Journal for Educators, Teachers and Trainers
The PROFESIOLab electronic, peer-reviewed, open-access Magazine

ISSN 1989-9572

DOI:10.47750/jett.2021.12.02.027

Smart IoT-Enabled Pill Reminder System for Enhanced Medication Compliance and Healthcare Management

Dr. S. Sreenath Kashyap[1],

Dr. U. Rajender[2]

Journal for Educators, Teachers and Trainers, Vol.12(2)

https://jett.labosfor.com/

Date of reception: 15 Feb 2021

Date of revision: 10 Mar 2021

Date of acceptance: 30 April 2021

Dr. S. Sreenath Kashyap, Dr. U. Rajender (2021). Smart IoT-Enabled Pill Reminder System for Enhanced Medication Compliance and Healthcare Management. Journal for Educators, Teachers and Trainers, Vol.12(2). 212-221.

Journal for Educators, Teachers and Trainers, Vol. 12(2)

ISSN 1989 –9572

https://jett.labosfor.com/

Smart IoT-Enabled Pill Reminder System for Enhanced Medication Compliance and Healthcare Management

Dr. S. Sreenath Kashyap[1], Dr. U. Rajender[2]

[1]Associate Professor, Department of Electronics and Communication Engineering, Kommuri Pratap Reddy Institute of Technology, Hyderabad, Telangana

[2]Assistant Professor, Department of Electronics and Communication Engineering, Vaageswari College of Engineering, Karimnagar, Telangana

ABSTRACT
Individuals across various age groups utilizing medication for medical conditions, cosmetic enhancements, or dietary supplements due to deficiencies are increasingly common in contemporary society. Due to their demanding schedules, individuals often overlook the necessity of taking their medications. This statement is especially applicable to the elderly population and individuals experiencing memory-related issues. An automated pill reminder can be utilized for this purpose. This device is equipped with a Real-Time Clock (RTC) timer and an Internet of Things (IoT) module for internal functionality. The device features an LCD display and provides audio prompts for user interaction. The wireless IoT server-based Android application will function as a central hub, facilitating customer reminders through notifications. This will allow users to easily monitor and adjust their prescription schedules remotely. The Automatic Medicine Pill Reminder serves as a comprehensive and accessible solution for users, thanks to its integration of intuitive interfaces and advanced IoT functionalities. The objective is to streamline the process of medication administration, promote compliance with prescribed regimens, and ultimately enhance the overall quality of healthcare delivery.

Keywords: Smart health, Medication Management, Internet of Things, RTC timer, Arduino UNO.

1.INTRODUCTION

Currently, the global increase in aging populations and the prevalence of chronic diseases are raising significant concerns. Many countries are implementing hospital restructuring initiatives that involve decreasing the number of hospital beds while increasing the focus on home healthcare. This approach is intended to enhance the quality of healthcare and has garnered significant attention. The proposed idea will be beneficial for monitoring the physical status of the elderly while simultaneously promoting their health. The Internet of Things (IoT) extends the Internet into daily life through the wireless connection of diverse smart objects, resulting in substantial transformations in how individuals live and engage with smart devices. The emerging trend in computing is shifting away from traditional desktop environments. The Internet of Things (IoT) refers to a network in which numerous objects in our environment are interconnected in various ways. This technology enables the observation of health statistics related to medication. The encryption process involves transmitting schedule data or a doctor's prescription to the pill box via a mobile application. The LEDs are positioned to provide indication, while the buzzer serves as an alarm alert. The reset button is utilized for counting medication on cloud platforms. The current methods available in the market

for reminders include a pill box. This, however, does not assist in verifying the medication. The proposed idea presents a valuable solution to the issue of medical noncompliance.

The innovation scheme is designed to assist patients in monitoring their medication intake by utilizing a series of LED alarm indicators and audio alarm signals. In contemporary society, the majority of individuals maintain a high level of activity within their daily routines. They prioritize their work over attending to their health. The prevalence of blood pressure issues and other conditions, including diabetes, is increasing significantly. For elderly individuals, the management of regular medication schedules presents significant challenges. It is observed that younger individuals often encounter similar challenges. Due to the high demand for continuous support among individuals, it is often impractical to consistently remind them to adhere to their prescribed medication schedules. A monitoring center for patients is essential for this purpose. A medication reminder system is designed to support elderly individuals in self-care by ensuring they adhere to their medication regimen, taking the correct dosage at the appropriate times. This is utilized for contemporary technology-driven lifestyles. This technology is expected to provide utility in various applications. Cell phones primarily serve the function of facilitating voice communication; however, they can also function as a suite of integrated sensors that support the development of various services, such as social networking, environmental monitoring, healthcare applications, and human services. Mobile devices are increasingly integral to contemporary medical care systems.

The Internet of Things (IoT) can serve as a valuable tool for monitoring real-time events. Additionally, it presents a practical and efficient framework for the storage of sensor device data in cloud environments. This project involves a comprehensive monitoring system that will be managed by an IoT-enabled device. An Android application has been developed to support patients by providing reminders for medication intake and other relevant tasks.

Various mechanisms are available for patient recall, including alarms and reminders. The Pill Reminder facilitates adherence to prescribed medication schedules, ensuring consumers take their medications at the appropriate times. The integration of Internet of Things (IoT) technology into various aspects of daily life has significantly transformed interactions and management of our environments. The Internet of Things (IoT) presents significant opportunities in the healthcare sector, especially concerning the management of medication adherence. Medication non-adherence represents a critical challenge worldwide, resulting in negative health consequences and elevated healthcare expenditures. In addressing this challenge, automatic medicine pill reminders utilizing IoT technology have been developed as an effective solution to enhance medication adherence and patient outcomes.

PROBLEM STATEMENT

- Medication Non-Adherence: Develop a system that utilizes IoT and real-time clock (RTC)technologies to address the issue of medication non-adherence by providing timely reminders and monitoring drug administration.
- Patient Safety: Create a smart drug administration system that ensures patient safety by integrating IoT sensors to detect potential adverse reactions, ensuring the right medication is administered to the right patient at the right time.
- Inventory Management: Implement an IoT and RTC-based solution to track medication inventory in real-time, providing alerts for low stock levels and expiring drugs, improving efficiency in healthcare facilities.
- Remote Monitoring: Design a system allowing healthcare professionals to remotely monitor and adjust medication schedules based on patient conditions, enhancing personalized care and treatment outcomes.
- Data Security and Privacy: Develop a secure IoT and RTC-based platform that ensures the confidentiality and integrity of patient data, addressing concerns related to privacy and security in healthcare systems.
- Integration with Electronic Health Records (EHR): Integrate the smart drug administration system with EHR platforms to enhance data continuity, facilitate comprehensive patient care, and streamline healthcare workflows.
- User-friendly Interface: Design an intuitive and user-friendly interface for both healthcare providers and patients, promoting easy interaction with the smart drug administration system and minimizing the risk of errors.
- Power Efficiency: Create an energy-efficient IoT and RTC solution to prolong the battery life of devices used in the smart drug administration system, ensuring continuous functionality without frequent replacements.

2. LITERATURE REVIEW

Savithaa. N et al (2021) had designed a smart medicine box which had an android application which is installed on the patient's smart phone. Through this application patients could view their prescriptions and get notifications regarding medicine intake. Medicine box is provided with different compartments. An LED on top of each section signify the right box. At any moment patient opens a mistaken section, a warning will occur with the help of

Arduino. A WI-FI shield is attached to the Arduino board and this microcontroller picks up the data and sends it through WI-FI module. These compartments are opened or closed by servo motor by means of electrical signal arrived from Arduino microcontroller. The device is programmed with Arduino which is plugged with alarm and LED display. Smart medicine box attached with vital parameter measuring sensors is implemented with IoT technology. Doesn't recover special training for handling. It is a user-friendly device even elder patients can operate easily. The instructions are displayed in LCD display

K. Karthikeyan et al.(2021) A study suggested deploying a separate bot to oversee the administration of medications. The bot will move to the user's home and dispense the necessary medications in accordance with the user's preprogrammed orders.

Divya Sai. K et al (2021) had designed a medicine box where the schedule data/configuration data is sent to the pill box through IoT. The smart pill box contains Arduino MCU, LED display, LEDs, buzzer, buttons, Pulse Sensor and Temperature Sensor.The LED are used to display the commands in pill box by MCU. The Wi-Fi module is configured with IoT. The configuration data is sent to the smart pillbox when the configuration is in ON mode. The concerned LED glow with buzzer at schedule time. It is cost efficient and user friendly as user can set time table of medicine by himself. Highly reliable and the product can be used for long time. It is easy to use and manufacture It also provides accurate result.

AnandhapadmanabanS. et al (2020) used Peltier module which is imported into one of the compartments made for cold storage and other compartments left without Peltier for room temperature storage. According to medical adherence, box is splitted to store drugs to be taken thrice times in a day. The patient's vital signs namely body temperature and heart beat rate are sensed and sent via sensor probe. An additional switch is built to alert the preset guardian through GSM module when it is triggered by strangers or guardians at emergency situation. Cloud storage 4 assists doctors to analyze the patient's health graph and gain knowledge about the recovery or degradation of their patient's health. By these knowledge doctors easily prepare their treatment plan earlier for his/her patient

Rao, A. et.al.(2020) methodology of proposed system. An IoT-based programmable innovative medicine kit guides users/nurses to manage the precise medication at the correct time schedules through a unique alarm system that includes buzzers, mobile notifications, and LED signals on the equipment sections. The parts containing suitable tablets are unlocked at the prearranged time.

Nur Zulaikhah Nadzri et al (2020) designed the device in such a way that the user will set the time according to the medicine scheduled by the doctor by using the Blynk apps. Then, if the time is correct it will notify by 2 notification, LED and buzzer is on. Magnetic switch is used to detect the action of opening and closing the iBox cover. LDR to detect the action of taking the medicine If the user takes the medicine, the data will be stored in the cloud and this is triggered by the reed switch

Latif, G. et.al.(2020) proposed design After seeing so many of these cases the correct person must take the correct pill at the correct time, otherwise taking an incorrect one or not taking one at all may expose the patient to several dangerous situations, ranging from mild health issues up to death.

Harshitha V et al (2020) created an IoT device is designed to remind patients about their medication time. By using the GSM, the caretakers can be notified through smart phones. Sensors like IR sensor, camera, and RFID tags are used to count the number of pills inside a tray and whether medicines has been taken properly These are interfaced with Arduino UNO micro-controller. The RFID stickers fastened on each tablet sheet will be scanned by using the RFID, camera and IR sensor. The sensors will be giving the count of pills inside the box periodically for every 5 to 6 hours. The timings for the intake of medicines by the patient will be set using RTC. By using RFID tags the pills which are taken can be identified, whether the patient has taken correct medicine or not at a prescribed time. The data will be updated into the web browser using the Wi-Fi module. After completely taking the medicines over days/months the device will be fixing an appointment with the doctor automatically by sending a message using the GSM module and also convey the same to the medical shops to deliver the required medicines to patients address or to the hospitals. Focuses on alerting the users, care-takers about the medicine intake time of the patients. When the pill box becomes empty it sends a purchasing notification to the medical shop about the medicines that has to be purchased. The device also fixes an appointment with the doctor when the usage of medicines is completed.

Viral Doshi et al (2019) made a device which consisted of a small box divided into 21 sections for storing pills for a week of up to 3 patients. The box was connected to an RTC module, an Arduino AT mega 2560. The RFID tag will be given to each patient. When it is brought close to the reader, the medication will be dispensed. RTC is used to compare the time the dosage is to be given with the current time. It will check whether the RFID tag is read by RFID reader. If the condition is true. The 5 box will open about 60 sec and then the section will be closed, also it will store data as DOSAGE TAKEN. It will then go back to monitor the current time. If the condition is false and 30 sec after the notification was sent are completed the LED and BUZZER will be turned off. It shall then check for the current time is equal to set time + 5 minutes, if the condition is true, the patient will receive the second reminder. The LED

and BUZZER will be turned on again for 30 sec. If the RFID tag is not detected the data would be stored as dosage missed. WIFI-module is used in sending the results which will be stored in the database.

3. PROPOSED SYSTEM

The proposed medicine drug admin system is integrated of both hardware and software. This system used IOT android based RTC time, buzzer and ESP32 model microcontroller, regulated power supply section for sign conversion system using python programming. When the set time is match with controller data base time then automatically medicine box will open to consume medicine pill.A smart system that will continuously cover the case's health with the help of a detector and also at the same time will cover the patient diurnal cure of drug. Each drug box will have its own set of timing information which will be compared to a real world clock. However, the buzzer will go out and thereby remind the case to take his/ her drug, If the information matches. A data will also be maintained regarding the case's health and hisdiurnal input of drugs. Propose a smart system that will continuously cover the case's health with the help of a detector and also at the same time will cover the cases daily cure of drug Each drug box will have its own set of timing information which will be compared to a real world clock. However, the buzzer will go out and thereby remind the case to take his/ her drug A data will also be maintained regarding the case's health and his diurnal input of drugs, If the information matches.

The 16x2 LCD serves as the interface through which the user can select the compartment for which they want to set the time, they can select the time for 3 compartments titled med 1, med 2 and med 3. This is done by the help of the rotatory encoder which acts as the knob by turning the knob clockwise and anticlockwise we can scroll through the list of options provided. The time that has been selected by the user will then be displayed on the LCD for a min or two and then will move to the default screen which displays the current date and time The time that has been selected will be stored in the EEPROM of the Arduino and at that time set, the buzzer and the led which serves as the audio and visual indicator respectively is activated. There are 3 LED present to indicate the 3 compartments and only the LED corresponding to the compartment will glow so the patient can know that it's time and which compartment they have to reach out for their medication.

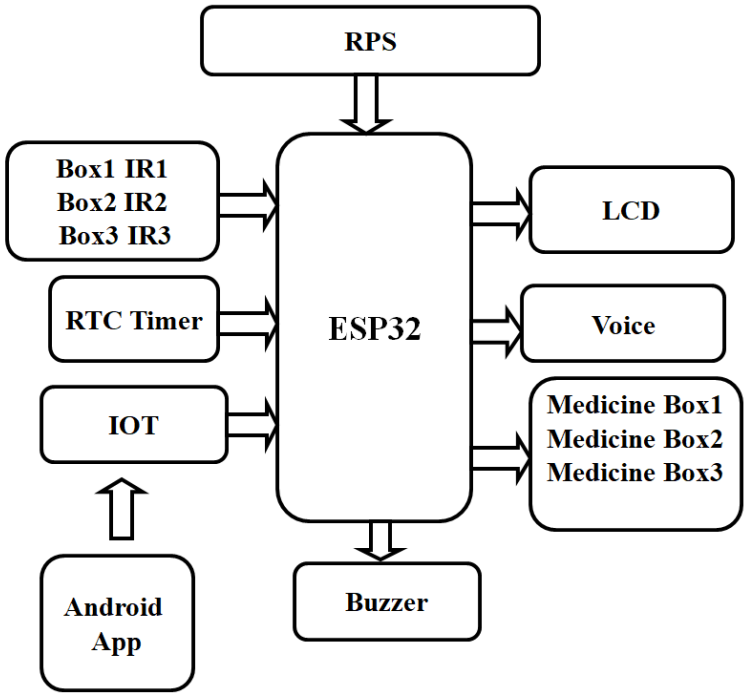
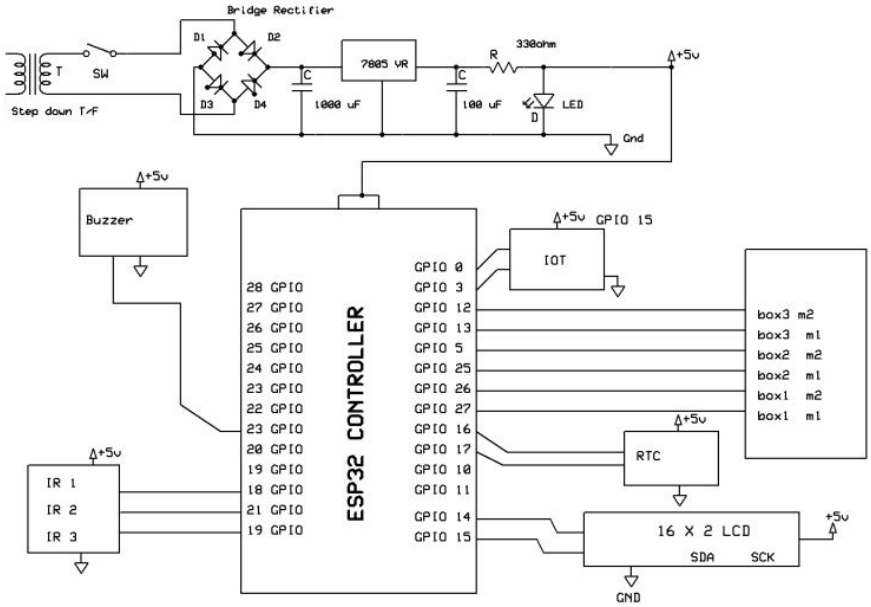


Fig.1. Architectural Block diagram of the Project.

The RPS module converts the 230 ac volts into 5v of dc. The5v of power supply goes to all components in the system. The input of the project is RTC and IOT module. The RTC has CMOs battery and RTC circuit and it counts the time and opens the medicine box. The IOT server can send the data and display the data in the IOT server app. The output has LCD, Buzzer alarm and dc motor, In the Arduino microcontroller contains the software programming code Embedded C. The main purpose of the microcontroller is the data can be control by the microcontroller.Once we should ON the kit first Reset the kit because to connect Wi-Fi to IOT server. The kit is

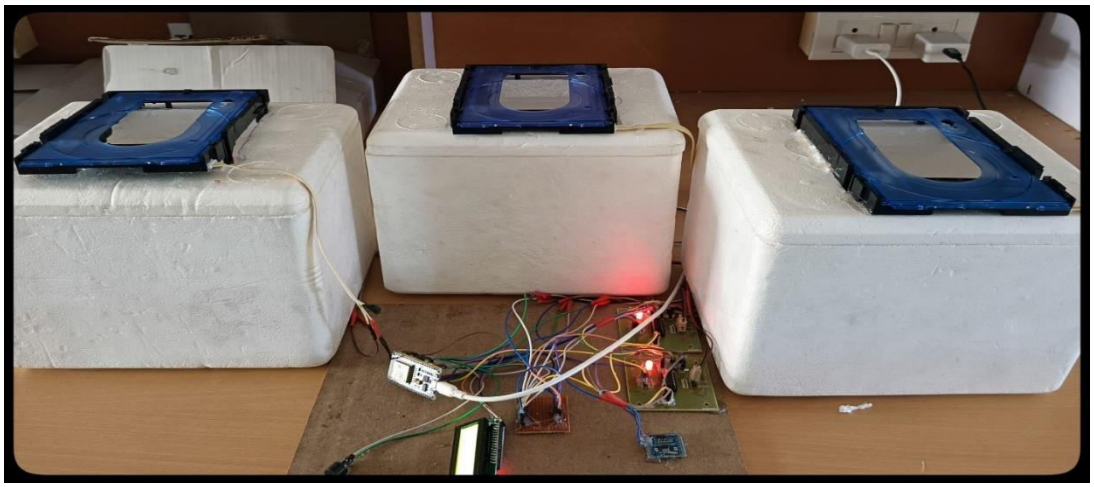
reset the LCD displays the Medicine Remainder. After we configure to IOT server by using an TCP Telnet Terminal app. By using our mobile phone, we can connect the Wi-Fi to IOT server. Once the Wi-Fi is ON the mobile data should be OFF. By using the IP address 192.168.4.1 and port:23 connect the IOT server. Once it is connected the LCD displays the present Date and Time.Next we can the set the time for reminding the Medicine we can use the command like @HH:MM:SS#. We can give the Eight commands first we can save and then send the LCD displays the configurations of reminders. The first two commands are getting the same voice and similarly the next six commands also. The next command is for the reminding purpose. Not only giving the voice we can also see the name of the medicine on the LCD and at the same time IOT app.In real time once we can set the commands it working on 24/7 until the power is OFF. Suppose the power is OFF we can again set the commands.



Arduino sketch those functions as a medicine drug admin system using an Arduino board, a Real-Time Clock (RTC) module, a Liquid Crystal Display (LCD) module. The system is designed to remind users to take their medication at specific times by displaying messages on the LCD and dc motor opens the medicine box. The proposed system designed to configure and manage medication reminder times, display the current date and time on an LCD, and trigger dc motor box to remind users to take their medication. It uses an RTC module to keep track of time and EEPROM memory to store configuration data. However, there are a few issues with the code, such as incorrect variable names and potential logic errors, which might need further debugging and refinement for the system to work correctly. not used in the provided code. It seems to have been intended to set up a Wi-Fi connection.

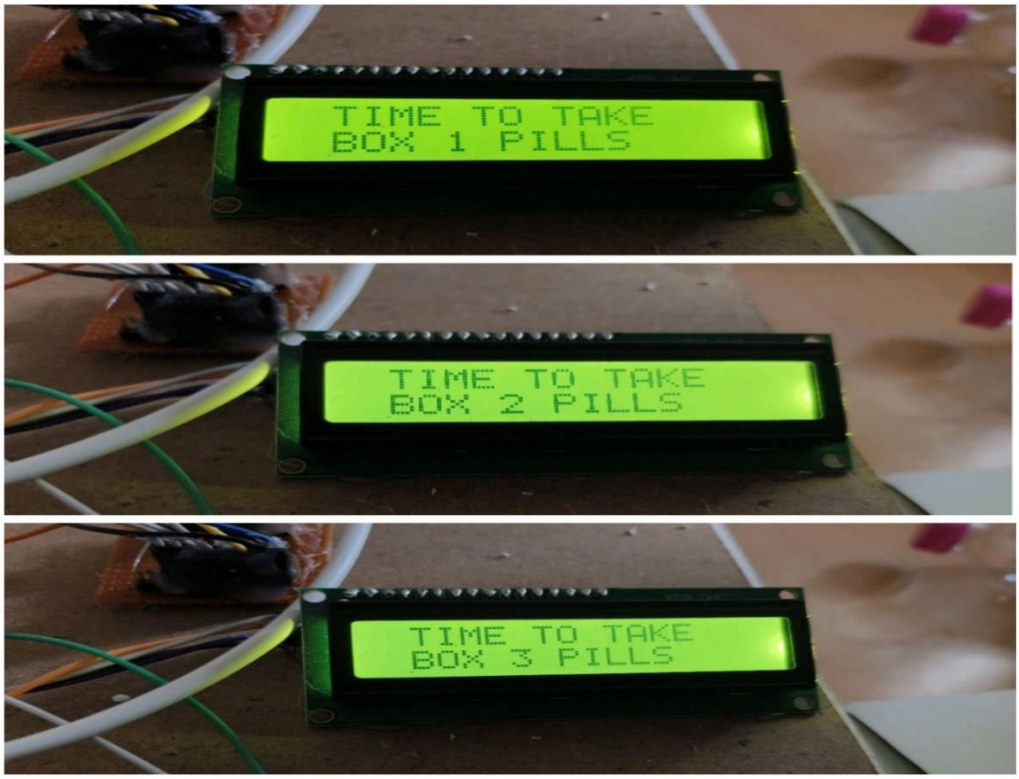
The LED and the buzzer can be switched off with the help of a button and if that's not the case they automatically stop after a min Another button is present which controls the micro servo motor that serves the purpose of opening the box and for sending the SMS to the guardian based on the button input a SMS will be sent. For instance, if the button is not pressed the box remains in the same place as such a conclusion can be drawn, that the patient has Fig 4.3.1.1 Proposed system 14 failed to take their medication at the specified time and so an SMS will be sent to indicate this. On the other hand, if they press the button the servo pushes the box forward and so the patient has taken said medication and hence a corresponding SMS will be sent to convey this information to the guardian/caretaker.

4. RESULTS

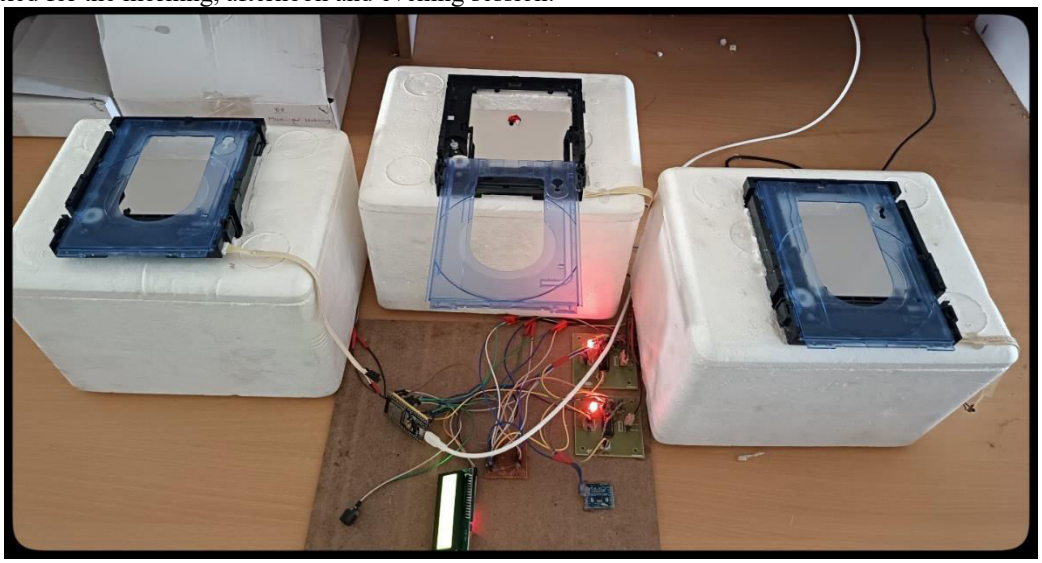


The above image shows the hardware equipment of the project. The kit is turned ON by giving the regulated power supply of 12v which is then converted to 5v dc current. The generated 5v dc current passes to every hardware component in the circuit.

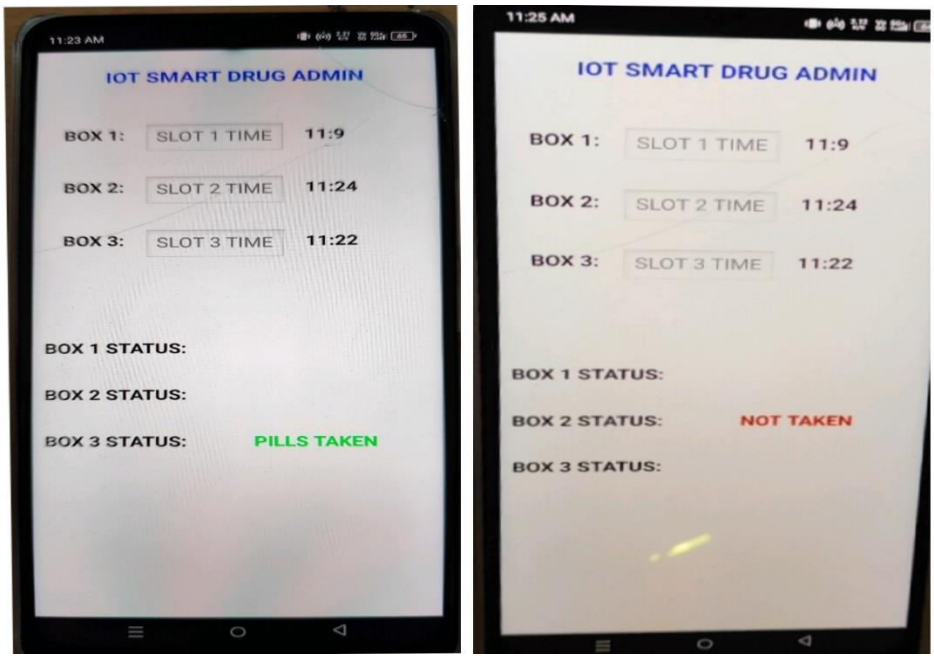
The above figure indicates the LCD display. After connecting the regulated power supply, the ESP 32 has a wi-fi module by connecting the hotspot to it, the title (SMART DIGITAL DRUG ADMIN) is display on the LCD screen.



The above figure indicates the reminder to take the medicine. For taking the medicine the time slot has fixed in the android app. The corresponding message was displayed on the LCD screen for respective box. For example the time slot has fixed for the morning, afternoon and evening session.



The above figure indicates the opening of the medicine box, when the message is displayed on the LCD screen the respective box was opened for one minute and it will close automatically after one minute.



The above figure indicates the interface of the IOT server android app. When the medicine box opened for one minute if patient take the medicine the android app displays the "PILLS TAKEN" message in the box status and it will send corresponding voice over, vice versa if patient does not take the medicine the android app displays the "NOT TAKEN" message in the box status and it will send the corresponding voice over.

5. CONCLUSION

Overview of the project is "IOT RTC based smart drug admin gives the medicine box automatically open and close for easy consumption of medicine at correct time." the main aim of the project reminding the medicine for the people who are having the health problems Mentally elderly and Physically. In this project we are using the RTC timer and IOT module transmitting the data. And the data can be controlled by Microcontroller. By using the wifi connect the IOT server. The data can display on the LCD display and at the same time IOT server. The medicine box will be open through the dc motor module.

REFERENCES

[1] Savithaa. N, Savitha.P, Trisha.S, Subhashree.C, 'Intelligent medicine box for medication management using IOT' International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 08 Issue: 12 | page no 1390- 1392, 2021

[2] Karthikeyan, K. R., Babu, E. D., Ranjith, S., &Arunkumar, S. (2021, October). Smart Pill Dispenser for Aged Patients. In 2021 International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA) (pp. 1-5). IEEE

[3] Divya Sai.K, SwarnaLatha.S,Shoban Babu'.B "IoT Based Smart Pill Box Using Arduino Microcontroller", International Journal of Emerging Technologies and Innovative Research (www.jetir.org), ISSN:2349-5162, Vol.8, Issue 1, page no.370-375, January-2021,

[4] Anandhapadmanaban .S, Ashifa .A, Sanjay Kumar .S, Suryalakshmi .R, ' A Smart Medicine Box for Medication Management using IoT' Journal of Xi'an University of Architecture & Technology, Volume XII, Issue V, page no.1169- 1173, 2020

[5] Rao, A., Pranathi, B. S., Shivani, A., & Mohan, R. (2020, July). IoT based Smart Medicine Kit. In 2020 IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT) (pp. 1-6). IEEE.

[6] Nur Zulaikhah Nadzri1, Yusman Yusof, Ahmad Firdaus Ahmad Fazil, 'Ibox: Smart Medicine Box WithIot Application' European Journal of Molecular & Clinical Medicine ISSN 2515-8260 Volume 07, Issue 08, pp. 3747-3757 2020

[7] Latif, G., Shankar, A., Alghazo, J.M. et al. ICARES: advancing health diagnosis and medication through IoT. Wireless Netw 26, 2375–2389 (2020)

[8] Harshitha V, Sandeep K, Swasthika Jain T J, 'An Interactive Pill Box using IoT', International Journal of Engineering and Advanced Technology (IJEAT)ISSN: 2249-8958 (Online), Volume-9 Issue-3, page- no 2436-2438,February 2020

[9] Viral Doshi, Shrishti Dey, Nirav Mehta, Rajesh Prasad, 'An IoT based smart medicine box', International Journal of Advance Research, Ideas and Innovations in Technology, Volume 5, Issue 1, page no 205-207, 2019.