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AN AUTOMATIC LIQUID DISPENSING ROBOT WITH DATABASE MANAGEMENT AND BIOMETRIC SECURITY SYSTEMS

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ABSTRACT

A dispensing system is a system designed to respond to the user's instruction to dispense the liquid. This paper discusses an automatic dispensing system with a biometric security system such as a finger print analyser. The finger print analyser checks the authorization of the person who wishes to access the liquid. As many harmful chemicals are used in industries today, it should be kept protected for safety issues. Auto guided vehicles such as a line follower robot can be used to take the vehicle to the place where the liquid is needed. Now the user gives the amount of liquid needed. This information is given to the micro controller which uses the fuzzy logic algorithm to decide how long the solenoid valve should be open. If the level of water in the tank of the dispenser is more, the pressure of liquid coming through the valve is more and vice versa. Now the database collects all the information as to which user accessed how much amount of liquid at what time. This information is stored in a weekly and daily basis for ease of the viewer in a GUI (Graphical user interface). The administrator of this system can be given the authority to authorise any other persons to access the liquid in the system. These systems can be used in industries were harmful chemicals that cannot be touched by human beings are used.

Keywords: microcontroller, fuzzy logic, biometric security, database management.

1. INTRODUCTION

In earlier days the dispensing systems were used in the medical field for storing and dispensing the medicines. They were used for patients with diseases like Alzheimer's so that the patients don't forget to take their medications. Now a day's many harmful chemicals are used in industries for various purposes. These chemicals can cause harm to human beings if they come in direct contact. This is the purpose for the automatic dispenser unit. It can also reduce the manpower used for each application. Ammonia is a chemical that is used in textile and industrial refrigeration industries. This can cause lung problems and coughing etc. Another example is arsine which is used in semiconductor industries. This can cause rapid poisoning and skin problems. These are a few examples of chemicals that are used in industries but are harmful for human beings. Here we discuss about an automatic dispensing system along with a biometric security for safety measures and a database management system to give information of the liquid that is in the system and the amount of the liquid that is dispensed. Here we use a simple PIC micro controller to improve the efficiency and cost effectiveness of the system.

2. LITERATURE SURVEY

This system has been developed for both medical and industrial purposes. Karat Thanaboonkong, Jackritsuthakorn (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.

YasothaaKalaiChelvam, NorshuhaniZamin (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.

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.

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.

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.

FaizanMehboob (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.

Ya-Ping Shi, Qun-FengNiu (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.

Jinhuang Huang and Jun Xie (2010) tell about 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.

3. OVERVIEW OF THE PROJECT

This project consists of different modules. There is a biometric security module, a service robot module, a dispensing module and a database management module. A simple block diagram of the entire project is given in fig 3.1. The microcontroller helps in working of the different modules together in an order to dispense a liquid.

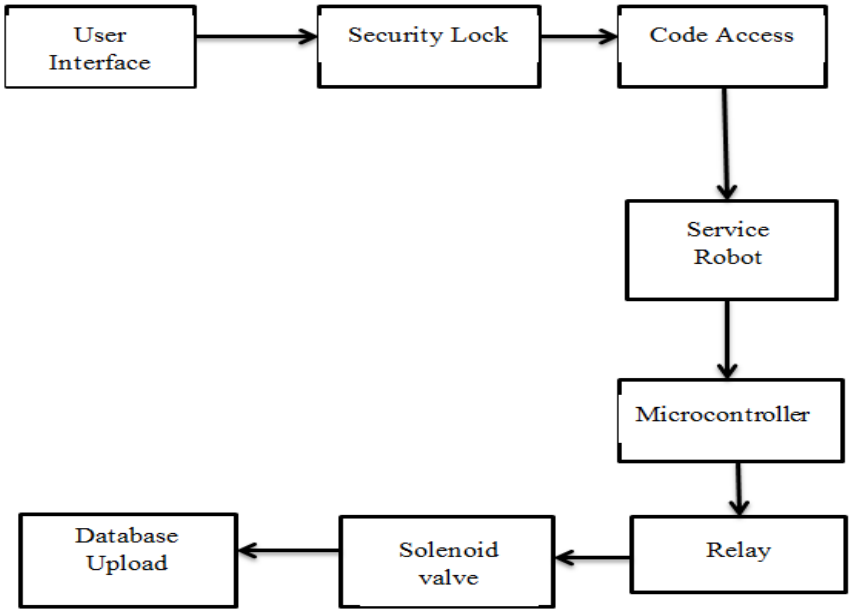

Figure-1. Block diagram of dispensing system.

In the latter parts of the paper we shall see the working of the different modules of the system and how they work together to get an efficient output in the dispensing system. Here there is a user interface to get the fingerprints of the user who needs to access the system. The admin can also register using the register icon provided in the front panel.

Now the system moves to the location where the liquid is needed and the amount of liquid needed is give via the user interface provided. The microcontroller is programmed based on the fuzzy logic algorithm to dispense the amount of liquid i.e., open the valve of the dispenser based on the lever of the fluid in the dispenser tank. All these information are collected in a database and can be viewed by the administrator of the system.

3.1 Biometric security module

Here a fingerprint scanner is used as a lock for the automatic dispenser system. The front end of the scanner is designed using visual basic. We have provided 2 icons in the screen. The first one is register. The administrator of the system has the access to this. We collect a set of five finger prints for a single person for the purpose of accuracy. This data is stored in an excel sheet. The other icon that we have used here is match.

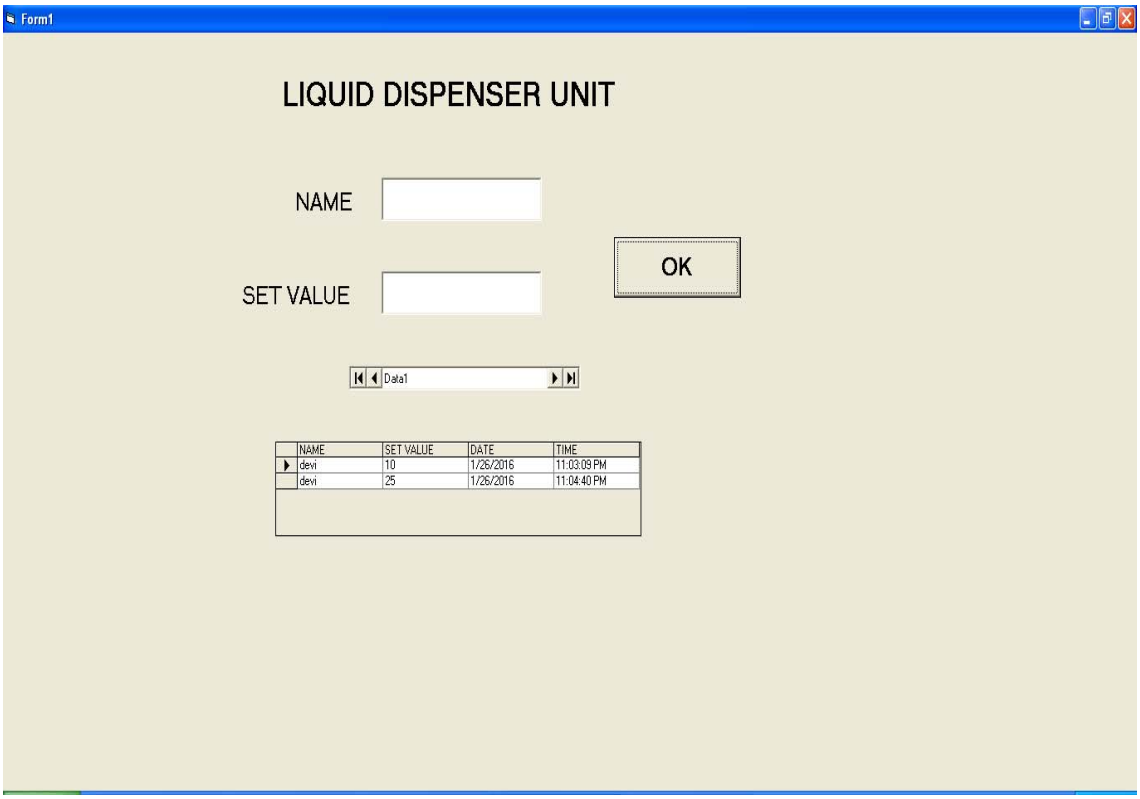

Figure-2. Front end of biometric security system.

When a person needs access to the system, the fingerprint is obtained and matched with the list of finger prints already collected. If the match is found then the person is allowed to access the system. If the match is not found the words "unauthorised" appear on the screen. The front end of this system is shown in the Figure-2.

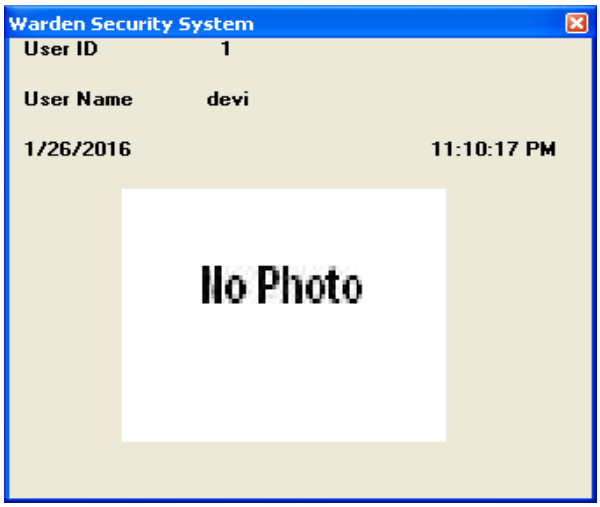

Figure-3. Warden security system.

For convenience here the digital persona u are u 4500 fingerprint scanner is used. This is connected to the PC via the USB interface of the scanner. This scanner stores all the information in the PC's excel sheet. Once the fingerprint is authorised the service robot moves to the place where the liquid has to be dispensed. If the person is unauthorised they need to register with the administrator. Then the access is provided to that person too. The front panel consists of all the options which make it easy to use.

3.2 Service robot

When the authorisation test has been passed, the system is moved to the place where the liquid needs to be dispensed. The DC motors are used here. For this project we use simple forward and backward movement. When a switch in the front end is pressed the motor moves to the location where the liquid is needed. The DC motors are connected to the PIC microcontroller. This microcontroller is programmed using the embedded c language. This helps in the forward and the backward movement of the dispenser system. The input 00 to the controller helps the system to move forward while the input 11 to the system helps the system to move backward.

3.3 Dispenser system

This system consists of a solenoid which is connected to a relay. This relay is connected to a port of the microcontroller. This relay is used to open and close the solenoid valve. When the amount of liquid needed is entered, the microcontroller takes that value and implements the fuzzy logic algorithm to determine the amount of time the valve needs to be open. Based on the level of the liquid in the dispenser tank, the time period the

valve should be opened is determined. This logic is implemented using the embedded c language and is embedded into the microcontroller. When the amount of liquid needed is entered, the level of the tank is determined using the level sensor. Based on these 2 values the time period the valve should be open is determined. When the valve is opened the liquid in the tank is dispensed. The model of this dispenser system is shown in Figure-4.

Figure-4. Dispenser setup.

3.4 Database management

All the information is stored in a database in the form of an excel sheet. The information of the person who accessed the system is obtained from the fingerprint scanner. The amount of liquid accessed is got by the amount of liquid dispensed from the solenoid valve. The time in which the liquid was accessed is obtained from the clock in the PC. All these can be viewed in a daily basis or in a weekly basis. For future scope this can be uploaded to a webpage for remote access. But here we have used a simple excel sheet for this purpose. The database is accessed using the visual basic using Microsoft access 7.0 using this database can be updated automatically from the visual basic directly. This Microsoft access combines a jet database engine with a GUI (graphical user interface) and software development tools.

4. CONCLUSIONS

This dispensing system can be used in industries for storage and dispensing of the harmful chemicals that are used in the industries. It can also be used in hospitals for dispensing of drugs. This system is cost efficient and improves the efficiency of the system. It reduces the man power involved in the process and also increases of the safety of the persons that are handling the chemicals. This system can also be internet enabled so that the information of the system can be accessed from any remote location. For implementation purposes a line follower robot can also be used as a service robot while implemented in industries. A micro dispenser can be used where the liquid needs to be dispensed in very small quantities.

5. RESULTS AND DISCUSSIONS

The amount of liquid dispensed is determined by using a level sensor placed in the cup where the liquid is dispensed. The below table shows the results and the error percentages. There is a little variation between the desired output and the actual output. The experiment is conducted 10 times and the various results obtained are tabulated. The Table-1 shows the results that were obtained using the level sensor in the cup where the liquid is dispensed.

Table-1. Results obtained from level sensor.

Desired output	Actual output	Error
10ml	9.8ml	0.2
10ml	9.5ml	0.5
10ml	9.9ml	0.1
10ml	10ml	0
10ml	9.6ml	0.4
10ml	9.4ml	0.6
10ml	9ml	1
10ml	9.7ml	0.3
10ml	9.9ml	0.1
10ml	9.8ml	0.1

REFERENCES

[1] Karat Thanaboonkong and JackritSuthakorn. 2014. Study and Development on Robotic Drug Storing and Dispensing System in Drug Logistics. International conference on Robotics and Bio medical.

[2] Yasothaa Kalai Chelvam and Norshuhan Zamin. 2014. A Design of Automated Patient tracking and Medicine Dispensing Mobile Robot for Senior Citizens. International conference on computer, control and communication technology.

[3] Ezekwe Chinwa Genevra and Mbonu E.S. 2014. An Effective Approach To Designing and Construction of Microcontroller Based Self Dispense Detecting Liquid Dispenser. International conference on Robotics and Automation.

[4] AnoopRaghav S, Ajith S. R and PramodMurali. 2014. Design of an Automated Dispenser Unit. IEEE CONECCT.

[5] Xiuyang Shan, Yun Chena, XiananPenga and Hanxiong Li. 2014. Modeling of Laminar Fluid Flow

in Jet Dispensing Process. 15th International conference on electronic packaging technology.

[6] Faizanmehboob. 2012. A Novel Multi-Purpose Robotic Dispenser with Database Management System. 17th international conference on Robotics and Embedded systems.

[7] Ya-Ping Shi and Qun-FengNiu. 2011. Design of Networking Liquid Flow Measurement and Management Control System Based on NET. 4th International Conference on Biomedical Engineering and Informatics (BMEI) 2011.

[8] Zusheng Cao, WenlongCai, Yizheng Lin. Visual basic 2005 fully development guides. Beijing: Science Press. 2007.10.

[9] Park K. and Lim S. 2012. Construction of a Medication Reminder Synchronization System Based on Data Synchronization. International Journal of Bio-Science and Bio Technology.

[10] Russel S., Norvig P. 2013. Artificial Intelligence: A Modern Approach (3rd ed.). Prentice Hall.

[11] F. Reverter, M. Gasulla and R. Palhls-Areny. 2007. Analysis of power-supply interference effects on direct sensor-to-microcontroller interfaces. IEEE Trans. Instrum. Meas. 56(1).

[12] F. L. Chun. 2009. Anti-wetting trench of nozzle plate for piezoelectric actuating dispenser. in IEEE Trans.

[13] Jinhuang Huang and Jun Xie. 2010. Intelligent Water Dispenser System Based on Embedded Systems. in IEEE Trans.

[14] E. Sifuentes, O. Casas, F. Reverter and R. Pallils-Areny. 2007. Improved direct interface circuit for resistive full- and half-bridge sensors. Fourth International Conference on Electrical and Electronics Engineering ICEEE Mexico.