Alinteri J. of Agr. Sci. (2021) 36(2): 08-12
e-ISSN: 2587-2249
info@alinteridergisi.com

http://dergipark.gov.tr/alinterizbd
http://www.alinteridergisi.com/
DOI:10.47059/alinteri/V36I2/AJAS21109

RESEARCH ARTICLE

Design and Development of IoT-Enabled Medicine Reminder Box

P. Sathish[1*] • Anusha Bamar[2] • Likhitha Ande[3] • Sangapu Sowmyasri[4]

[1*,2,3,4]*Assistant Professor, Department of ECE, CBIT, Hyderabad, India.*

ARTICLE INFO

Article History:
Received: 25.04.2021
Accepted: 02.06.2021
Available Online: 12.07.2021

Keywords:
Medicine Reminder
Internet of Things
Gmail
IR Sensor
Alarm
Blynk App

ABSTRACT

IoT (Internet of Things) refers to a system of internet-connected devices which are capable of sending and receiving the data without human intervention. This technology enabled the remote monitoring in health care sector which lead to keep the patients safe and heathy, and ensuring to deliver superlative care. Some people apparently should be taken care by the caretakers and other family members. This is not provided by everyone in today's life. So, they may forget to consume medicines at the right time and may also forget what pill has to be taken. This paper aims to develop a device which alerts the patients to take medicine at the right time in an efficient manner. The proposed system has a facility which alerts the patients to take medicine on time and also acknowledges the medicine in-take through a Gmail notification. In the proposed system, the alarm is set up with the help of Blynk app indicating the patient to take the medicine. The IR sensor interfaced with the microcontroller unit determines the patient medicine in-take. The sensor detects the hand movement of the patient when he opens and takes the medicine from the slot provided. The corresponding message is sent to the caretaker via Gmail based on the IR sensor status.

Please cite this paper as follows:
Sathish, P., Bamar, A., Ande, L. and Sowmyasri, S. (2021). Design and Development of IoT-Enabled Medicine Reminder Box. *Alinteri Journal of Agriculture Sciences, 36*(2): 08-12. doi: 10.47059/alinteri/V36I2/AJAS21109

Introduction

Healthcare sector is continuously updated up with extensive technologies. The rise in chronic diseases, as well as limits on hospitals', doctors', and service providers' ability to give quality healthcare services in order to enhance patient health, are all quickly expanding healthcare concerns. Internet of Things (IoT) technology is one of those technologies along with artificial intelligence and machine learning [14]. IoT with its own benefits which include real-time monitoring, providing accuracy in collection of data and tracking patients activities meets the requirements of the users [12]. IoT helps in the health care sector at different phases, from making an appointment with the doctor, analysing the patient condition and communicating the condition of the patient using mobile application [8]. These changes emphasis on the individual needs of people thereby improving the efficiency, quality of medical care, and represent the future development direction of modern medicine science [19].

* Corresponding author: P. Sathish

Elderly people need to take so many tables in a day. This leads to forget them to take medicine at sometimes [7]. It will be difficult for them to remember the medication schedule if the consumption is multiple times [2].

Health service using Internet of things (IoT) has a great potential in medical field. Research shows that above 60% of elder people have bad medical history due to the lack of effective medical care [10]. In the event of a life-threatening situation, prompt notification is essential [13]. Medical IoT devices collect the required data and send it to doctors for monitoring, as well as sending out alerts to people about critical parts through mobile apps and other devices which are connected. Reports and warnings provide a reliable assessment of a patient's condition, regardless of location or time. Internet of Things (IoT) also aids in making well-informed decisions and providing prompt care. As a result, IoT allows real-time alerting, tracking, and monitoring, allowing for hands-on procedures, improved accuracy, and appropriate doctor involvement, as well as improved overall patient care delivery outcomes [17]. Patients may use mobile apps to contact a doctor thousands of kilometres away in an emergency. With the flexible solutions in healthcare, doctors can check on patients and

diagnose illnesses when on the move. Moreover, several healthcare delivery chains are planning to develop machines that can direct the medications based on a patient's prescription and the data related to the disease can be accessible via linked devices. The Internet of Things (IoT) will improve hospital patient care. As a result, people healthcare costs will be reduced. Sensors are crucial in the development of IoT solutions. Sensors are devices that sense and replace peripheral data with a signal which can be understood by humans and machines [15]. Sensors have enabled data collection in almost any environment and are currently employed in a variety of industries, including health sector, logistics, transportation, agricultural, disaster protection, tourism, regional companies, and many others. IoT sensors are used to detect and quantify a variety of physical events, including heat and pressure, along with the five human senses: sight, hearing, touch, taste, and smell [7].

System Architecture

The number of IR sensors used depends upon the number of slots in the box. Each IR sensor is placed near the slot such that it detects the hand movement and also each LED is fixed on each slot indicating that the pill has to be taken from that particular slot. The buzzer which is given as the output to the blynk app rings at the time of the event created [4]. The LED on one of the slots will turn on. The LEDs connected to each slot are also controlled by the blynk app. The patient takes the pill from that slot. The IR sensor detects the hand movement as soon as the patient takes the pill from the slot. After few minutes i.e. according to the input time given in the program a mail is sent to the caretaker [5]. Depending on the IR sensor output the message in the mail changes. If the IR sensor detects the hand movement the irvalue reads '1' and the message says that patient has taken the medicine else irvalue reads '0' and the message says that patient has not taken the medicine [3]. The block diagram of the proposed system is shown in Fig-1.

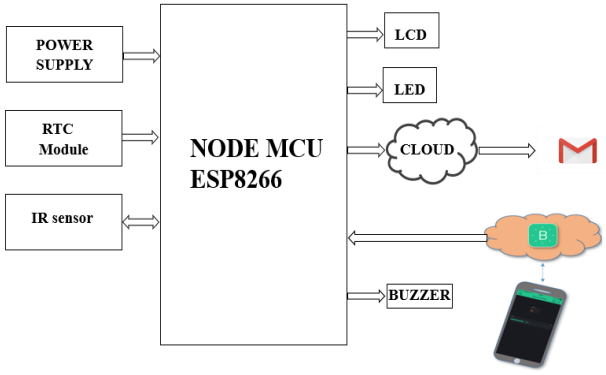

Fig. 1. Block diagram of the Proposed system

Development of Medicine Reminder Box

The smart medicine box helps to monitor the patient and is able to keep a track on the patients pill consumptions daily and also it can communicate these activities to the caretakers [1] [18]. The medicine box is connected via wireless network that allows to connect with the internet which makes the communication easy and in no time to the caretaker. The caretaker is able to change the timings of the medicine intake with the help of blynk app installed in his/her phone. This flexibility ensures that the patient has taken the medicine following the specified time in Blynkapp [9] [11]. According to the time specified in the blynkapp, the buzzer rings which indicates the patient has to consume the medicine [16] [17] [6]. The notification is sent to the caretaker via Gmail. The Gmail is sent to the user with the help Simple Mail Transfer Protocol. By creating an account for SMTP, we will get a username and password. We use these credentials in our source code to send the message to the caretaker.

The libraries and header file required for RTC module, LCD, WI-FI, Blynk app are included in the program. The baud rate for the controller should be set up as 9600.The required credentials should be given for WIFI to send the notification via Gmail. After giving the credentials the WIFI gets connected. The LCD interfaced with RTC module displays the date and time continuously. The buzzer rings according to the time given in the Blynk app. The IR sensor interfaced with the microcontroller unit reads the digital value of irpin. The rtc module compares the time with the given input time. Based on the status of the irpin the mail is sent to the caretaker displaying the corresponding message. The proposed system flowchart is shown in Fig-2.

Flowchart of the Proposed System

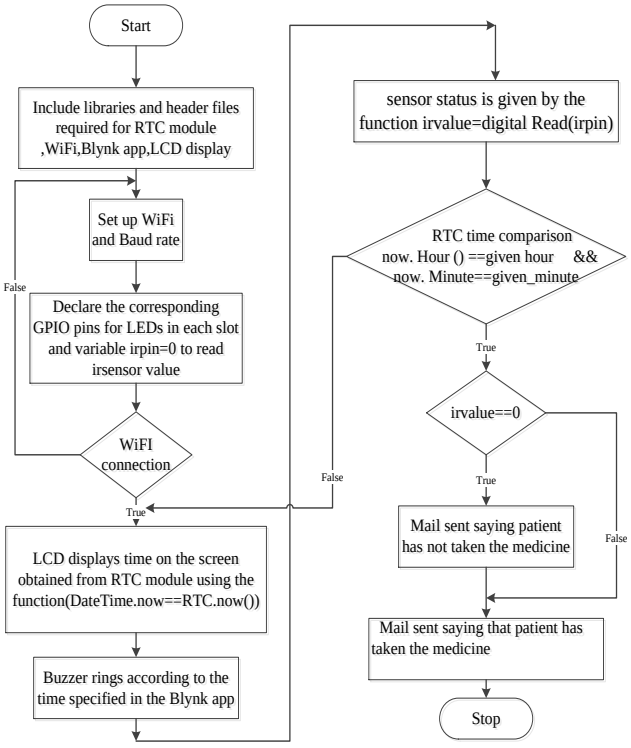

Fig. 2. Flowchart of the system

Results and Discussions

The LCD interfaced with RTC module displays the date and time continuously. The buzzer rings at the given input time in the Blynk app which alerts the patient to take medicine. After opening the medicine box, the patient takes the medicine from the respective slot. This is indicated with the help of LED connected to each slot. The IR sensor detects the hand movement and after few minutes i.e. according to the time setup in the program the mail is sent to the caretaker displaying the corresponding message. The overall project setup is shown in Fig- 3.

Fig. 3. Overall project setup

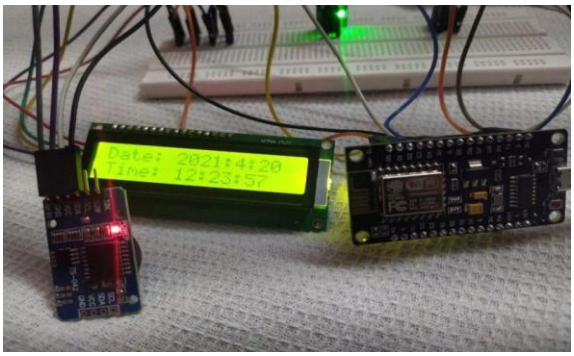

Fig. 4. LCD and RTC module interfaced with NodeMCU

LCD and Rtc module are connected to NodeMCU for timing information is shown in Fig-4. The liquid crystal display(16x2) interfaced with the Real Time Clock module displays the time and date.

The buzzer interfaced with NodeMCU alerts the patient to take medicine. The interfacing is shown in Fig-5.

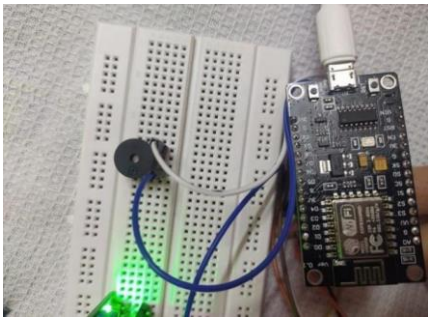

Fig. 5. Buzzer interfaced with NodeMCU

The hour is obtained to the controller with the help of Blynk app. Events (Alarm) are created in the Blynk app and the buzzer connected to the one of GPIO's of the controller. The buzzer rings at that particular instant of time.

IR sensor detects the object in the surroundings by emitting the light.IR sensor can detect the object as well as the motion of the object IR sensor detects the object in the surroundings by emitting the light.IR sensor can detect the object as well as the motion of the object.TheFig-6 and Fig-7 shows the photodiode of the IR sensor detecting the hand movement by turning on the in-built Light Emitting Diodes (LED)

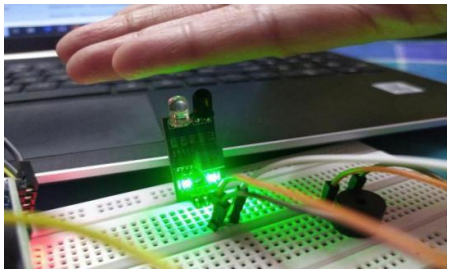

Fig. 6. IR Sensor detecting hand movement

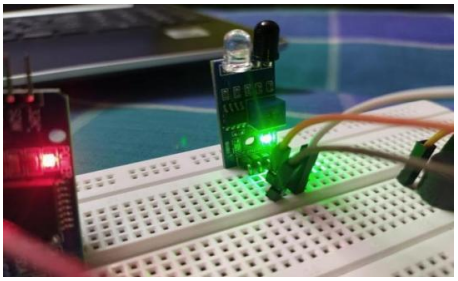

Fig. 7. IR Sensor status is zero

The reminder is set up in the blynkapp. The screenshot of setting up alarm of blynkapp is shown in Fig-8.

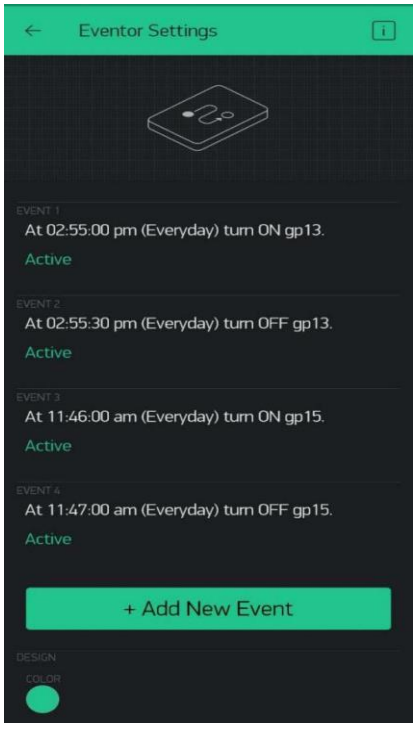

Fig. 8. Blynk app Screenshot

One of the GPIO pin is given as the output for the Blynk app. This can be switch ON and switch OFF according to the time in the event created. In this way the buzzer rings at a given time alerting the patient. The acknowledgement via Gmail is shown in Fig-9.

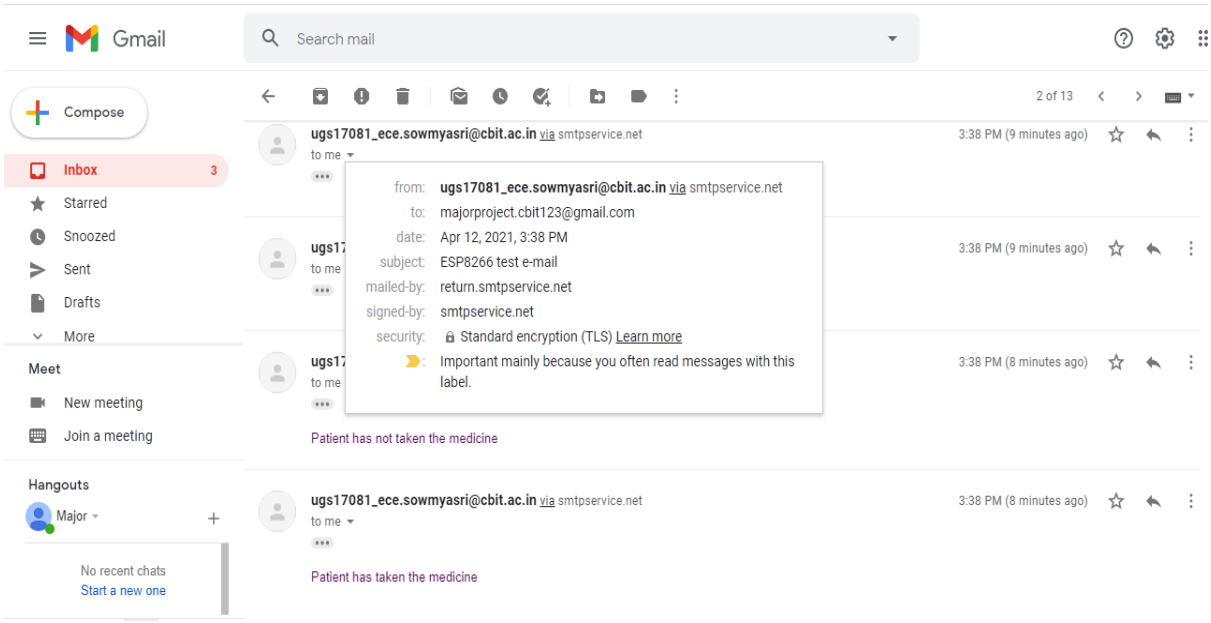

Fig. 9. Gmail screenshot

The sensor detection helps us to know the patient's consumption of pill by sending the corresponding message via Gmail. If the sensor detects the hand movement it is considered that the patient has taken the medicine and the corresponding message is sent. If the hand movement is not detected, the message is sent via Gmail saying that the patient has not taken the medicine

Deployment of the Proposed System

The designed medicine box displaying date and time is shown in Fig-10.

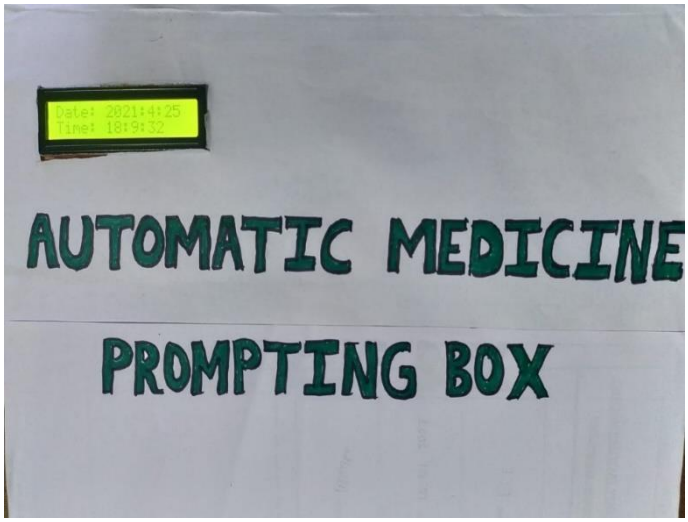

Fig. 10. LCD interfaced with the RTC module displays the date and time

Fig. 11. Pills distributed in slots

The box is divided into three slots. Each slot is provided with an IR sensor and a LED. The LEDs are controlled by the Blynk app and they turn on each slot indicating that the particular slot pill has to be consumed. The medicine box is divided into slots and pills are distributed. The setup is shown in Fig-11. The IR sensor in each slot determines the hand movement and sends the notification via Gmail.

Conclusion and Future scope

The developed medicine reminder box assures the medicine intake of the patient according to the specified duration. It also reduces the effort of remembering the medicine which has to be taken as the LCD displays the timing schedule. An efficient algorithm is developed

which helps the patient's medicine intake at right time. With the help of this system there is no need of continuously monitoring the patient so that in the absence of care taker, the patient can take pill. The LED connected to each slot indicates the patient which pill should be consumed. The IR sensor interfaced with the microcontroller ensures the consumption of pill. The developed medicine box is cost efficient. Further, this work can be extended, not only in health sector, but also in industrial and automotive applications where time management is crucial. In order to develop efficient patient monitoring system, the designed system can be connected to other sensors to sense temperature, pulse etc. there by connecting to the system interface, so that it may be placed in a nursing station and the pill details of various patients are recorded in the system.

References

Shawn Benedict Kumar, Wei Goh and Sumathi Balakrishnan "Smart Medicine Reminder Device for The Elderly", *In Fourth International Conference on Advances in Computing, Communication & amp; Automation (ICACCA),* Subang Jaya, Malaysia 26-28 Oct. 2018.

Hiba ZEIDAN, Khalil KARAM, Roy ABI ZEID DAOU, Ali HAYEK, Josef BOERCSOEK, MART Learning, Education and Research Canter "Smart Medicine Box System" 2018 *IEEE International Multidisciplinary Conference on Engineering Technology (IMCET).*

T.L. Hayes, J.M. Hunt, A. Adami, J.A. Kaye, "An Electronic pillbox for continuous monitoring of medication adherence", *In processing's of the 28th IEEE EMBS Annual International Conference,* Aug. 30 – Sept. 3, 2006.

Samir V. Zanjala, Girish. R. Talmaleb," Medicine Reminder and Monitoring System for Secure Health Using IOT*", International Conference on Information Security & Privacy (ICISP2015),* Nagpur, INDIA, 11-12 December 2015.

Diaa Salama Abdul Minaam, Mohamed Abd-ELfattah," Smart drugs: Improving healthcare using Smart Pill Box for Medicine Reminder and Monitoring System", *Future Computing and Informatics Journal* 3 (2018) 443e456.

C. McCall, B. Maynes, C. C. Zou, N. J. Zhang, "An automatic medication self-management and monitoring system for independently living patients". *Medical Engineering and Physics,* 2013.

M. Kavya, G. Ravi Kumar Reddy "Intelligent pillbox: Automatic and Programmable Assistive technology Device" *International Journal of Management, Technology and Engineering,* Volume 8, OCTOBER 2018.

Home Based Health Monitoring System Using Android Smart phone, *International Journal of Electrical, Electronics and Data Communication,* Vol-2, Issue-2, Feb-2014, Sushma Pawar, P.W. Kulkarni.

Aakash Sunil Salgia, K. Ganesan and Ashwin Raghunath. "Smart Pill Box", *Indian Journal of Science and Technology,* Vol 8(S2), 189–194, January 2015.

Mohammed Asad Fasahate," Smart Medicine Box Using IOT", *International Journal of Scientific & Engineering Research,* Volume 9, Issue 2, February 2018.

B. Abbey, A. Alipore, C. Camp, C. Hofer, "The Smart Pill Box*", In proceedings of the Rehabilitation Engineering and Assistive Technology Society of North America,* 2012.

Slagle, J.M., Gordon, J.S., Harris, C.E., Davison, C.L., Culpepper, D.K., Scott P. and Johnson, K.B., (2011) "My MediHealth – Designing a next generation system for child-centered medication management", *Journal of Biomedical Informatics,* Vol. 43, No. 5, pp. 27-31.

M. Končar, "e-Health projects – European experience," Vol.17 No.94/95, 2011.

Shuo Tian 1, Wenbo Yang 1, Jehane Michael Le Grange, Peng Wang, Wei Huang, *"Smart healthcare: making medical care more intelligent",* Department of Orthopaedics, Wuhan Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, 1277 Jiefang Avenue, Wuhan 430022, China

S. Majumder, E. Aghayi, M. Noferesti, H. Memarzadeh-Tehran, T. Mondal, P. Zhibo and M. Deen, "Smart Homes for Elderly Healthcare--Recent Advances and Research Challenges," *Sensors,* vol. 17, no. 11, pp. 1-32, 2017.

H.-L. Tsai, C. Tseng, L. Wang and F.-S. Juang, "Bidirectional smart pill box monitored through internet and receiving reminding message from remote relatives," *In IEEE International Conference on Consumer Electronics - Taiwan (ICCE-TW),* Taipei, Taiwan, 2017.

A. Sawand, S. Djahel, Z. Zhang, and F. Na. Multidisciplinary Approaches to Achieving Efficient and Trustworthy eHealth Monitoring Systems. *Commun. China (ICCC), 2014 IEEE/CIC Int. Conf.,* pp. 187–192; 2014.

Shih-Chang Huang, Hong-Yi Chang, Yu-Chen Jhu, Guan-You Chen," *The Intelligent Pill Box - Design and Implementation",* 2014 IEEE.

P. Ray. Home Health Hub Internet of Things (H 3 IoT): An architectural framework for monitoring health of elderly people. *Sci. Eng. Manag. Res.,* 3–5, 2014.