

Precise Drug Dispensary System

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Abstract - There is a rapid development in industrial automation. Many systems have been developed which use sensor arrays to precisely control the process occurring in industrial production. These systems are least immune to voltage fluctuations and may lead to failure in one or complete process of manufacturing. In case of pharmaceutical industry different drugs are combined to form a specific drug. The proportion of these mixed drugs needs to be accurate to a great extent. A small error during the manufacturing process can have fatal impacts on consumers. In order to minimize this error, automatic drug dispensary system is used. In this system the proportion of drug is controlled by using lead screw and the advantages of replacing sensors array with lead screw is that it is immune to voltage fluctuations and maintenance free as well as it provides precise drug dispense. By using lead screw it can operate in high temperature regions as well not affecting the performance of the system where sensors might cause.

Key Words: precise, maintenance free, lead screws, different proportions for mixing, accuracy

1. INTRODUCTION

The manufacturing industry of medical or pharmaceutical requires mixing of different drugs at proper amount. Like when they require two different drugs to be mixed in different proportion to make a new drug or like mixing of different drugs in different levels to make tablet of drug. But sometimes due to spikes in systems or because of some failure of sensors it may lead to an error. But while performing this type manufacturing in medical industry it is not tolerable for this type of stage. Because of these small errors, patient that is taking drug may suffer through some medical problems due improper amount of drugs at the time manufacturing. So it has to be manufactured in very precisely manner. In pharmacy or medical industry if we throw-out this small errors like upto 0.01ml it can be very improving for manufacturing. So we have designed a system which performs mixing of drugs in very precise manner. This system performs mixing of different drugs upto 0.01ml. We used lead screws in this model for mixing of drugs through syringes acts as containers of drugs to achieve this limit of accuracy. Our system is least immune to sparks problems or noise problems that are causing errors in previous methods. We tried to made the system maintenance free while including its components. It can operate in high temperature region also. Our system which is Precise drug dispensary system will provide mixing of two different drugs in six

different proportions with resolution of 0.01ml. This system is maintenance free, very simple and can be used to dispense drugs in very precisely manner.

2. LITERATURE SURVEY

The nursing-unit primarily based automatic drug dispensing cupboards are the centerpiece of most automation solutions opted for by aid facilities and sit at the apex of most of the discussion found within the out there literature. every system and every cupboard is configured slightly completely different, however all treat constant basic principle: usually put in in nursing wards, and sometimes within the emergency departments and operative rooms of hospitals and other aid facilities, the cupboards look and performance very similar to an automatic teller machine. The user inputs their confidential ID, selects a patient profile from a listing of choices and chooses the acceptable medication to be administered. The dispensing cupboard then unlocks a nominal drawer or carousel containing the medication permitting the user access for a limited quantity of your time. Establishments have different protocol around United Nations agency has access to the machines, for a way long and at what times, additionally as what's to be through with came medications, and the way to handle medication errors. Medication error may be a elementary issue self-addressed within the literature evaluating the successes and failures of automation in pharmacy, at the side of cost-savings and therefore the economical use of nursing and pharmacy time. Section II of this literature review focuses on these specific issues and the way they need been treated in each educational and business material; provides a broad characterization of the whole body of labor that includes the up-to-date coverage of automatic drug dispensing. The literature on automatic drug dispensing systems are often classified as originating in either educational or trade publications and as theoretical, empirical or editorial in nature – several articles are a mixture of the on top of. the tutorial literature is set up mostly by articles printed within the yank Journal of Health-System Pharmacy (formerly the yank Journal of Hospital Pharmacy) (Barker, Pearson, Hepler, Smith, and Pappas, 1984; Borel and Rascati, 1995; Guerrero, Nickman, and Jorgenson, 1996; Lee, Wellman, Birdwell, and Sherrin, 1992; Perini and Vermeulen, Jr., 1994; Schwarz and Brodowy, 1995; Tribble, 1996; Wong, Rancourt, and Clark, 1999) and people printed by Canadian scholar Joel Novek (Novek, 1998; Novek and Rudnick, 2000a; Novek, 2000; Novek, 2002; Novek, Bettess, Burke, and full general, 2000b). different educational publications embody the Journal of Medical Systems.

3. BLOCK DIAGRAM OF SYSTEM

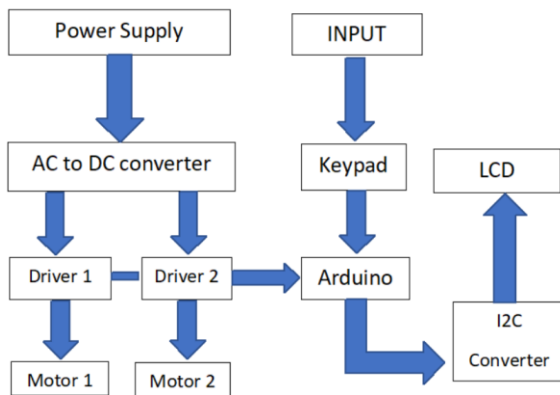


Fig. 1. Block Diagram

Power supply is connected to AC to DC converter into and AC supply is generated into constant 12V DC supply. This supply is given to the motor driver IC's which is A4988 to drive motors. By driving stepper motor which is bipolar it can dispense drugs from the tubes attached to it in very precise manner. Here the drug mixing limit is upto 40ml per step. We provided six different ratios in which we can mix drugs. Both driver IC's are controlled by Arduino to control stepper motors for drug dispensing. Syringe is used as liquid container in this experiment. For current boosting we have used boost converter. The 4*4 matrix keypad is used to give input to the precise drug dispensary system. By taking input from keypad Arduino controls the necessary operations for dispensing drugs. The whole process is monitored through LCD. The I2C adapter is used to minimize the connections to Arduino by connecting it to the LCD module. We have used lead screws for movements of containers of liquid for mixing because they can moved very precisely and with resolution upto 0.05 ml of mixing. The whole process takes efficient time for mixing drugs very precisely hence it can be used in large scale at manufacturing industries.

4. COMPONENTS DESCRIPTIONS

4.1 STEPPER MOTOR

We have used Nema 17 5.6kg-cm stepper motor for our model. It performs precise moves in repeatable steps like forward and backward so it is the choice of any manufacturer for this model. This Nema 17 motor operate in 1.2A current rating per phase which is normally less than the motors. It can hold its position as well as move at certain amount through using stepper motor drivers. To drive this motors we have used A4988 motor driver IC's. Stepper motors have multiple toothed electro magnets which are organized around a central shape like a gear in piece of iron.

This motor provides excellent movements of lead screw like starting, stopping and reversing for mixing of drugs at different levels using stepper motor drivers. Our application require very low speed of operation sometimes with better precision for mixing so it us the advantage of using Nema 17 in manufacturing process. We require only 4 wires for controlling this motors through A4988 motor driver IC's. So it can wired very easily in our model. Shaft of motor hold very good grip on lead screw which is attached using coupler, so there are very rare chances of slipping and also used to avoid stalling. It has a step angle of 1.8 degree and hence provide mixing of drugs upto 0.05ml. Speed of this motor is directly proportional to the frequency of input impulses so speed can controllable at greater extent. So it is highly acknowledged in our manufacturing method.



Fig. 2. Stepper Motor

4.2 LEAD SCREW

The lead screw is also called as power screw. We have used a 9 mm lead screw in our model. By rotational of lead screw which is attached to Nema 17 stepper motor we are able to move syringe up and down very precisely to mix different drugs at different proportions. Lead screws are able to convert their rotational motion into liner motion so we have used this concept to dispense our drug from syringe or container by applying pressure through piston. Lead screws are manufactured by various companies and almost all of them provide reliable operation. By using stainless steel lead screws which are least reactive to corrosion, noise sparks, etc it increases the model performance of system. The motion of lead screws while performing motion is very smooth and very accurate.



Fig. 3. Lead Screw

The most advantage of using stainless steel lead screws is that it provide maintenance free work, by this way system performs will stay last longer. We attached bearing at one end of the lead screw and other end to the coupler of stepper motor. To heavy loads it performs better than other screws so this also an advantage of using lead screws in drug dispensary system.

4.3 BALL BEARING

A bearing is like a rolling element which uses balls to allow separation between the bearing races. Main feature of ball bearing is that it cut back the friction and supports the radial and axial movements. So we used bearing with lead screw to allow its movement radially and movement of lead screw through bearing up and down. Ball bearing contains balls and these balls transmits masses through it. Here bearing is fixed in one place and lead screw is moved through it using balls in bearing for mixing of drugs in precisely manner. Bearings require only small maintenance like oiling, changing of balls so it is quite easy for maintenance purpose.



Fig. 4. Ball Bearing

4.4 ARDUINO

The whole operations of drug mixing are controlled through arduino module. Now a days arduino is most popular microcontroller used for programming different electronic circuits. Whole programming in arduino is done in C language. So programming through arduino is very simple and easy. Arduino consists of different sections of input and outputs to control devices attached to it. Stepper motor operation is controlled by stepper motor driver IC's which are programmed through arduino. The input is given through keypad which then processed through arduino to



Fig. 5. Arduino UNO

amount of drug is going to dispense, how much degree should be given to motor to perform motion of lead screws. perform different calculations to mix drugs like how much amount has to be mixed, from which container how much To compile the whole program and run we just need arduino software installed in our laptop. It gives 5 volts of output ,so we have connected a 12V adapter to arduino to drive driver IC's. which require that much amount of supply. Debugging is quite easy if someone knows about arduino little bit. So by using arduino we control the whole operation sets of our drug dispensary system.

4.5 4*4 MATRIX KEYPAD AND 16*2 LCD WITH I2C

To provide input operations to the drug dispensary system we have used 4*4 matrix keypad. We have used 4 keys A, B, C, D from which A and C are used to fill drugs in syringes and B, D to dispense drugs if insufficient amount is their in syringes. Numbers 1 to 6 first provide how much amount of drug we want to mix? And in second step in how much proportions you need to mix drugs from syringes and likewise to perform some other operations. In this model we provided 6 different proportions for mixing of drugs but for grater proportions we can use big keypads. LCD is used to display monitoring of



Fig. 6. 4*4 Matrix keypad and 16*2 LCD with I2C

proportions for mixing of drugs but for grater proportions we can use big keypads. LCD is used to display monitoring of process. It shows the status of every process that is occurring in drug dispensary system while working. But LCD contain 16 pins connections to arduino which makes it more complex. To overcome this problems we used I2C adapter module. By using this adapter module we require only 2 pins to connect to the arduino which are scl and sdi, which makes system more and more simple and easy.

5. CONCLUSION

The Precise Drugs Dispensing System has significantly improved the delivery of Pharmaceutical Service to a large acute industry. The study confirms the finding of an earlier study using the different type of automated system in view of the size of the system, this result are potentially applicable to both Hospital and community pharmacy along with a pharmaceutical industry. By using lead screws it can operated in high temperature region very precisely. Thus it is maintenance free and cheap compare to other system because of high performance in critical conditions. We can mix different drugs into different proportions for manufacturing from a single model so it is not space consuming and operated very easily by giving simple inputs hence can be used easily by any person in pharmaceutical industry.

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BIOGRAPHIES



I am Sandesh Malvankar, I am studying in TY Electronics Engineering. Project idea came into mind while we are discussing issue on industry automation in pharmacy domain.



I am Amol Vaidya. The project idea came in my mind while we was studying the course based on industrial Automation I find it quite interesting and decided to prepare a model that is used in industrial Automation



I am Akash Alekar studying in Vishwakarma Institute Of Technology. While performing project we face many problems about how to mix drugs very precisely , we overcome this problem by generating our own equation.



I am Viraj Deochake. I am studying in Third Year Electronics Engineering in Vishwakarma Institute of Technology.