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A Survey on Automatic Liquid Dispensing and Database Management Robotic Systems.

Benishia B Christo*, and MS Sheeba.

Department of ECE Sathyabama University, Chennai, Tamil Nadu, India.

ABSTRACT

Many harmful chemicals are being used in the industries in the upcoming days for various purposes like electronic industries and textile industries etc. These chemicals can be harmful for human beings if they come in physical contact with it. Hence these chemicals need to be secured and obtained automatically without any human intervention. This is an automated dispensing robot, which is designed with a graphical user interface which gives the location where the chemical is needed. Now the dispenser moves to that location. The system can be accessed by a biometric system. The amount of chemical needed is given by using a keyboard and the fuzzy logic is used to program the micro controller to dispense the required amount. The detail of the person who accessed the system and the amount of liquid dispensed along with the time it was dispensed is updated in a webpage. The details of the persons who used the liquid can be viewed any time in a weekly and daily basis using a graphical user interface (GUI). Hence it is more useful in industries for dispensing of very harmful chemicals that cannot be in direct contact with the skin of human beings.

Keywords: Microcontroller, Dispenser robot, .NET, Jet dispensing systems.

Corresponding author

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INTRODUCTION

Automatic dispensing systems are most widely used in the medical field for storing and dispensing drugs. These are helpful for many patients who are not able to remember to take their medicines and for various other purposes. This reduces the man power needed in the hospitals. In many industries there are some harmful chemicals used for various purposes. Some of the toxic chemicals are ammonia which is used in textile and industrial refrigeration systems etc.

Fig 1: A Juice Dispenser

Arsine is used in electronic industries in the manufacture of semiconductors. The particle form of ammonia is dangerous to human health and the gas form is dangerous to animals and agriculture. It causes asthma, coughing and lung problems. If arsenic is consumed by a human being it can cause rapid poisoning and skin problems. Hence such chemicals must be handled with extreme care. In this system the persons does not have to handle the chemical directly. It also gives the accurate amount of chemical that is needed.

DIFFERENT METHODOLOGY:

There are various types a liquid can be dispensed based on its applications and requirements. Some of the various methods in which a liquid can be dispensed automatically are discussed.

Medical Applications:

Karat Thanaboonkong, Jackrit suthakorn (2014) this paper is for robotic drug storing and dispensing systems for a hospital have used auto guided vehicles for the storing and dispensing process. A database consists of the drugs that are available and the box in which it is stored. There are 2 main processes in this system. One is the automation system and the other is the drug delivery system.

In the robot and automation system a head person updates the drugs that are available on a regular basis. All the drugs available in the storage are registered.

When new drugs arrive they are kept in a box that is attached to bar code that contains the information of the drugs. A robot moves its end effector and scans the bar code and sends the information about the drug to the database. Now when a drug is required in a ward the information is sent to the central information system. When the head approves of the drug the robot moves its end effector to the requested drug. It checks the drug before grasping it and places it on a conveyor belt which sends the medicine to the AGV (Auto guided vehicle).

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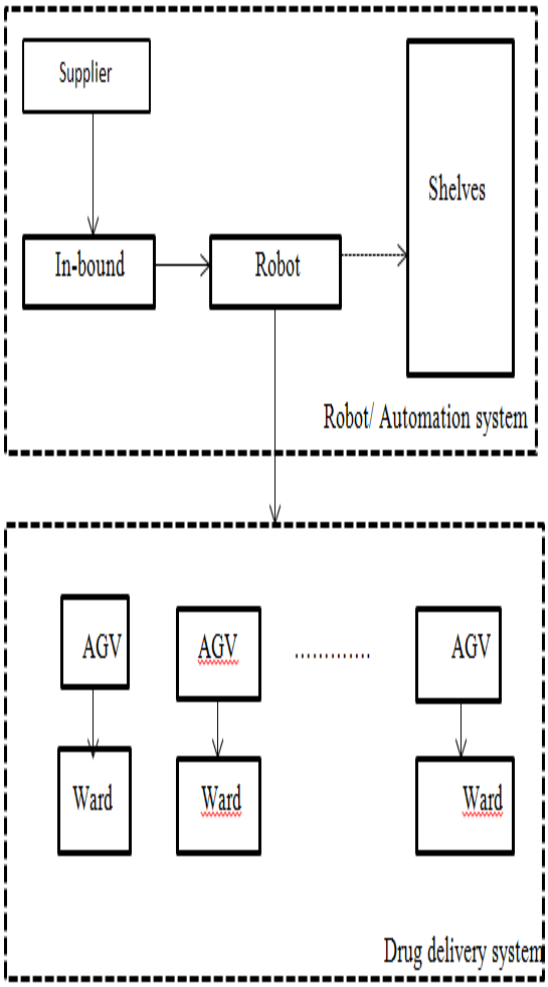

Fig 2: Robotic drug dispensing system overview

Now staffs take the drug and give it to the ward where the drug is needed. This process reduces the time taken for dispensing but it is tedious and requires man power. (Refer Fig 2).

Yasothaa Kalai Chelvam , Norshuhani Zamin (2014) This is an automatic patient tracking and medicine dispensing system using a robot. This system consists of an infra-red attached to each patient in the form of a bracelet. The robot tracks the patient using this infra-red sensor and the medicine has to be taken care of by a person. This system can be used for patients having ageing problems and forget to take their medications properly. This robot tracks the time, patient and the medicine to be dispensed to the patient. Instead of using the IP address to find the location the patient they have used infra-red as the smart phone technology approach is not recommended for the elderly patients. The patient is attached with a sensor that can communicate with the robot.

It is made up of touch sensor, infra-red sensor, ultrasonic sensor, steering motor and dispensing motor. Touch sensor detects when the button has been pressed. Ultrasonic sensor is used to find the proximity. Steering motor is used to move the root to the needed location and dispensing motor is used to dispense the drug.

Liquid Dispensing Applications:

Ezekwe Chinwa Genevra (2014) This is a microcontroller based self-dispensing system. When the user specifies the instruction the system dispenses the given liquid which is achieved by using a cup sensor. The use of cup sensor is to detect the presence of the cups and to avoid the overflow of the liquid. Hence only the

needed amount is dispensed from the module. The micro controller can be programmed by using a high level language program or an assembly language program.

An electronic keypad can be used to input the amount of fluid needed. LM358 cup sensor can be used for this application. An LCD is present where it displays to enter the amount of liquid that should be dispensed. There is also a reset button which can be used to reset the system to cancel a process when the amount is already mentioned and the liquid is not needed later on. At first the assembly language program for the system is compiled. Then the simulation of the design is done using Proteus. The components are soldered and the control system is ready. Then the system is tested for final result. This system gives a minimal percentage error.

Anoop Raghav S, Ajith S. R (2014) The dispenser core of this system is made up of polyfimethylsiloxan. It consists of a Graphical user interface (GUI) where the location where the liquid is needed is mentioned. The micro positioner is adjusted automatically to that location. The minimum amount of liquid that can be dispensed is 4 nl. The dispenser core is filled with the liquid using the syringe pump. The dispenser core is attached to the micro positioner is a vertical manner. The liquid is injected into the dispenser core through the top part and the bottom part consists of a micro pipette.

The syringe pump is used to prevent the back flow of the liquid. The figure 3 shows the micro pipette. The GUI interface is used to control the movement of the micro positioner using the joystick. An USB microscope gives the live video of the location at the tip where the micro pipette is positioned. A reset button is also provided to move the position of the micro positioner to the initial location.

Fig 3: Micro pipette

Xiuyang Shan, Yun Chen (2014) This paper discusses of the jet dispensing system. The whole process is divided into 3 parts. This system is developed for steady state flow of liquids. It consists of a nozzle. The fluid is driven to the nozzle by using needle. There is a fluid filling state and fluid jetting stage. In the filling stage the needle moves in the upward direction. The fluid fills the space left by the needle.

During the jetting stage the needle is moved downwards and it forces the fluid outside the nozzle. Here the fluid flow should be incompressible and laminar. The below figure 4 is an illustration of the jet dispensing system.

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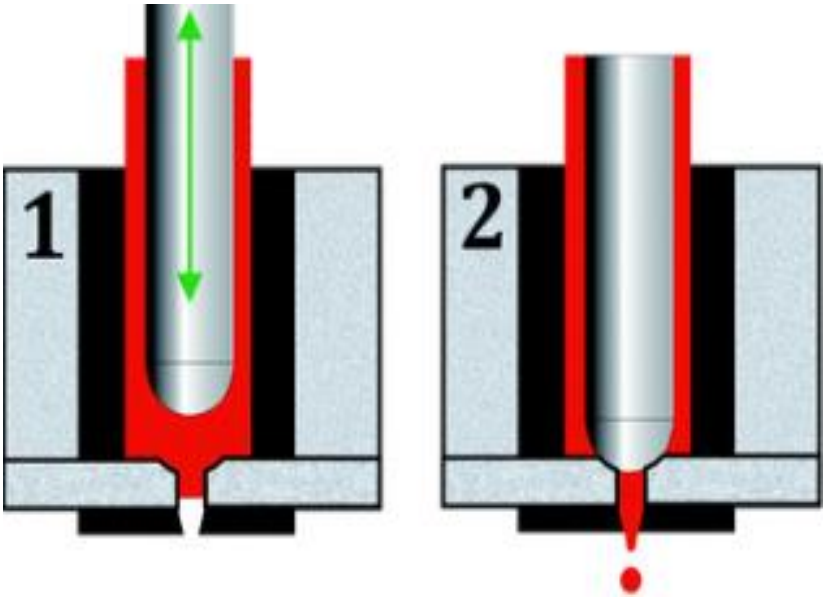

Fig 4: Jet dispensing system

Faizan Mehboob (2012) paper deals with a multi-purpose robotic dispenser system with database management module. The mobility of the system uses the line follower robot to move the dispenser to the location where the fluid is needed. The dispenser unit is placed on the line follower robot built with the DC motor. Three circular discs are placed on the top that can be used to dispense three different types of fluid at different locations. There is a GUI where the location where the liquid needs to be dispensed is given. It maintains a database of the liquids available.

When the liquid is needed in a location, the location is identified using an IR sensor and the robot moves to that location and the needed liquid is dispensed. The line follower goes along the line by finding the boundaries of the line. The records in the database need to be manually updated on a regular basis. SQL is used to maintain the database. The liquid that needs to be dispensed can be indicated to the robot by checking or marking that particular liquid in the database. This robot can mostly be used in medical applications for dispensing the drugs to the patients. There is also a protected login system to get the liquid from the system.

Ya-Ping Shi, Qun-Feng Niu (2011) This paper is a networking flow measurement and control system using .NET. The level devices and management devices are placed on-site. These devices can be controlled from the main plant using visual basic 2005. It collects the liquid and the data is collected in a database in a remote area using this visual basic. MODBUS is used to send and receive the information in the form of packages. ASCII protocol is used here, hence the characters are sent in the ASCII form.

The flow of the liquid is controlled by using the micro controller. When the input is given, the pump starts working and the liquid is dispatched. The amount of liquid dispatched is sent to the computer using a serial port. RS232 can be used here. The system is connected to the database using visual basic 2005 and it is interfaced using ADO.NET and structured query language (SQL). LRC check is used for error checking of the data. The amount of liquid to be dispatched is given in the on-site PC. When the amount of liquid is dispatched it is again reset to 0.

Jinhuang Huang and Jun Xie (2010) tells about an intelligent water dispenser based embedded system. It can be used in automatic fountain applications with temperature control. The real time temperature is measured along with the calendar for the date and time for the fountains. The microcontroller used here in MCU 89C52. The different modules are shown in Fig 5.

A variable power heating, intelligent control, Remote control, temperature control, cooling system is interfaced with the MCU89C52 micro controller. It consists of a display module, cooling module, heating

module, clock module, keyboard module, temperature acquisition module interfaced with the microcontroller which provides a user interface for the input and the output systems.

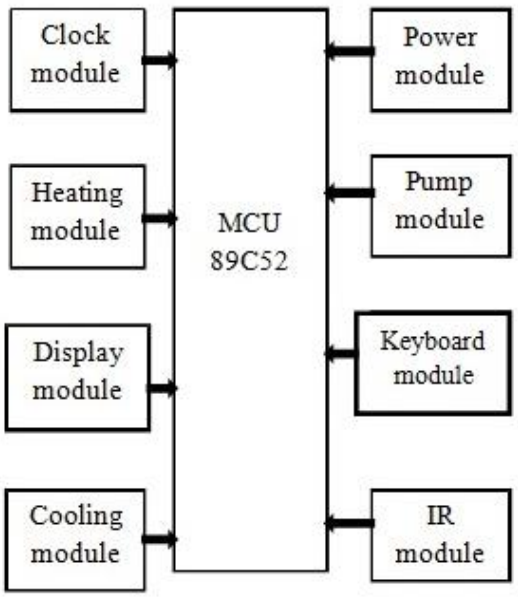

Fig 5: System solution diagram

Author	Title	Method	Disadvantages
Karat Thanaboonkong and Jackrit Suthakorn	A Study and Development on Robotic Drug Storing and Dispensing System in Drug Logistics	Robot/ Automation and drug dispensing system.	Requires man power for database management.
Yasothaa Kalai Chelvam and Norshuhani Zamin	A Design of Automated Patient tracking and Medicine Dispensing Mobile Robot for Senior Citizens	Infra-red sensors to locate the person and Robot to dispense	If the patient removes the IR bracelet they cannot be located.
Ezekwe Chinwa Genevra and Mbonu,E.S	An Effective Approach To Designing and Construction of Microcontroller Based Self Dispense Detecting Liquid Dispenser	Cup sensor and LCD for display	Only particular amount of liquid can be dispensed according to the size of the cup.
Anoop Raghav S, Ajith S. R and Pramod Murali	Design of an Automated Dispenser Unit	Micro positioner and Micro pipette	It can be used only where small quantities of liquid are needed.
Xiuyang Shan, Yun Chena, Xianan Penga and Hanxiong Li	Modeling of Laminar Fluid Flow in Jet Dispensing Process	Jet dispensing	Used for laminar flow.
Faizan mehboob	A Novel Multi-Purpose Robotic Dispenser with Database Management System	Line follower robot, circular disc.	Liquid can be delivered only to particular location.
Ya-Ping Shi and Qun-Feng Niu	Design of Networking Liquid Flow Measurement and Management Control System Based on .NET	.Net, Visual basic 2005.	Automatic update not available.

Table1: comparison table

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CONCLUSION

This survey paper discussed various dispensing techniques that can be used in various applications according to its purposes. Micro controllers, jet dispensing systems, Micro pipette, Cup sensor can be used for dispensing the required amount of liquid needed. When harmful medicines are used it needs to be secure and a database is updated in the web page which can be used to contain the necessary information about the amount of liquid dispensed and the time at which it was dispensed. To acquire more accuracy fuzzy logic can be used to determine the amount of the liquid that needs to be dispensed. When the amount of liquid present in the storage container is full, the time for the solenoid valve to be open is minimum. When the amount of liquid present in the storage container is half full the time for the solenoid valve to be open is medium. When the amount of liquid present in the storage container is almost empty, the time the solenoid valve should be open is maximum according to the amount of liquid to be dispensed.

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