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Real-Time Monitoring and Automation in Drug Delivery using IoT and RTC Technologies

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ABSTRACT

The major goal is to create a smart medicine box for users who regularly take medications with long prescriptions that are hard to remember for patients and caregivers. Older folks forget to take their prescriptions, which can cause health concerns for those with permanent ailments including diabetes, blood pressure, breathing problems, heart problems, cancer, etc. Patients can know which box to take drugs from. The mechanism preloads all pill boxes that patients must take. Our system uses RPS power supply, RTC, and Bluetooth IoT connectivity to improve functionality. Users can easily set medication schedules with an Android app for timer settings. The entire system runs on embedded C code for efficiency and reliability. Thus, our method cures patient health quickly employing our favourable system. People may forget to take their medications at the right time. We created this project to aid them with this liability.

Keywords: IoT, Smart Drug Administration, RPS Power Supply, Reliable System, Medication Adherence, Forgetfulness Mitigation, Fast Curing,

1.INTRODUCTION

Given a purpose, the Internet of Things (IoT) is not only a concept but an architecture that facilitates the interconnection between people, systems, and devices of any kind. When the resources amalgamate with respective people, it can solve issues known to humanity for several years. Medication nonadherence is expected for patients with chronic infections, concerning as many as 40% to 50% of patients prescribed medications to manage chronic conditions like diabetes or hypertension. This nonadherence to specified therapy is thought to cause at least 100,000 avoidable deaths and $100 billion in avoidable medical costs per year. The issues which have not been solved throughout decades have the power to be fulfilled through concepts of IoT. An IoT helps us create an environment enabling the growth of the products and aiding humanity regarding the issues it chooses to address. Embedded software in these devices adheres to its functionality and helps us deal with ever-growing challenges. An essentially proper schedule needs to be followed, and the quantity also needs to be regulated. The risk of overconsumption or under consumption may lead to unprecedented circumstances over time. Antimicrobial resistance has become a global problem primarily because of overuse, and misusage of opioids has shown to be an obsession epidemic in some nations. There are also chances of developing adverse drug reactions if a different medicine is provided due to human error, especially with people who are administered multiple prescriptions throughout the day. Thus, to solve these issues, especially among the elderly, there are vast chances of forgetting medicine schedules and repeatedly consuming the same medicine more than prescribed. Therefore, we present the “Medicine Dispenser” in the proposed paper a result of this.

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

W. Antoun et al (2018, March). The technique of the suggested prototype system is described in this section. The SMD design and its external peripherals are explained. In this study, we developed an Android application that is in charge of managing the entire system.

F. Kleinsinger et al (2018). The science of human behavioral modification can be used to help patients adopt healthier lifestyles and create healthy habits in order to help patients adhere to taking their prescriptions more consistently.

K. Karthikeyan et al (2021, October). 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.

Latif, G. etal (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.

Neiman, A. B. etal (2017). Given a purpose, the Internet of Things (IoT) is not only a concept but an architecture that facilitates the interconnection between people, systems, and devices of any kind. When the resources amalgamate with respective people, it can solve issues known to humanity for several years. Medication non adherence is expected for patients with chronic infections, concerning as many as 40% to 50% of patients prescribed medications to manage chronic conditions like diabetes or hypertension.

Pandey, P. et.al (2018, June). Design proposed system Smart Medicine Dispenser (SMD) was also developed, containing all the recommended dosages for a fortnight or a month and dispensing them at the correct timings with the correct quantity.

Rao, A. et.al (2020, July). 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.

Samhitha, S. et.al (2019). Proposed prototype system. In the study, Node MCU ESP8266, an Android; microcontroller with an inbuilt Wi-Fi component, is utilized for development. The Xcluma 28Ybj-48 stepper motor is used to rotate the medicine container. The stored history is also displayed to the user, which has the list of alarms successfully given the alarm, and the rotation of the container completed successfully. A medical alert is sent to the caretaker via a notification using the Android Application if the medicine is not taken within a specified time and specified dosage.

Salama, Dr-Diaa&Abd-ELfattah, (2018) Mohamed et.al Proposed prototype system. After seeing so many of these cases, the correct person must take the correct pill at 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.

Shaikh S.A.et.al (2021) Designed The Medicine reminder system consists of a pillbox provided with a set of compartments. It is designed in such a way that normal people can use it easily for their medication. The pill box's control system consists of LEDs for giving visual alerts to the patient for medicine. There is a buzzer in the system which alerts the patient in audio form.

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 his diurnal 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.

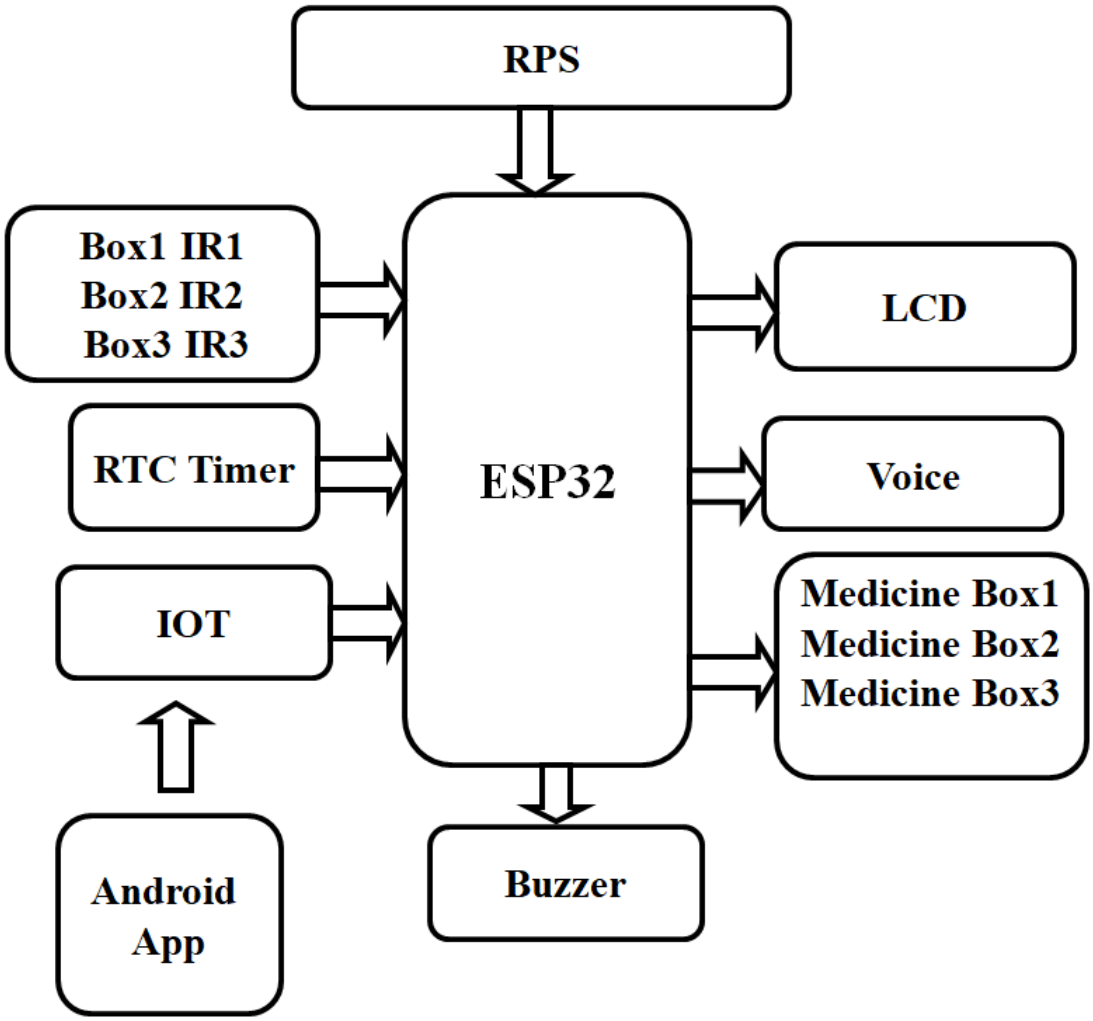
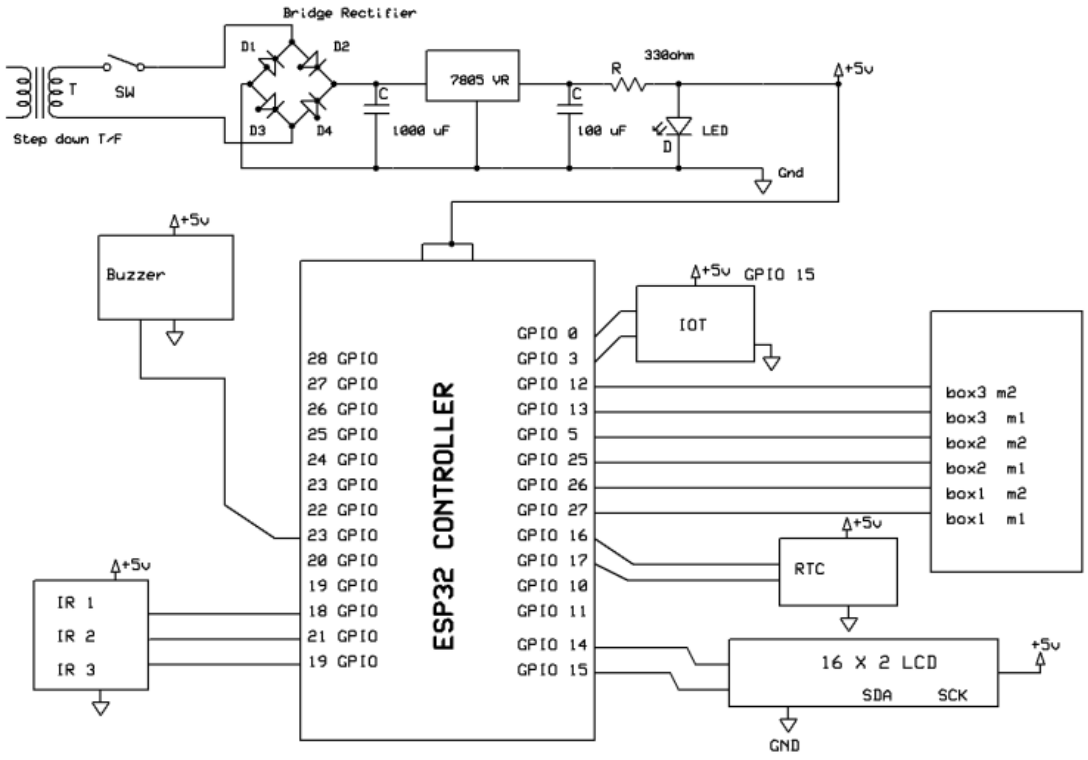


Fig.1.Block diagram

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.



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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 boxto 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.

ADVANTAGES: -

1) **Cost efficient**
   Our product cost is affordable compare to other product available in market.
2) **User friendly**
   User can set time table of medicine by himself.
3) **Highly reliable**
   Good in quality and performance; able to be trusted for patients & old age people.
4) **Easy to use and manufacture**
   It is very easy to use and manufacture.
5) **Accurate result**
   Alarm will ring at proper time which is set by user previously. Easy to maintain: It need less Maintenance. It is one time investment afterwards it can be used continuously.
6) **Enhanced Medication Adherence**
   Automated reminders and real-time monitoring improve patient compliance, ensuring medications are taken as prescribed.
7) **Real-Time Monitoring**
   Continuous monitoring of patient adherence, allowing healthcare providers to intervene promptly if issues arise.
8) **Improved Patient Outcomes**
   Enhanced adherence often leads to better health outcomes, reducing the risk of complications and hospital readmissions.
9) **Cost Savings:**
   Preventing medication-related complications and hospital readmissions can result in cost savings for healthcare systems.
10) **Reduced Human Error:**
    Automation minimizes the risk of errors associated with manual medication administration, improving patient safety.
11) **Emergency Alerts**
    Prompt notification of missed doses or emergencies allows for immediate intervention, reducing potential health risks.
12) **Improved Patient Experience**
    Simplifying medication management with user-friendly interfaces and reducing the burden on patients and caregivers.

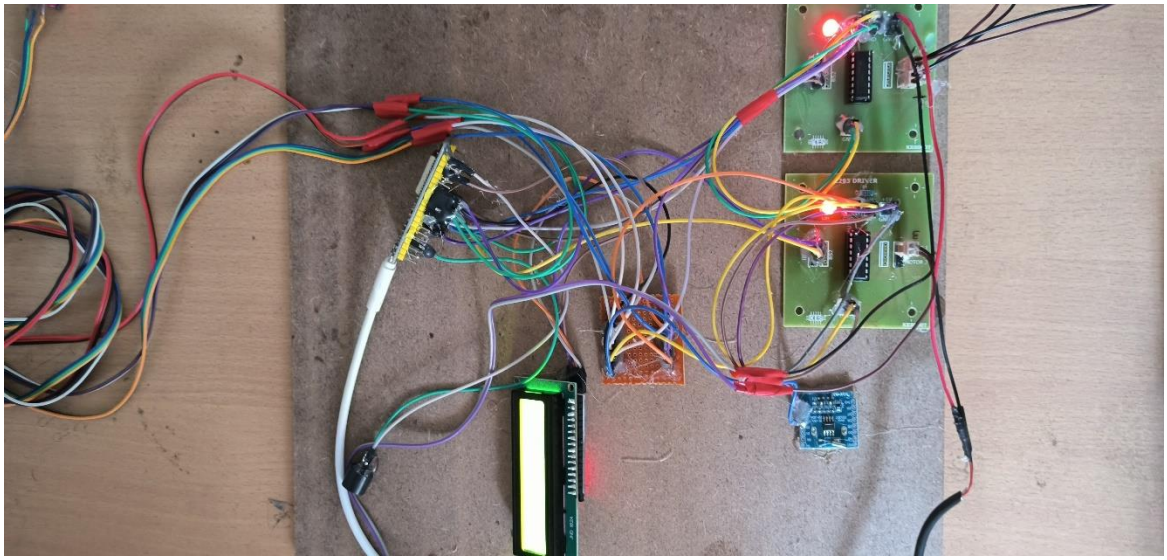
APPLICATIONS: -

1) **Medication Adherence Monitoring**
   Ensuring patients take medications on time through automated reminders and tracking.

2) **Remote Patient Monitoring**
   Enabling healthcare providers to remotely monitor patient drug adherence and adjust treatment plans as needed.
3) **Inventory Management**
   Tracking medication levels in real-time, automating reorders, and preventing stockouts.
4) **Temperature and Storage Monitoring**
   Using IoT sensors to monitor environmental conditions to ensure proper storage of medications.
5) **Data Analytics for Healthcare Providers**
   Analyzing patient adherence patterns to improve treatment outcomes and personalize care.
6) **Emergency Alerts**
   Providing real-time alerts to healthcare providers or caregivers in case of missed doses or emergencies.
7) **Integration with Electronic Health Records (EHR)**
   Seamlessly integrating with existing healthcare systems for a comprehensive patient profile.
8) **User-Friendly Interfaces**
   Developing intuitive mobile apps for patients to easily view and manage their medication schedules.
9) **Cost Reduction**

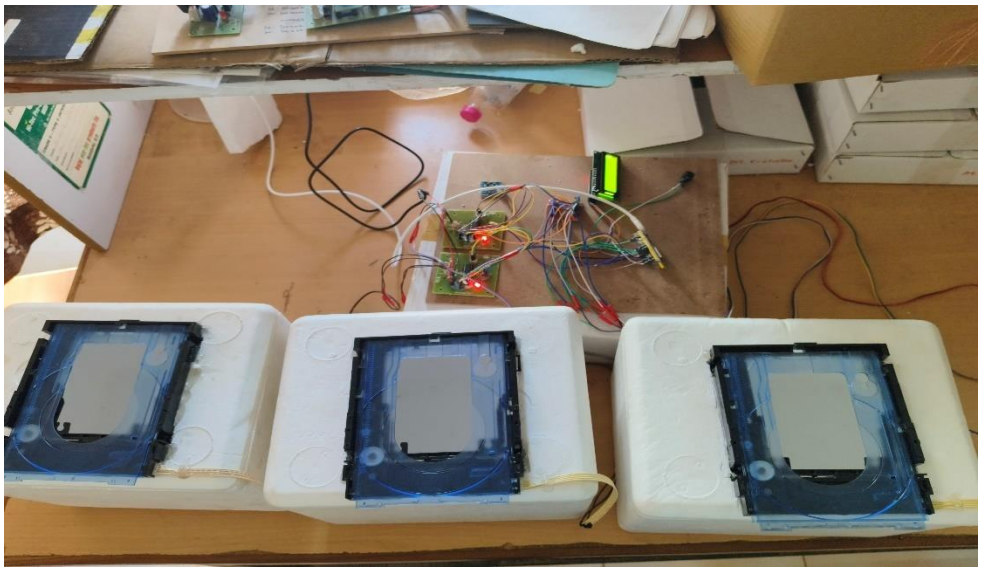
Optimizing medication management can lead to cost savings by reducing hospital readmissions and improving overall health outcomes**.**

4. RESULT

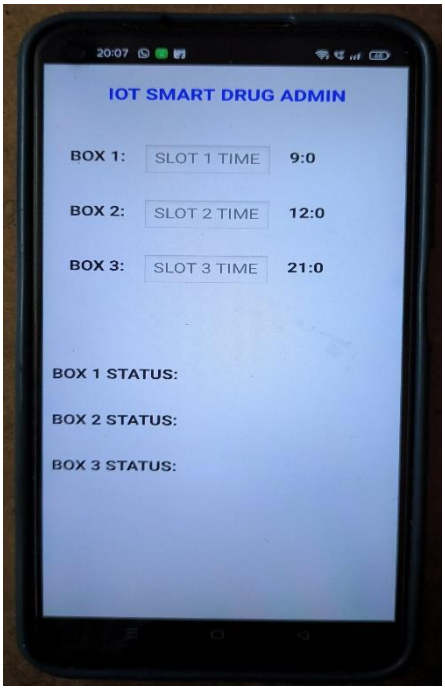


The above image shows the hardware equipment of the project. The kit is turned ON by giving the regulated power supply of 12v which is then converted to 5v dc current. The LED is the indication for

5v current so, if there is 5v current then automatically the LED glows. The generated 5v dc current passes to every hardware co component in the circuit.

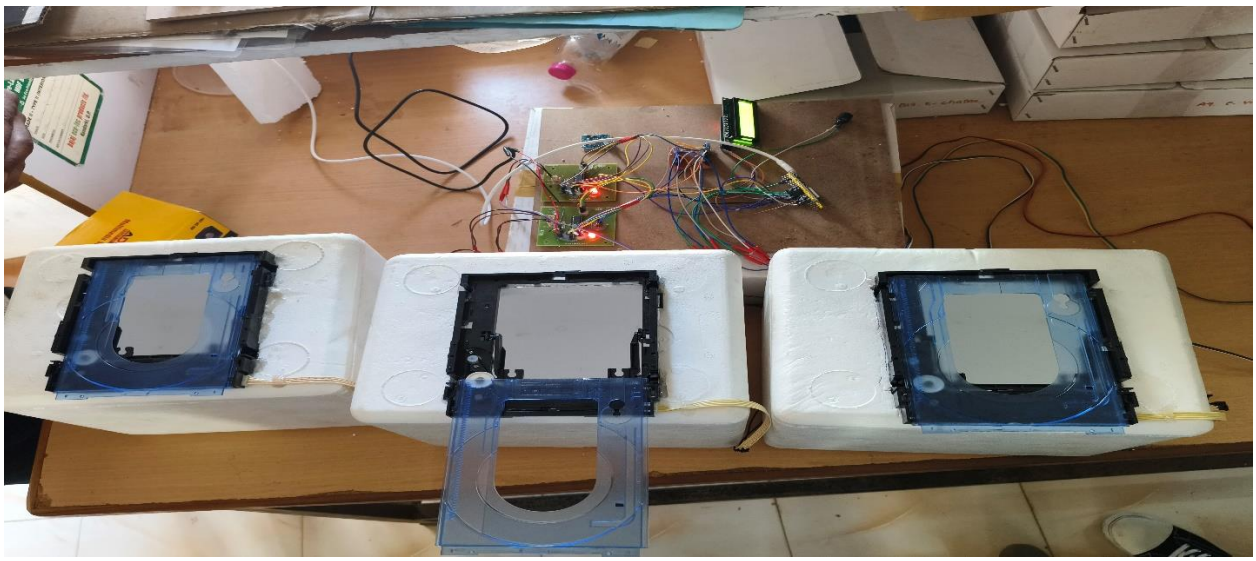


The pills are inserted in those boxes and boxes are opened according to RTC timings allotted in the IOT Android app.



The timings are set in the IOT android APK based app which is used to download easy and operations also easy to set and also easy to change the timings by just clicking on the on the slot time and box is opened as per timings

In LCD display project title were displayed when it is connected with WIFI Hotspot from internet device (Android phone, Laptop, wi-fi rooter). Internet is required to work the system for opening the boxes according to the timings.



Above picture can be seen that how a box is opened to take the pills. The software coded so that the box will be closed within one minute automatically. When the box is open for every 10 seconds a buzzer sound will be coming from speaker up to the door closes.

When the box is opened, the IR sensors are recorded that, pill is taken or not. The sensor detects human hand which we kept inside the box to collect our tablet. If the tablet is taken, by the server message is sent to IOT app that pill is taken in green color, if pill is not taken, it is displayed that no pill is taken from box in red color.

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 Wi-Fi 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] N. Sriskanthan and Tan Karand. "Bluetooth Based [1] Viral Shah, Jigar Shah, Nilesh Singhal, Harsh Shah & Prof. Prashant Uapdhyay, "Smart Medicine Box", Imperial Journal of Interdisciplinary Research (IJIR), Vol-2, Issue-5, 2017.

[2] Naga Udayini Nyapathi1, Bhargavi Pendlimarri2, Karishma Sk3 , Kavya Ch4," Smart Medicine Box using ARM 7 Micro controller", International Research Journal of Engineering and Technology(IRJET) , Volume: 03 Issue: 05 | May-2016.

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

[4] P. Raga Lavima1, Mr. G. Subhramanya Sarma2, "AN IOT BASED INTELLIGENT MEDICINE BOX", IJCSMC,

Vol. 4, Issue. 10, October 2015, pg.186 – 191.

[5] Suneetha Uppala1, B. Rama Murthy2, Smart Medicine Time Indication Box, International Journal of

Science and Research (IJSR), Volume 6 Issue 1, January 2014.

[6] Aakash Sunil Salgia*, K. Ganesan and Ashwin Raghunath(January 2014), Smart Pill Box

[7]. Collins V.J."General Anesthesia Fundamental Considerations", 3th Edition, Philadelphia, Lea&Febiger, 1993, 314-359.

[8]. Durgadevi S, Anbananthi Embedded System: Patient Life Secure System Based On Microcontroller. International Journal for Advance Research in Engineering and Technology, 2014, 142-147.

[9]. Hanumant R.Vani , Pratik V, Makh, Mohanish & Chandurkar.K Anesthesia Regularization using Heart Beat Sensor International Journal Of Engineering, Education And Technology (ARDIJEET),2 (1), 2014,1 - 9.

[10]. Isaka, S., "Control Strategies for Arterial Blood Pressure Regulation", IEEE Trans. Biomed. Eng., 40, 1993, 353- 363. Jung Kim, Gina Bledsoe, Steven R Hofstetter, Maureen Fitzpatrick & Maria Fezza, Patient Safety, Practice Management, BJA: British Journal of Anaesthesia, 108(2),2012, 310-367,https://doi.org/10.1093/bja/aer487.

[11]. Kraft HH & Lees DE., "Closing the loop: How near is automated anesthesia?" Southern Med. J., 77, 1984, 7-12.

[12]. Manikandan N, Muruganand S & Vasudevan K, Low Cost Anesthesia Injector Based On Arm Processor, International Journal of Advanced Research in Computer and Communication Engineering, 2(7), 2013, 2810- 2813.