

Internet of Things (IoT) Based Supervision of a Pharmacy Store

Trupti Kapse¹, S. M. Kulkarni¹

¹Department of Electronics and Telecommunication, MITCOE, Pune-411038, (India)

ABSTRACT

For the past 15 years since its appearance, Internet of Things (IoT) innovation has been driving the planet towards a brilliant world where all gadgets and physical items, referred to as things, will be connected via electronic sensors through the Internet. The conveyance of medicine to patients at a pharmacy in specific locales is still extremely customary and obsolete. Patients wait for a long time in queues to get their medicines; this is mostly because of the nonappearance of an effective appropriation framework. Additionally, the refrigeration temperature inside several pharmacies is of a huge concern, as medications must be kept at a consistent temperature for ideal outcomes. In this we propose a basic and solid way to deal with supervision of a pharmacy store, the strategy depends on electronic sensors associated with Raspberry Pi, to carry out a medicine audit and furthermore to control the refrigeration temperature inside pharmacy shelves. The execution cost of such frameworks is significantly less expensive than software based system; this makes such frameworks appropriate for underprivileged areas. This framework was composed and worked for a pharmacy but it can be generalized for different purposes.

Keywords :IoT, Raspberry Pi, Touch Switch, Temperature Sensor, IR sensor, Relay, Python, VNC viewer.

I. INTRODUCTION

It has dependably been a central need on the planet to enhance hospital infrastructures in terms of electronic gadgets and equipments, as it gives more productive social insurance to patients. The Internet of Things (IoT) innovation acquired a new vision in the world of technologies which is applicable in different fields. A very detailed work on expressive models for IoT is displayed in [1] and a procedure definition language for IoT in [2].

In the medical world, more precisely in a pharmacy environment, IoT can be connected for example to the inspecting and the tracking of prescriptions. Likewise, IoT can significantly reduce the paper work needed when checking medications in or out from the pharmacy, which is somewhat the reason for long lines for patients at tellers. A review was performed in the pharmacy of the Helen Joseph Hospital situated in Johannesburg, South Africa, in order to investigate possible improvements on the present framework. A couple issues in the drug store working were watched, as long lines of patients at tellers, paperwork based framework, pharmaceutical refrigeration checking issues and prescriptions put in disorder on shelves.

A framework was composed and created to partially solve the issues that were mentioned above. The mind of this framework is a Raspberry Pi which is a microcontroller provided with open-source software and hardware integrated development environment (IDE) for project developments. The Raspberry Pi was decided for the few elements that it has, like shield compatibility, Wifi/Ethernet library compatibility, real time clock, micro SD



card support, USB host port, serial connectivity, linux on board, Peripheral Component Interconnect (PCI), two-wire serial interface (TWI)/inter-integrated circuit (I2C) and serial peripheral interface (SPI) support [7]. Much work has been done on the utilization of IoT in the field of medicine and human services.

For instance, an expansive review was done in [6], where uses of IoT were highlighted in medicinal smaller scale fields, for example, telemedicine, mobile medical care, medical information management, medical equipment and medication control. However, this work like many others is absolutely theoretical in the sense that there was no case study considered and therefore few efficient results on the applicability of IoT in the medical and health care domain.

In this paper, a proficient and basic framework is proposed to screen the distribution of medication in a pharmacy, and furthermore to control the pharmaceutical refrigeration temperature of medicines. This approach characterizes a framework made of hardware and software components. It is a user friendly framework including a basic Graphical User Interface (GUI).

II. LITERATURE SURVEY

In the field of medical and health services, real uses of the Internet of Things incorporate medical devices and pharmaceutical control, medical data administration, telemedicine and mobile medicinal care. With the assistance of perception technology of material administration, we can screen the entire procedure of generation, conveyance and medicine tracking of the medicines in a pharmacy store.

In particular, the use of the Internet of Things in the observing and administration of the pharmacy store incorporates the accompanying perspectives. In the event that RFID technology can be connected to the capacity, utilizing and assessment of pharmaceutical, it will streamline manual and paper recording, avoid short supplies of pharmaceutical and made medication distribution, much more convenient. In this way to stay away from the confusion of similar medication names, measurements and dose shapes, enhance pharmaceutical administration and shield timely supplies of medication[6].

The presence of medication errors is of particular concern because majority of these errors are preventable. Hence an efficient electronic system can help us manage efficiently. Existing systems are software-based systems, for example, library rack administration systems. These systems require visit updates and maintenance. The framework was produced utilizing Radio Frequency Identification (RFID). The exploration was produced in coordinating the RFID framework and the making of Graphical User Interface (GUI) at the host PC. The extent of work of the exploration is to build up a programmed library rack administration framework to help the bookkeepers for more productive rack administration to locate any lost books on the library shelf. The GUI errand is to store points of interest data of the book to the database. Hence a Shelf ID was made and coded to the RFID tag. The framework at that point utilized this code to locate any lost book on the chose shelf[4].

Another approach is outline of Internet of Things System for Library Materials Management Utilizing UHF RFID. With RFID applying in library, this paper builds up an Internet of Things Framework for Library Materials Management utilizing Android based UHF mobile reader (Android mobile reader) as its entrance to expand the proficiency of library materials administration. The elements of the Internet of Things System for

III. SYSTEM OVERVIEW

A proficient and basic framework is proposed to monitor the appropriation of medication in a pharmacy, and furthermore to control the pharmaceutical refrigeration temperature of medications. This approach defines a framework made of hardware and software components. The proposed framework made utilization of electronic sensors namely the touch and temperature sensors. It is a user friendly system featuring a simple Graphical User Interface (GUI). This kind of interacting framework is very advantageous as the risk of making mistake is reduced and also computer illiterate persons can use it. The greatest preferred standpoint is that every one of the exchanges are recorded on the cloud, this permits the manager to access and monitor data remotely. This system is to designed to partially solve the problems in the current system in pharmacies which is purely paperwork based.

IV. IMPLEMENTATION OF THE SYSTEM

The proposed approach for a Pharmacy Monitoring System (PMS) was detached into two subsystems, to be specific the Medicine Distribution Monitoring Subsystem (MDMS) and the Temperature Control Subsystem(TCS)

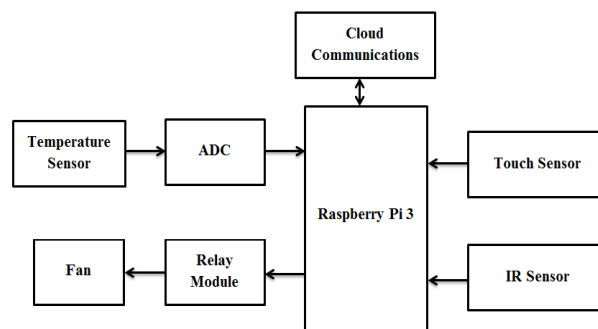


Fig 1: Block diagram of proposed system

A. Design of the Medicine Distribution Monitoring Subsystem (MDMS)

The MDMS manages the drug appropriation using a database for each one of the meds in the drug store and they are arranged in racks as per their use. To look at prescription in or, a teller picks the appropriate rack by means of a touch sensor. Furthermore, the teller is required to indicate the quantity of units required. The IR sensor is for the detection of the medicine when it is being picked. Even the quantity of medicine can be determined by utilizing IR sensor for the object counting purpose. In any case, all exchanges are recorded on the cloud. This framework additionally monitors the amount of every class of medication in the store. There is a real-time update of the quantity of medication from the cloud at any time when an exchange is finished. Additionally when the store is running out of a product, the manager is notified via a cell phone message and/or by email.

For the purposes of the implementation, a pharmacy made up of four racks is considered with each rack containing two types of medicine. Raspberry Pi 3 is being used with Raspian as the operating system a Debian-based Linux distribution. Python is the main programming language. Python underpins different programming styles, including object-oriented, basic, functional programming and procedural styles. The TTP224 is the 4 way switch digital touch sensor. There are four touch switches that represent four racks in the store. At the point when a rack is chosen its comparing LED swings on to advise the client of the correct rack determination. After selecting the appropriate rack, the user specifies the medicine name as well as the quantity. The medicine then can be handpicked with automatic detection. IR sensor is used for this purpose. The quantity of the medicine thus gets refreshed.

B. Design of the Temperature Control Subsystem (TCS)

A 5 V input micro controller board is used to drive a 230 V input fan motor via a relay module. A temperature sensor is connected to the same micro controller. This performs complete monitoring of the room temperature via the GUI. The temperature of the room is detected and the relay is activated for the fan engine to be on and its speed is controlled to get a preset temperature. The temperature report of the room is additionally available from the cloud. The temperature sensor, LM35 is connected to the Raspberry Pi as well. It is programmed to trigger the relay module when the temperature of the room exceeds certain threshold level.

Basically the PMS was expected to encourage the dissemination of solutions to the patients and furthermore to make the work of the tellers less demanding. From a paper-based work framework where all medicine exchanges were done physically, this framework proposes an efficient approach where the teller interacts with the electronic sensors to choose the appropriate medications and sign them out to the patients. The real advantages of this approach is that every one of the exchanges are recorded on the cloud, it depends on electronic sensors in this way the chances of making a mistake when checking medication in or out, or a system failure, is much less compared to full computer based systems. Also, computer illiterate people can still use it, especially old persons as the system GUI is purely for reading purposes.

C. Cloud Communications

All classifications of medicines from the five racks are effectively enrolled in the database using phpMyAdmin software tool. VNC viewer can be used to remotely connect Raspberry Pi to laptop. PHP is used for the development of the webpage where results can be viewed.

V RESULTS

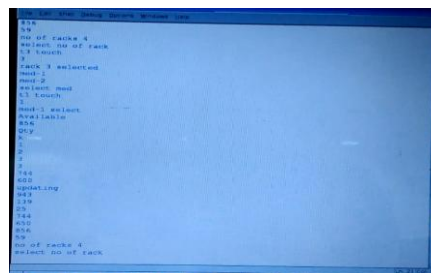


Fig.1 : Output obtained by executing the python code.

Fig. 1 shows the executed python code for the medication auditing. Fig. 2 represents the temperature monitoring graph. From this graph, we can track the temperature of the store at any point in time.

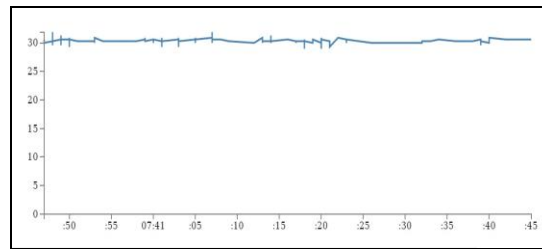


Fig. 2: Temperature Monitoring

Fig. 3 shows the MySQL account for the database entry. The initial amount of every item is preset in the system when the medication is stacked on the rack. Alterations can be made only by the user who holds the access to the MySQL online account. Fig. 4 shows the monitoring of the medicines from the racks. We can observe the remaining stock units.

Table	Action	Rows	Type	Collation	Size	Overhead
rack1	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16 KiB	-
rack2	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16 KiB	-
rack3	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16 KiB	-
rack4	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16 KiB	-
rack11	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16 KiB	-
rack12	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16 KiB	-
rack13	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16 KiB	-
rack14	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16 KiB	-
8 tables Sum		8	InnoDB	latin1_swedish_ci	128 KiB	0 B

Fig. 3: Manage MySQL account over the web



Fig.4 : GUI showing the medicine stock

Next Fig.5 shows the list of medications that the user will be notified about when a certain threshold is reached. In the Fig.5, we can observe that the Med1 alerts for the rack 1 and rack 4 are turned on, the limit was set to 10. Hence whenever the quantity of a product will be less than 10, the user will get a proper notification



Fig.5 : Medicine Alert

VI. SYSTEM ANALYSIS

From the outcomes displayed in the previous segment, the checking and distribution of medicines and the temperature control in a drug store can be performed with a straightforward and solid system in light of IoT. . Be that as it may with the use of electronic sensors, the client collaborates physically with the system which makes the use simpler, diminishes the odds of committing errors and requires less upkeep work. This sort of system is exceptionally proper for underprivileged drug stores. Additionally it decreases the paper based work since all exchanges are saved on the cloud which encourages the observing and examining of the firm for accounting purposes.

VII. CONCLUSION

A way to deal with the supervising the medicine conveyance as well as controlling the temperature of a drug store was exhibited. This framework was planned and executed effectively to mostly explain the present framework in a few drug stores which is simply printed material based. The proposed framework made utilization of electronic sensors, to be specific the touch and temperature sensors. This sort of collaborating framework is extremely favorable as the danger of committing error is diminished and furthermore computer related uneducated people can utilize it. The greatest favorable position is that every one of the exchanges are recorded on the cloud, this permits the supervisor to get to and screen information remotely.

This framework shows at the end of the day that IoT innovation is an effective and dependable method for interfacing all electronic gadgets together to bring the entire world before a screen continuously. The IoT have its applications in all fields of science, innovation and building. Having a "brilliant world" where all gadgets will be associated is as yet a fantasy in the sense that a great deal of exertion is as yet important to achieve that state.

REFERENCES

- [1] Y. Huang and G. Li, "Descriptive models for Internet of Things", in Proc. Int. Conf. Intell. Control Inf. Process., Dalian, China, Aug. 1315, 2010, pp. 483486.



- [2] F. Chen, C. Ren, Q. Wang and B. Shao, "A process definition language for Internet of Things", in Proc. IEEE Int. Conf. Service Operations and Logistics, and Informat., Suzhou, China, Jul. 810, 2012, pp. 107110..
- [3] Prof Libby Roughead, Dr Susan Semple, Ms Ellie Rosenfeld, "Literature Review: Medication Safety in Australia", Australian Commission on Safety and Quality in Health Care (2013)
- [4] Ahmad Tarmizi Bin Abdullah; Ismarani Binti Ismail; Azlina Binti Ibrahim; Mohd Zikrul Hakim Bin Noor, "Library Shelf Management System Using RFID Technology", 2011 IEEE International Conference on System Engineering and Technology Pages: 215 - 218, 2011
- [5] Dong-Ying Li, Shun-Dao Xie^{1, 2}, Rong-Jun CHEN^{1, 2, 3}, and Hong-Zhou TAN^{1, 2}, "Design of Internet of Things System for Library Materials Management Using UHF RFID", 2016 IEEE International Conference on RFID Technology and Applications (RFID-TA) Publications Pages: 44 - 48, 2016
- [6] F. Hu, D. Xie and S. Shen, "On the application of the Internet of Things in the field of medical and health care", in Proc. IEEE Int. Conf. Internet of Things and IEEE Int. Conf. Cyber, Physical and Social Comput., Beijing, China, Aug. 2023, 2013, pp. 20532058.
- [7] <http://www.wired.co.uk/article/raspberry-pi-three-wifi-bluetooth-release-price-cost>: