Automatic Medicine Alert & Dispenser

Author(s):
[1] V. Dilleswara Rao, [2] B. Vedika, [3] S. Vamsi, [4] R. Vamsi Krishna, [5] R. Bhanu Prakash, [6] Yogesh Misra
[1,2,3,4,5] UG Students, Department of Electronics and Communication Engineering, GMR Institute of Technology, Rajam, Andhra Pradesh, India
[6] Corresponding Author, Professor, Department of Electronics and Communication Engineering, GMR Institute of Technology, Rajam, Andhra Pradesh, India, Email: yogesh.m@gmrit.edu.in

Abstract

In these days, Internet of Things (IoT) clear the way for parcel of openings in terms of disclosure, item and client applications. Based on the IoT, therapeutic division is moving towards a more astute health-based application to conclusion, treatment and control of wellbeing issues. This paper will examine an IoT-based pill container application to give how legitimate intercession to the quiet can be accomplished for a more advantageous life. The reason of the proposed container pills is to screen the legitimate admissions of pills for our self, and particularly for seniors, which is much more critical. IoT is coordinates to give human interaction between the persistent and specialist to screen and give legitimate measurement of pharmaceutical to the understanding. By having a wide dialog on the IoT and cloud based on pill allocator, we have dissected and compared different pill containers and how they vary from cloud-based wellbeing application.

Keywords: IoT, Medicine Dispenser, Healthcare, Node MCU

Introduction

In today's fast-paced world, ensuring timely and accurate medication intake is a significant challenge, especially for elderly individuals and patients with chronic conditions who often require multiple medications at specific intervals. Missed doses or incorrect medication administration can lead to severe health complications, reducing the effectiveness of treatment regimens and potentially leading to hospitalizations. The primary purpose of an automatic medicine alert and dispenser system is to assist patients in managing their medication schedules more effectively, reducing the burden on caregivers, and improving overall

healthcare outcomes. The system typically consists of both hardware and software components that work together to provide a comprehensive solution. This unit is equipped with a mechanism that can automatically dispense the correct dosage of medication at the scheduled time.

The intended function of auto medicine alert and dispenser system is to enhance the ability of the patient to remind themselves of the medication schedules, take a load off the caregivers and to improve on the overall health status as well. The system often encompasses a hardware part and a software part to form a complete chain. Specifically, this unit is fitted with an alternative that makes it possible for it to release the appropriate amount of the drug at the required time. Key to this system is the role of IoT that connects the dispenser with internet. Medication schedule can be managed on smartphones or tablets using Wi-Fi or Bluetooth, and the dispenser communicates with them. Patients or caregivers can enter the times and doses for each medication using a mobile app or web interface. The data is then stored by the system and processed to deliver timely alerts, so that when a prescription needs to be taken this triggers an alert telling the patient. It could, for instance, be called to order at the time a dose is required and notify the patient what they need to do using an SMS or email style alert on their phone or wearable tech like a smartwatch. If the patient fails to pick up, a second alert is sent to family members who act as the caretaker. Due to the remote monitoring aspects of the system, it is specifically of immense benefit to caregivers and health care givers. They can see the reports and history of the adherence to mediations for example missed doses or those taken at a particular time. It is essential for elderly patients especially those treated at home or those living alone in remote areas, thus helping families and health care givers have an eye on the patient's situation without having to be physically present.

Altogether, the system provides many advantages which include better compliance, less number of dosing errors and so on but there are certain issues to consider. These are issues such as communication interruptions which may be prevalent in areas with low internet connection, the cost of establishing the IoT

network. However, managing resources, which include patients, nurses, time, staff productivity, disease prevention, and patient outcome are the major challenges faces by the CHCs. Moreover, there are possibilities to develop this medicine dispenser of IoT-based system with incorporating artificial intelligence and wearable devices. AI could be EHRs to forecast the future pattern of health considering medication compliance whereas wearables would give real time health parameters including the heart rate or blood pressure. If the above data could in some way be fed back into the formula, then an even more effective system could be devised where medication dosages could be varied reactively.

Thus, the proposed system of automatic medicine dispenser alert through the use of IoT is a progressive course in healthcare technology. It assists patients to stick to their medication regimen, it helps to off load some of the work from the caregiver as well as providing health care workers with information on controlling patient care more efficiently. The more this IoT technology develops, such systems will play an even more critical role in patients' care and health management than it is today. This medicine dispenser system which is based on the implementation of IoT can be advanced further by incorporating AI and wearable gadgets. Using this data one could further fine tune the dosage range for specific medications on the fly and thereby make this system even more effective. Summing it all up, the automatic medicine dispenser alert system employing IoT could be considered as one of the most effective in the sphere of healthcare technologies. This enables patient to stick to the prescription and dosage recommended, it relieves caregivers and gives valuable information to caregivers to manage patients' health in a better way. As technology advances, systems such as this will only become even more enriched to patient care and the care delivery model, improving safety and expediting the delivery of health care.

Literature Review

A novel design for a medication dispenser that integrates advanced technologies to enhance dosage accuracy was proposed and the proposed dispenser features sophisticated mechanisms, such as automated systems and sensors, to ensure

that medications are dispensed with high precision. The drawbacks of the proposed system were technical complexity and high cost (S. S. Srinivasan et al. 2018).

A System was developed to improve medication adherence by integrating principles from both population health science and precision medicine. The medication adherence follows traditional approaches focus on broad strategies like patient education and remainders. Some of these methods often fail to address individual patient needs. precision medicine, in contrast, tailors treatments to the specific characteristics of each patient, such as genetics and life style. These integrated approach holds the potential to significantly improve medication adherence. The drawbacks of the proposed system was complexity in implementation and data privacy and security concerns (zullig LL et al.2018).

A healthcare solution was created to improve medication adherence by utilizing a smart pillbox system. The common problem of patients forgetting to take their medications, which leads to poor health outcomes. To overcome this problem the authors proposed a system that combines a smart pill box with medicine remainder and monitoring system. This system gathers real-time data on the patient's adherence, which can be shared with health caregivers, enabling more informed and proactive care. The drawbacks of the proposed system was Technological reliance and privacy and security concerns(Diaa salama Abdul Minama et al.2018).

The challenges of medication adherence are explored. The author proposes a smart medication kit that leverages the Internet of things to remind patients to take their medications at the appropriate times. This system not only sends remainders but also tracks the medication intake, ensuring that the patient follows prescribed schedule by this we can solve the common issues of patients forgetting to take their right at right time. The drawbacks of the proposed system were technical complexity and Reliability and connectivity (A. Rao, et al.2020).

An innovative portable medicine dispenser designed to improve medication adherence is discussed. The common problem of patients forgetting to take their medications or taking incorrect doses, which can lead to adverse health effects. So, the authors proposed a smart dispenser which automatically gives correct dose at prescribed times. It is equipped with remainders and alerts to notify patients when it is time to take the medicine. The main goal of these authors are to improve health outcomes and reducing likelihood complications due to missed or incorrect doses . The drawbacks of the paper was Dependence on proper loading and limited flexibility in medication changes (Samitha, S., and Srinath, N.K, 2019).

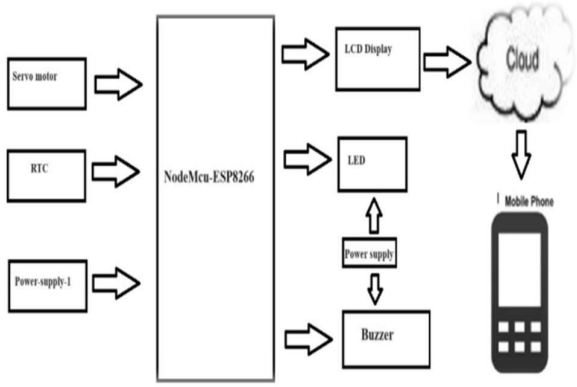


Figure 1: Block diagram of Automatic Medicine Alert& Dispenser System

The list of components utilized for developing the system and it's description is as follows:

NodeMCU – NodeMCU as shown in Figure 2 is a popular development board that is based on the ESP8266 Wi-Fi module. It offers a convenient way to develop IoT projects by providing an easy-to-use platform with a built-in USB-to-serial converter and plenty of GPIO pins for interfacing with sensors and other hardware. It is widely used for developing a range of IoT applications. With its Wi-Fi connectivity, it can connect to the internet and communicate with cloud services which makes it possible to build powerful and flexible IoT systems.

Some Technical specifications of NodeMCU are:

i. Microcontroller	ESP-8266 32-bit
ii. Operating voltage	3.3V
iii. Input voltage	4.5-10V
iv. Digital I/O pin	11
v. Analog input pins	1

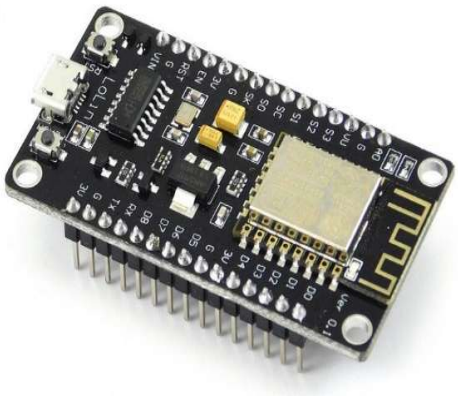


Figure 2: NodeMCU

Servo Motor– Servo Motor shown in figure 3, The SG90 servo motor is another component of the system and this is in charge of dispensing medication The SG90 servo motor is a small-sized, comparatively light motor which is used to release the medication. In this project, the servo motor is attached to a dispensing mechanism that holds the medication and releases it at the appropriate time to take the dose As for control, the Arduino Uno controls the servo motor through PWM –pulse width modulation to determine the angle of rotation. The Arduino Uno provides a PWM signal to turn the servo motor to the right angle to dispense the correct dosage of the medication. The SG90 is a model of a micro servo motor that is widely used in various hobby-related and robotics applications. It is easy to transport, requires a small amount of space, and is not expensive, which is a perfect option for projects where precise angular motion is needed. Servo motors are ideal for use in this application in as much as they provide accurate and optimum control of angular position.

i. **Operating Voltage:** 4.8V to 6V

ii. **Stall Torque:** 1.8 kg/cm (4.8V)

iii. **Operating Speed:** 0.1s/60 degrees (4.8V).

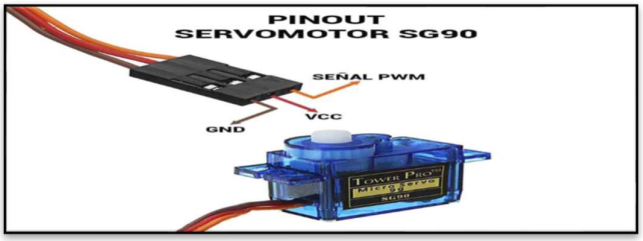


Figure 3: Servo Motor

Real Time Clock Module (RTC) – Real Time Clock is the original title of the RTC. According to Figure 4, it is a kind of electronic device which is required to have a precise time function in different applications. It has its own set of time, completely different from the other aspects within a computer which can be shut down, usually with the help of a small backup battery. The following is the description for a typical RTC such as the DS1307 and DS3231.RTC are integrated circuits used for setting up operations in different systems and controlling their time and dates. For instance, in a smart home system, it is the RTC that makes sure that lighting is on at the right time, probably at night, or the plants are watered.

i. Operating Voltage: Typically 3V to 5V

ii. Current Consumption: Low, typically around 0.5 µA (sleep mode) to 10 µA (active mode)

iii. Time Accuracy: ±2 minutes per month (varies by module and conditions)

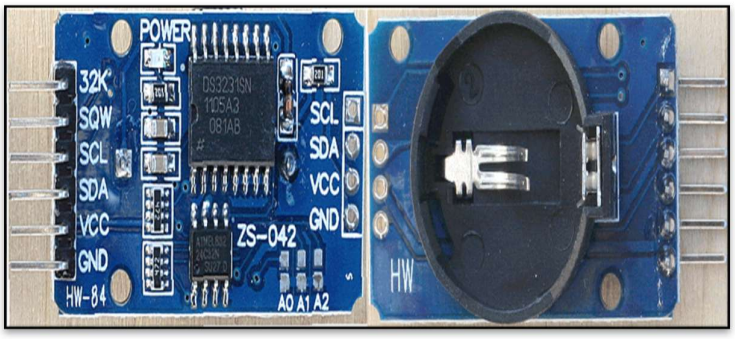
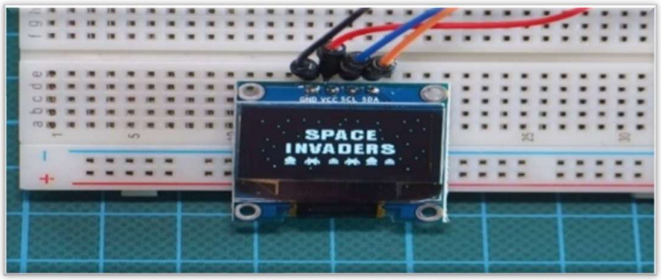


Figure 4: Real Time Clock

Organic Light Emitting Diode(OLED)- This can be characterized as Natural Light Transmitting Diode, According to Figure 5, where OLED is made of natural compounds that create light with an electric current passing over them. An OLED show is composed of natural compounds found between two terminals, meaning that the pixels are able of emanating light independently. There are essentially two subtypes of OLEDs: those made of two layers of natural materials, and those



made of three layers. OLEDs are utilized due to their effectiveness and their capacity to provide tall quality, tall determination pictures in thin bundles.

Figure 5: OLED

Jumper wires – Pin connections in Arduino, relays and other connections are made via jumper wires as shown in the below Figure 5. Male to male, female to female and male to male wires are also available.

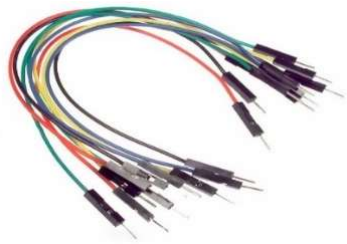


Figure 6: Jumper wires

3.2 Software Implementation

Arduino IDE – Arduino IDE is an open-source integrated development environment (IDE) used to program and upload code to Arduino microcontrollers. It is used for the Arduino AVR as well as ESP8266 processor boards. In this project

we have used NodeMCU board, which has an ESP8266 processor which helps to connect the devices over internet. We have to upload the program to this board using the micro-USB cable. The files of this software are saved with a ino extension. Also, this shows the errors in the written code while compiling. The Arduino IDE is compatible with Windows, Mac OS X, and Linux operating systems. Users can create their own libraries and add them to the IDE and can also customize the interface to suit their needs. Additionally, the IDE is compatible with a range of third-party tools and plugins which can extend its functionality.

Operational flow chart – The operational flow chart of Automatic Medicine Alert &Dispenser System is shown in Figure 6. Automatic medicine alert and dispenser system involves the procedural flow from alert identification and notification to medication dispensing. It begins with turning on and waking up all appendages including the sensors and the node MCU ESP8266 controller. The system then determines from the RTC the current time and compares it with the prior set medicine times. If it is time to dispense the medicine, the system is able to open a box through the help of a servo motor and dispenses the right quantity. The LCD screen display a message and a buzz sound to inform the user that his medicine is ready. The system then expects the user to acknowledge that the medicine has been administered through either a button or a mobile interface. As soon as a pair is confirmed, the statuses of that pair are sync with cloud and an LED flashes to inform the user that the process is over. At last, the system goes into a sleep mode and will wake up again based on the next time planned for performing all the described actions. This means that for the overall consumption of the medicine, the prescription and distribution of the medicine is correct and additionally, the user will be informed and monitored for each dosage..

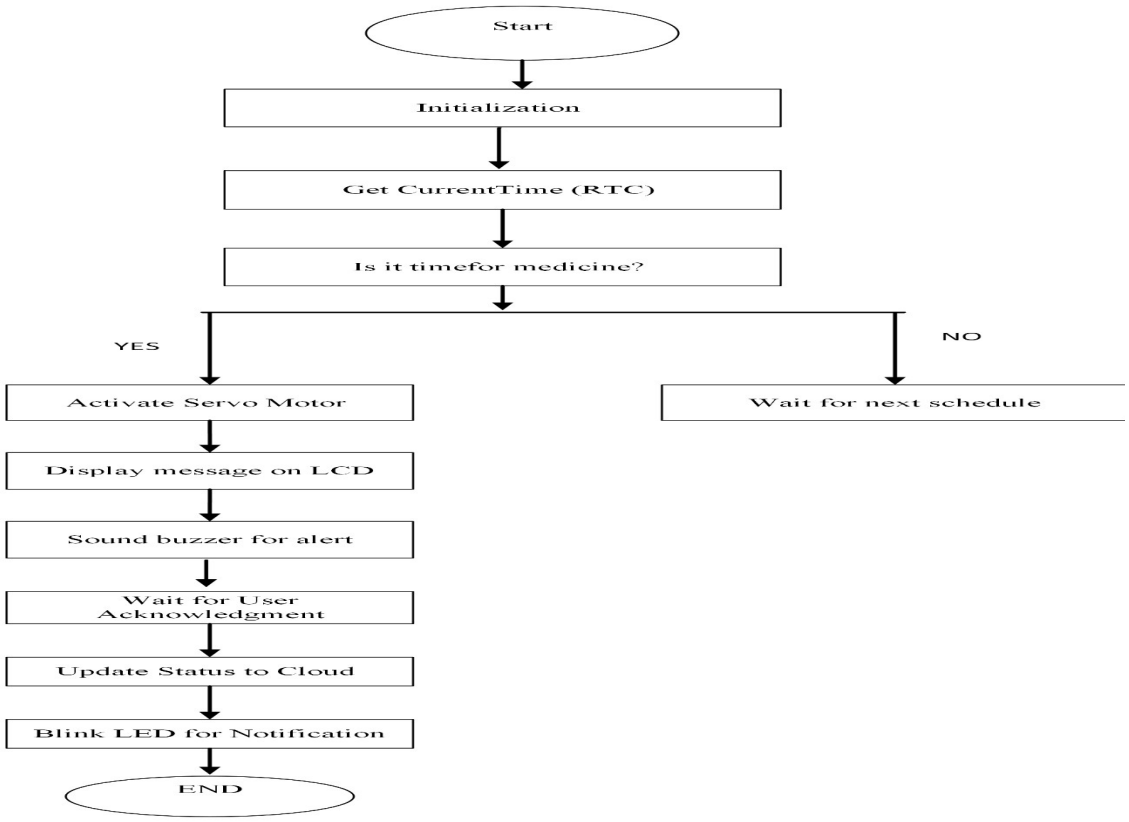


Figure 7: Operational flow chart of the system

4. Materials & Methods

In this Section, we have enclosed experiments done for the Automatic Medicine Alert& Dispenser System along with storing the data in the cloud server. The

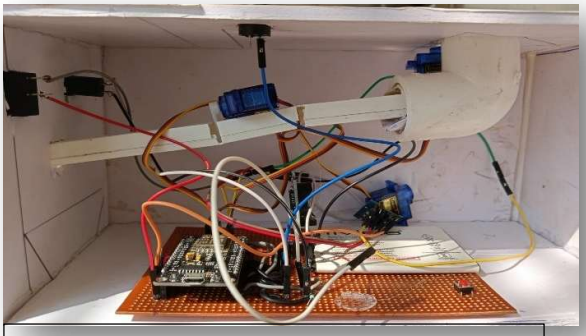


Figure 8: Internal view of prototype

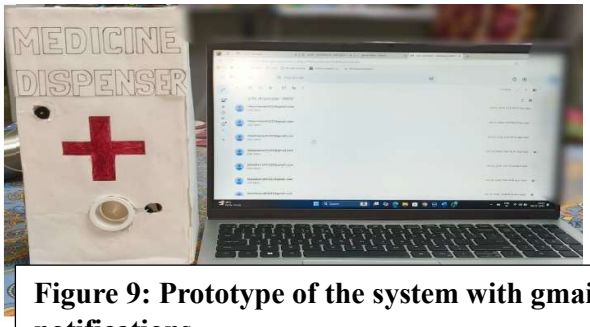


Figure 9: Prototype of the system with gmail notifications

prototype of the system is shown below.

The experimentation works which are done is shown below.

Experiment 1: Setting Up the Medicine Dispenser Mechanism.

Experiment 2: Integrating Real-Time Clock (RTC) Module.

Experiment 3: Working with Webhooks for Medicine Reminders.

Experiment 4: Working with Gmail Notifications.

Now let us see the working of experiments in depth.

Experiment-1: Setting Up the Medicine Dispenser Mechanism:

The part of the code for the Medicine Dispenser Mechanism is shown in Figure 10.

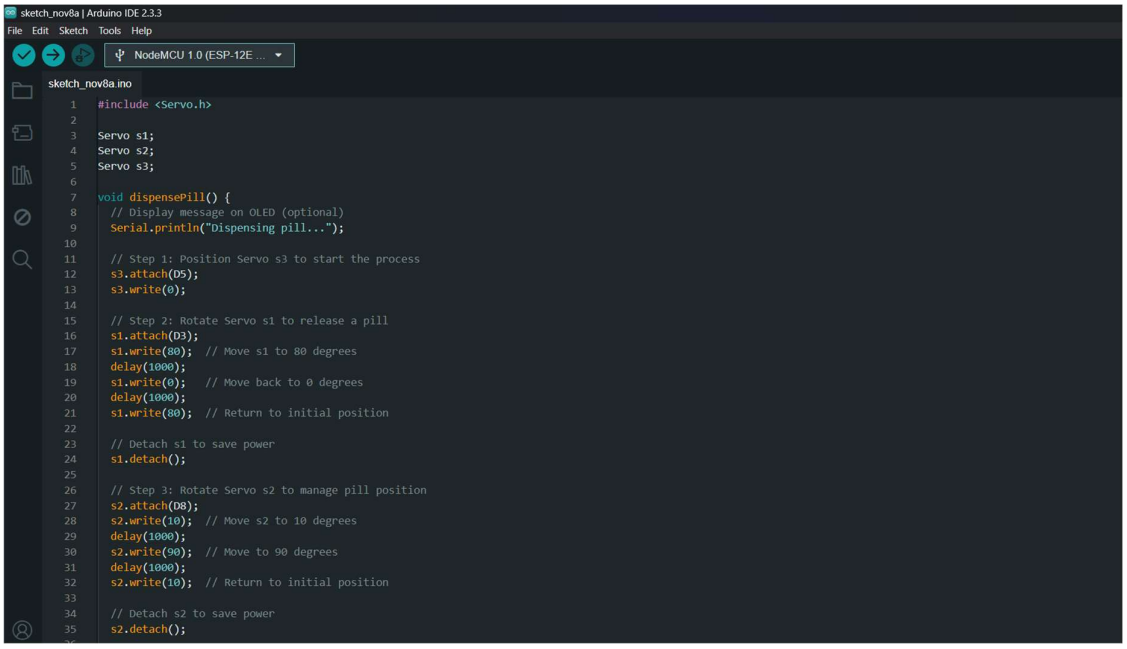


Figure 10: Part of the code.

Experiment-2 : Integrating Real-Time Clock (RTC) Module:

The part of the code for RTC setup and Data reading from the RTC Module is shown in Figure 11.

Figure 11: Part of the code for RTC Setup .

Experiment 3: Working with Webhooks for Medicine Remainders.

The part of the code for storing the data in Blynk cloud is shown in the Figure 12.

Figure: 12 Storing data in Webhooks.

Experiment – 4 : Working with Gmail Notifications

The data obtained are shown and notification is sent to the mobile through Blynk cloud are shown in the Figure 13.

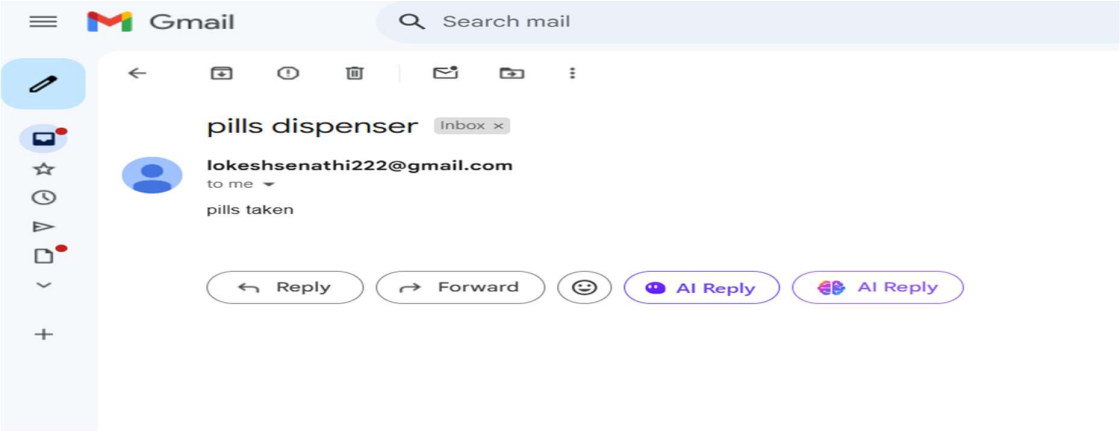


Figure 13: Notification on Gmail

4. Results

An automatic medicine alert and dispenser system is a technological advancement designed to support individuals, especially the elderly and those with chronic illnesses, in adhering to their prescribed medication schedules. This system incorporates various components such as an alarm, timer, and a medication dispensing unit that work in synergy to remind and administer medication on time. The system typically functions by setting specific times for each medication dose, and when it's time to take the medicine, an alert-often in the form of a sound, light, or vibration—is triggered to notify the user. In more advanced systems, reminders can also be sent through a mobile application, which offers the added benefit of notifying caregivers or family members about missed doses. This ensures a higher degree of adherence, which is critical for treatment effectiveness and overall health improvement.

5. Conclusion

In this project, we focused on developing an automatic medicine alert and dispenser system that enhance medication adherence. The system is designed to remind users when to take their medications and dispense the appropriate doses automatically. By integrating the Blynk platform, users receive real-time alerts through a mobile application, ensuring they never miss a dose. Overall, the

automatic medicine alert and dispenser system represents a practical and innovative approach to medication management, offering a low-cost solution that could significantly enhance the quality of care for patients. By continuing to refine and expand this technology, we can further support users in their healthcare journeys and improve adherence to prescribed treatments.

6. Acknowledgement

The lab setup and experimentation work to develop the proposed system were carried out in the Project lab of Department of Electronics and Communication Engineering of GMR Institute of Technology, Rajam, India. The application program is available with the authors. The Authors are thankful to the management for providing the support.

References

1. Shriya S. Srinivasan, sai N. R. Kantareddy, ebenezer A. Nkwate, Praveen meka, ivy chang, nevan Hanumara, and khalil b. Ramadi. “Design of a precision medication dispenser: preventing overdose by increasing accuracy and precision of dosage”. Volume 6, 2018.
2. Zullig LL, Blalock DV, Dougherty S, Henderson R, Ha CC, Oakes MM, Bosworth HB. “The new landscape of medication adherence improvement: where population health science meets precision medicine.” Patient Prefer Adherence. 2018.
3. 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, Volume 3, Issue 2, 2018.
4. 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.
5. Samhitha, S., & Srinath, N. K. (2019). Design and development of Portable Smart Medicine Dispenser. International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 5(3).