Smart Medkit

S.B. Lenin¹, S. Pushparaj², M. Adithya³, S. Murugesan⁴, N. Balaji⁵, J. Gurupriyan⁶
¹Associate Professor, Department of Electronics and Communication Engineering, Sri Manakula Vinayagar Engineering College, Puducherry, India.
²Assistant Professor, Department of Electronics and Communication Engineering, Sri Manakula Vinayagar Engineering College, Puducherry, India.
³, ⁴, ⁵, ⁶ UG scholars, Department of Electronics and Communication Engineering, Sri Manakula Vinayagar Engineering College, Puducherry, India.

*¹lenin@smvec.ac.in, ²pushselvan@gmail.com

Abstract. The medical field plays a vital role in our day-to-day life. In recent years, it achieved a tremendous growth in advancements and technologies. Along with the maladies, the diagnosing and curing techniques are also evolved. Despite these advancements, the death rate due to medical errors has not yet decreased. To reduce these medical errors, we have designed a system which reduces some of the common medical errors such as improper medication timing, under and over dosage of medicines and delay in treatment. This system reminds the patient about their pills using voice message using playback module and speaker and it also dispenses the pills via slot arrangement controlled by stepper motor. If the patient ignores the voice message an SMS alert is sent to the patient’s attender and the caretaker. It also has an emergency subsystem which can be used in case of any emergency situation to the patient and it also allows the caretaker to send the prescribed medicines list to the caretaker via SMS.

1. Introduction
In our day to day life medical field plays a vital role, it reached a tremendous growth in technology and advancements in many medical applications. Even though the advancements are increased a lot, the death rate is not yet decreased due to medical errors. As per WHO statement, almost 80% of the aged peoples are taking their medicine in their bed and they should take 2 to 3 times per day. Almost a decade, diabetes is increasing in drastic way for elderly person and in that, 40 to 60% people forgotten to take their medicine in proper time. However, it is important to give the remembrances for that kind of patients to take their medicine in time. The medical errors are potentially among the world’s top 10 causes of death and disability. In high-income countries, it has been estimated that at least 1 in every 10 patients are harmed due to medical errors in hospitals.

A number of adverse events can cause these harms, nearly 50 percent of which are preventable. In low and middle-income countries (LMICs), every year 134 million adverse accidents occur in hospitals, resulting in 2.6 million deaths due to unsafe treatment, which is standing third in the leading causes of deaths. The Organization for Economic Co-operation and Development (OECD) estimated that the adverse events cause 15 percent of total expenditure of country’s economy. Thus, the medical errors not only affect the patient’s health but also the economy. Therefore, if we reduce the occurrence of adverse events, we can reduce the wastage of resource.

2. Literature Review
Many medical mobile applications are there to support and for monitoring purpose in medical field. However, special attention is needed for safety issues and to control the application from unauthorized persons. Already many works was proposed about medical pillbox but much work is not discussed about the safety measures. In [1] author developed a system to overcome this problem but this device is not portable and cost is more and still it required human interface. In [2] author proposed a system using Internet of Things (IoT) platform, it required a knowledge to operate android operating system, to take their pills in the box. However, it supports health diagnosis and health monitoring. Therefore,
this is not suitable for old age peoples and illiterates. In [3] author proposed a concept to for this problem, but it required a special packing of medicine to dispense, practically is not suitable.

Consuming dose of medicine is misconception than in the prescribed format will lead cause of recovery [4]. As per recent survey most of senior citizens taking more than 4 tablets in a day and they fail to take it in proper time [5]. Many standard medical equipment manufacturers have developed a product to dispense the pill in the stored tray in the present, time intervals, which includes alarm and other reminder futures [6]. In [7] author explains about One pill dispenser, i.e. pill dispense automatically using dropping mechanism, and the speed and frequency to release of the pill is in controlled path. This is not suitable for the patients taking more than one pill. This author proposed a modified work of author, it dispenses many pills but one by one, may struck due to size matter. Problem is dimension and size of pill gets varies; extra servomotor is used to overcome the problems in [8]. In author [9] describes about the pill dispenser with mobile application assistance system is insufficient to fulfil the needs link exact reminding or monitor.

3. Existing Work

Now a day, medical issues are the biggest concern in the world. Many people in the world are having more than one health problem regardless of their age. Improper medication timing causes many health-related consequences. So, to avoid such complications, the smart medicine dispenser is built which reminds the person to take pills without any human assistance. The entire system is divided into 2 sections, the first involves taking medicines from the dispenser and notifying the authority and the second involves notifying the authority about the sudden increase in the value of humidity and temperature and insisting them to change the current location of the dispenser.

![Block Diagram of Proposed Locker System](image)

There are three compartments that have been separated and are distinguished by using different light emitting diodes. Each compartment has buzzer. When it’s time to take the medicines, the buzzer and the LED gets activated. The time schedule for medication is uploaded to the Raspberry pi 3 using the python code. The raspberry pi 3 uses an internal timer to activate the alarm. The DHT11 sensor is fixed inside the dispenser setup. The LCD screen shows the respective compartment number to take the medicines The IR sensor is mounted in front of the dispenser and checks whether the patient took the medications.
The flow chart for the working of the smart medicine dispense model will explain the flow of work. The primary purpose of this model is to simply support those suffering from amnesia or those who have not been able to keep track of their medications and ultimately lead to desperate conditions. The designed smart medicine dispenser model helps to assist a person who forgets to take his or her medications, along with a notification to change the place of the dispenser if required.

**4. Proposed Work**

The proposed model is designed to greatly reduce the medical errors like improper medication timing, dosage and delay in treatment when compared to previous models and it is user-friendly. The working of the entire system is divided into three subsystems

1. Reminder and Dispenser System,
2. Prescription System,
3. Emergency System.

**4.1 Reminder and dispenser system**

It is used for reminding the patients about their pills using RTC module and Playback module. The caretaker can manually set the time to take the pills using input keypad and when the RTC time matches with the pre-set time a voice alert is delivered as a reminder to the patient using Playback module and speaker and it also insists them to press the push button to discard the pills. Once the push button is pressed the servo motor gets activated and it opens the tablet compartment, If the patient doesn’t respond to the voice alert within few minutes an alert message is send to the caretaker.
4.2 Prescription System
The caretaker can use this system to send the prescription to the patient’s attender. The caretaker can select the required medicines using input keypad. After selection the medicine list will be send to the patient’s attender via SMS using GSM SIM800C.

4.3 Emergency System
In case of emergency situation, the caretaker can utilize this to send alert to the patient’s attender and Doctor. The caretaker can use this system by pressing 4 in the input keypad which in turn asks the caretaker whether or not to send the emergency alert and an alert message is sent to the patient’s attender and the doctor.

![Proposed model](image1)

Fig. 3 Proposed model

![Block Diagram of Proposed model](image2)

Fig. 4 Block Diagram of Proposed model
5. Results

This chapter gives the brief discussion about the results obtained from the three subsystems of the proposed model. This device has been made to help the patients to take their pills regularly.

5.1. Reminder and dispenser system results

![Main Menu](image)

**Fig. 5 Main Menu**

We can set the caretaker’s phone number based on their shifts by pressing 1 in the input keypad.

![Phone Number list](image)

**Fig. 6 Phone Number list**

We can set the reminder time by pressing 2 on the keypad. Now the LCD displays three time slots.

![Time Slots](image)

**Fig. 7 Time Slots**

Select the respective time for each time slots. If the selected time matches the RTC, the voice message is played. If the patient ignores the voice message, the alert message and call will be sent to the patient’s attender and the caretaker using GSM module.

![Message and call alert](image)

**Fig. 8 Message and call alert**

5.2. Prescription system results

The prescription system can be accessed by pressing 3 on the keypad from main menu. Now select the respective medicine from the medicine list.
The selected medicine list will be sent to the attender as a text message using GSM module along with call.

5.3. Emergency system results
If there is any emergency, the caretaker can press 4 in the input keypad and it asks for confirmation.

Now an alert message and call is sent to the patient’s attender and doctor.

6. Conclusion
The developed system greatly helps the patient to take the pills regularly and helps the caretaker and attender to keep tab of patient’s condition. The proposed model reduces the delay in treatment by
sending alert message to the Doctor and the attender during emergency situations. It helps to send the prescription via SMS thereby reduces the work load of the caretaker. It also reduces the common medical error which leads to reduction in death rate.

References

[1]. Salgia, Aakash Sunil, K. Ganesan, and Ashwin Raghunath, “Smart pill box”, Indian Journal of Science and Technology, no. 8, S2, pp:189-194, 2015.
[2]. Mukund, S., and N. K. Srinath, “Design of Automatic Medication Dispenser”, Indian Journal of Science and Technology, pp:189-194, 2012.
[3]. George, Meria M., NimmyMary Cyriac, and Tess Antony Sobin Mathew, “Patient Health Monitoring System using IOT and Android”, Journal for Research, vol. 2, pp:102-10, 2016.
[4]. C. Salzman, “Medication compliance in the elderly”, US National Library of Medicine National Institutes of Health, 1995.
[5]. M. Brophy Marcus, “Many seniors are taking their medicines in risky ways”, Chsnews.com, 2016.
[6]. G. A. Mugisha, F. Uzoka and C. Nwafor-Okoli, “A framework for low cost automatic pill dispensing unit for medication management”, IST Africa Week Conference (IST-Africa), Windhoek, 2017.
[7]. S. Chawla, “The autonomous pill dispenser: Mechanizing the delivery of tablet medication” IEEE 7th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON), New York, NY, 2016.
[8]. Jayesh Patil, Sameer Khairmode, Rishikesh Lokhande and Omkar Shinde, “The autonomous pill dispenser with alarm and mobile notifications” International Journal of Research in Applied Science & Engineering Technology, vol. 3, no. 2, pp: 75-80, 2019.
[9]. Ajay Mathew, John Paul, Karthik Nair, Sachin U.S, Srikanth Koncherry and Raghav C.V, “Design and implementation of a Smart Medicine Dispenser”, IEEE, vol. 3, no. 2, pp: 75-80, 2019.
[10]. Mohammed Abdul Kader, Mohammad Nayim Uddin, Asif Mohammad Arfi, Naemul Islam and Md. Anisuzzaman, “Design & implementation of an automated reminder medicine box for old people and hospital” Conference on innovations in Science, Engineering and Technology, Kyoto, Japan, October 15-19, 2018.
[11]. P. Ranjana and Elizabeth Alexander, “Health Alert and Medicine reminder using Internet of Things” IEEE International Conference on Computational Intelligence and Computing Research, Kyoto, Japan, October 15-19, 2018.
[12]. A. Jabeena, Animesh Kumar Sahu, Rohit Roy and N. Sardar Basha, “Automatic Pill Reminder for easy supervision” Proceedings of the International Conference on Intelligent Sustainable Systems, Kyoto, Japan, October 15-19, 2017.
[13]. Andrea Mondragon, Andres De Hoyos, Axayacatl Trejo, Marco Gonzalez and Hiram Ponce, “Medi-Kit: Developing a solution to improve attention on medical treatment” IEEE, vol. 3, no. 2, pp: 75-80, 2017.
[14]. Ying-Wen Bai and Ting Hsuan Kuo, “Medication adherence by using a hybrid automatic reminder machine” IEEE International Conference on Consumer Electronics, Kyoto, Japan, October 15-19, 2016.
[15]. JuGeon Pak and KeeHyum Park, “Construction of a smart medication dispenser with high degree of scalability and remote manageability” Journal of Biomedicine and Biotechnology, vol. 3, no. 2, pp: 75-80, 2016.
[16]. Namrata Kataki, Abhishek Nath, Manasweta Das and Abinash Goswami, “Portable medicine reminder and automatic monitoring system” International Journal for Research in Engineering Application & Management, vol. 3, no. 2, pp: 75-80, 2018.
[17]. Diaa Salama Abdul Minaam and Mohamed Abd-ELfattah, “Smart drugs: Improving healthcare using smart pill box for medicine reminder and monitoring system” Future Computing and Informatics Journal, vol. 3, no. 2, pp: 75-80, 2018.