some simple tasks like taking syrup at the scheduled time. An automated, cost effective, yet reliable and efficient medicine dispensing device useful to deliver medical syrups is designed and assembled. A prototype assembled is tested for the functioning of the device. Using this device, a good amount of saving in time and better nursing of patients and elderly persons is possible. This device is suitable to dispense a wide variety of liquids and a good control on flow rate is easily obtained. Easy to maintain. The dosing pump is supported by a 12 V rechargeable battery or a 12 V adapter. Only with a few parts and all are cost effective the total cost of device is at bear minimum value of Rs.2500/-. The performance of the device is found to be linear. This is very satisfactory.

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## REFERENCES

[1] Tehreem Naeem, “Arduino Based Automated Flow Control System” M.E. Thesis, Simon Fraser University Fall, 2021.
[2] Ellen Balka, Kelsey Nutland, “Automated Drug Dispensing Systems: Literature Review”, *Action for health*, 2004.
[3] Simborg, D. W. & Derewicz, H. J., “A highly automated hospital medication system. Five years' experience and evaluation”, *Annals of internal medicine*, 1975.

[4] Riley, A. N., Derewicz, H. J., & Lamy, P. P., "Distributive costs of a computer-based unit dose drug distribution system", *American Journal of Hospital Pharmacy*, 1973.
[5] Cork, A., "Storage system recommendations, HD", *The Journal for Healthcare Design & Development*, 1998.
[6] Hofer, M., "Storage units produce $1 million in savings", *Hospital Materials Management*, 2001.
[7] Miller, R., "Stop the Carts", *Nursing Management*, 1999.
[8] Shultz, S. M., White, S. J., & Latiolais, C. J., "Medication errors reduced by unit-dose, Hospitals", 1973.
[9] Vecchione, A, "Medication error reduction driving technology trends", *Drug Topics*, 2002.
[10] Hynniman, C. E., et al, "A comparison of medication errors under the University of Kentucky unit dose system and traditional drug distribution systems in four hospitals, *American Journal of Hospital Pharmacy*, 1970, 27, 802-814.
[11] Chung, K., Choi, Y. B., & Moon, S., "Toward efficient medication error reduction: error-reducing information management systems", *Journal of medical systems*, 2003.
[12] Barker, K. N., "Ensuring safety in the use of automated medication dispensing systems", *American journal of health-system pharmacy*, 1995.
[13] Navoneel Banerjee et al, "Arduino Based Liquid Dispensor System using Peristaltic Pump", *RCC Institute of Information Technology*, 2017.