



A SURVEY ON IOT BASED PORTABLE PILL DISPENSER FOR SAFE MEDICATION

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ABSTRACT

Portable smart pill dispenser is an automated pill dispenser for safe medication through proper guidance by a smart-phone application. The mobile application acts as a reminder to take specified pill and monitors the proper intake of tablets. The pill dispenser is an Internet of Things based device which is used to dispense the tablets required based on the physician's prescription. This project is targeted to help people who are under monitored medication and suffering from Alzheimer's, to make their medication process easy. Currently people under such medical conditions either have to rely on some third person to assist their tablet intake or feel difficulty in reading tablet names. It is always possible for medication errors to happen. These errors may cause major health effects, sometimes these may cause death. Having proper dosage of medicine at right time is required to treat any disease. When people take a lot of tablets in a single time, it is possible that they get confused with the order and number of tablets they have to take. Also certain patients who are bedridden and those who are suffering from nervous disorder may consider it difficult to take tablets from various bottles. To overcome all these difficulties we have proposed the automatic pill dispenser which is controlled by an algorithm based on the physician's prescription. The mobile application is used to monitor pill consumption of the patient by the caretaker. The pill dispenser is integrated with the mobile application to receive alert messages and notifications related to the pill dispenser and to provide reminder and monitor the tablet intake. This device is portable and thus people can take it along with them wherever they go. This product can be used to automatically update the pill quantities and thus we can link the device with a local medical shop so that we can get a home delivery of tablets as and when needed. The system can be integrated with a smart watch to monitor if the health is deteriorating even after the consumption of the medicine, mainly in the case of patients with heart disease.

KEYWORDS : Internet of things (IOT), Sensors, Arduino, Mobile Application and Automated Pill Dispenser.

1. Introduction

The Internet Of Things (IOT) is the technological exuberance every device in the world is currently working on. It connects all the non-living immobile things around the living beings to make it a more interactive environment. The main component of any IOT based device is the sensor. Sensors record every difference in the habitat and measure all possible changes. The brain of any hardware is the micro-controller. Similarly the most commonly available micro controller chip used to build an IOT device is the Arduino Board. The Arduino is a self-designable board which can accommodate Universal Serial Bus and Bluetooth functionalities. Mobile phones have become an inevitable part of every human's life. There is a need for a mobile application in order to perform every meagre task. Mobile applications are developed based on the operating system of the mobile device. The most commonly used mobile OS is Android. Android applications are built using the open source Android Studio. In the world of healthcare, applying technology has become very essential. Bio medical engineering is building a vast number of medical devices that incorporate IOT, machine learning, artificial intelligence in collaboration with other streams. The automated pill dispenser is a new advancement to be made in the field of medication. Automation of pill dispensing, health monitoring, pill refill, notification will help the elderly and the differently abled to free them from the tasks of remembering all these processes.

2. Literature Review

Suraj Shinde et al. [1] proposed a very basic medication dispenser. It used a 4x4 matrix keypad, an Arduino controller, LCD display, RTC module, GSM module and an alarm system. It helped patients to take medicines on time by using an alarm clock. Limitation of this system is there is no proper dosage monitoring. The system also does not automate the pill dispensing mechanism.

Pei-Hsuan Tsai et al. [2] presented a medication dispenser that is automated. The medication scheduler and dispenser perform a collaborative action to dispense the pill using embedded systems. It uses the concept of Medication Schedule Specification (MSS). Limitation of the dispenser is its inability to be portable and cannot be monitored from anywhere around the world.

Bharat Bhushan Singh et al. [3] proposed a GSM based pill dispenser. It assists users over the age of 60 who tend to forget their medicine intake. An SMS is generated based on the consumption of the medicine to the family member or the caretaker. It uses GSM as a communication module to provide a human machine interaction. The system is limited in terms of portability. Another important limitation is the rising network issues while communicating between modules.

Andrea Mondragón et al. [4] proposed an automatic pill dispenser in order to improve attention on medical treatment when a patient does not take medicine on time. It consists of two main components; one is a fixed device that functions as the pill dispenser and a portable device that can communicate with the fixed device to synchronize medical treatment information in both devices. The system is limited in terms of weight and portability. It also does not provide any evidence to monitor the medication.

Shashank Shinde et al. [5] presented a smart pillbox with remind and consumption functions. It sends alerts to the user and dispenses pills at a pre requisite time. It has also been designed in such a way that the pill refill is made possible by sending purchases to the chemist. Storage capacity in the system is limited. There is no application which monitors the functioning of the system.

Mohini Reddy et al. [6] developed a device called Avion, an

automated pill dispenser, which uses a combination of mobile application and LCD displays to remind elderly people to take medications at right time. Also it uses different trays to fill the tablets of different sizes.

The main limitation of this project is that there is no proper data exchange between the pill dispensing device and the mobile application for monitoring the proper intake of tablet. Also there is no solution for what happens when a person forgets to take a tablet.

Sanjay Bhati et al. [7] proposed a smart medicine box for those users who regularly take medicines and the prescription of their medicine is very long. It consists of a pill box which uses an EEPROM to save the notification time. A RTC module helps send alerts and alarms from the device. Therefore at the time of taking medicine, the system generates a notification sound and displays the bright light in the required pill boxes. Limitations of this system are it is pre-defined for a set of boxes and cannot be modified. There is no monitoring of the consumption of the pill as such.

J. Medina et al. [8] focused on a portable pill dispenser which identifies the holistic treatment needs of individual patients. This system tries to provide a solution for the problem of forgetfulness and stress with the elders. It provides space to integrate some third party sensors to monitor the patients and their health. The main limitation of this system is that the system does not provide a proper integration with the third party sensors, which leads to compatibility issues.

Priti Bedmuttha et al. [9] presented a smart pill dispensing machine. The machine uses pulse sensor to measure the pulses and these

values are sent to a mobile application. The mobile application then sends the data to the doctor's mobile application. The doctor monitors the patient. The main limitation is that the system can work at a time for a single user only. Also the doctor has to monitor the patient and his pulse rate. There is no automation. Also it causes overhead to the doctor.

Runhe Huang et al. [10] proposes a system which provides medication for fever automatically. The system uses sensors to monitor the human body temperature. Over a period of time an algorithm is applied on the body temperature to calculate the intensity of the fever. Based on the intensity of the fever the tablets are dispensed from the machine. The main limitation of this system is that there may be errors in medication due to faulty sensors.

Aakash Bharadwaj et al. [11] proposed a system which acted like a smart pill box. It consisted of a single board assistive device based on IOT. The smart device is set to a predefined time during which the alarm rises as a sign to take the medication. The alarm can manually turned off once the pills are consumed by the patients. It was mainly designed for patients with short term memory loss. The main issue in the system is it offers solution only for one-time medication and thus the efficiency of the system is reduced.

Maheswar Rao Kinthada et al. [12] presented a system called "eMedicare" which acts as a medication monitoring system. The system is designed in such a way that even the lesser privileged people could afford it. The system notifies the care taker if the medication is not consumed. The system is limited by the number of medications that can be monitored at a time.

3. Table on Literature Survey

S.NO.	TITLE	AUTHOR	TECHNIQUE	RESULTS	ISSUES
1.	"Smart Medication Dispenser"	Suraj Shinde, Nitin Bange, Monika Kumbhar, Snehal Patil	Arduino Controlled system	Alarm system reminds the patient to consume the medicine	Pill dispensing is not automated
2.	"Smart medication dispenser: design, architecture and implementation"	Pei-Hsuan Tsai, Tsung-Yen Chen, Chi-Ren Yu, Chi-Sheng Shih, Jane W. S. Liu	Embedded System	New functions can be added without modifying the dispenser control structure	Not portable, cannot be monitored from anywhere around the world
3.	"GSM Based Automatic Pill Dispenser"	Bharat Bhushan Singh, Sahil Upadhyay, Malik Sumra	Global System for Mobile communication	SMS is generated to the caretaker using GSM module	Portability issues, network disruption issues
4.	"Medi-Kit: Developing a Solution to Improve Attention on Medical Treatment"	Andrea Mondragón, Andrés De Hoyos, Axayacatl Trejo, Marco González, Hiram Ponce	Real Time Clock based mechanical dispensing	Prototype used reduces delay in dispensing and consuming pills	No alert system, no fully automated dispensing mechanism, portability issues
5.	"A Smart Pill Box with Remind and Consumption using IOT"	Shashank Shinde, Tejas Kadaskar, Pushpak Patil, Rohit Barathe	Internet Of Things	Reminder is set to help improve on time medication	Portability issues, application compatibility issues
6.	"Avion - The Intelligent Medicine Box"	Mohini Reddy, Videet Parekh, Chris Pinto, Vinay Pisharody, Devesh Ratho	Mobile Application	Tray separation based on the size of the pills	Improper data exchange, lack of reminder system
7.	"Smart Medicine Reminder Box"	Sanjay Bhati, Harshid Soni, Vijayrajsinh Zala, Parth Vyas, Yash Sharma	Internet Of Things	Sensing capability that can detect the consumption of medicines	Medication cannot be monitored through an application by a family member from anywhere
8.	"Intelligent multi-dose medication controller for fever: From wearable devices to remote dispensers"	J. Medina, M. Espinilla, Á.L. García-Fernández, L. Martínez	Sensor Data, Data analysis	Sensors to monitor any changes in health	Compatibility issues within the hardware and the sensors
9.	"A Health-IOT Platform based on the Biosensor And Intelligent Medicine Box"	Priti Bedmuttha, Nisha Jain, Yamini Thigale, Satyajit Gargori, Prof. T.R. Patil	Internet Of Things	Monitoring of health directly by the physician through a mobile application	Works for a single user at a time, portability issues

10.	"The contours of a human individual model based empathetic u-pillbox system for humanistic geriatric healthcare"	Runhe Huang, Xin Zhao, Jianhua Ma	Embedded systems	An algorithm to determine the intensity of fever	Faulty sensors could result in huge medication errors
11.	"Enhancing Healthcare using m-Care Box"	Aakash Bharadwaj, S, Divyank Yarravarapu, Sadiparala Charan Kumar Reddy, Thirumalaraju Prudhvi, K.S.P.Sandeep, Obulam Siva Dheeraj Reddy	Internet Of Things	Alarm based device that monitors consumption of medicine	Only useful for one time medication
12.	"eMedicare: mHealth solution for Patient Medication Guidance and Assistance"	Maheswar Rao Kinthada, Sivaramarao Bodda, Santhosh Bhanu Kumar Mande	Internet Of Things	Notification to the caretaker through messages or phone calls	Restricted in the number of pills

3. Application

For the elderly people who have memory deficiencies. People with physical disabilities such as weak limbs and patients suffering from Alzheimer’s disease can use the automated dispenser. In hospitals to monitor the health and medication consumption of every patient under a physician. For family members to monitor the health of their dear ones from a far off distance. To draw a comparison between the health changes before and after the consumption of a medicine. For the chemist, to refill pills as and when required through the mobile application. As a portable dispenser, to take proper medication even while travelling. To keep track of the medicines prescribed by the physician. For easy dispensing of the pill, thus making the whole process automated and preventing medication errors.

4. Conclusion

Thus this survey led to the conclusion that there is a need for an actual automated medication dispenser that can overcome all the limitations and also add up some more functionality. Hence the proposed pill container has the following functionalities mainly the separations to store different tablets by using a button based lever system to dispense the required medicines. The working of the button is based on a sensor based programming module which is controlled using a mobile application. The connectivity between the smart pill container and the mobile application is enabled through a gsm module or zigbee or wifi. The medicine is dispensed only at the particular time at the press of the button. By this way, the whole process of remembering the medication, buying it, monitoring health becomes automated. Thus the device avoids demises due to errors and provides the medicine on time for the patients.

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