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An Automated Medicine Dispenser using IOT

1st Aastha Lokhande
Dept. Artificial Intelligence
G.H Raisoni College of Engineering
Nagpur, India
aasthalokhande2010@gmail.com

2nd Astha Durge
Dept. Artificial Intelligence
G.H Raisoni College of Engineering
Nagpur, India
asthadurge06@gmail.com

3rd Dishu Gode
Dept. Artificial Intelligence
G.H Raisoni College of Engineering
Nagpur, India
godedishu06@gmail.com

4th Garima Somkuwar
Dept. Artificial Intelligence
G.H Raisoni College of Engineering
Nagpur, India
garima12somkuwar@gmail.com

5th Saundarya Raut
Dept. of Artificial Intelligence
G.H Raisoni College of Engineering
Nagpur, India
saundarya.raut@raisoni.net

***Abstract*—An Automated Medicine Dispenser using IoT is a part of IoT technology that takes on the challenge of medication non-adherence for daily medication schedules especially for aging population. Non-adherence to medication results in negative health outcomes, higher rates of hospitalizations, and considerable costs to healthcare. To ensure that medicine is delivered on time and accurately, the project integrates different hardware components such as a motor-driven dispensing mechanism. The project uses both audio and visual alerts to inform users when they should take their medication. This enables patients and caregivers, as well as clinicians care providers to instantly monitor medication adherence which is supported by the devices IoT connectivity. The dispenser is also designed to be easy-to-use and user friendly and aims at elderly patients who have a hard time managing the complexities of multi-medication schedules. The Dispenser offers a reliable solution for improving medication management.**

***Index Terms*—Automated Medicine Dispenser, IoT, medication adherence, elderly care, healthcare technology, real-time monitoring.**

I. Introduction

One of the most important issues is medication adherence as the elderly population continues to grow, posing significant healthcare challenges. Poor adherence to prescribed medications result in detrimental health consequences, increased rates of hospitalization and higher healthcare associated costs particularly for the elderly living with chronic condition. To overcome this problem, an automated medicine dispenser is designed that uses IoT technology and makes medication management easy and ensures timely administration of medicines in the elderly who have a large number of drugs to be administered. The system is a discrete, easy-to-use solution that can help to improve medication adherence and reduce human error while providing oversight for caregivers and healthcare professionals.

Major components in Automated Medicine Dispenser are Arduino Uno, Buzzer, LED display, LCD screen and a motor-based dispensing mechanism. These together guarantee that they are given at the perfect time and in the correct portion to remove the gamble of missed or inaccurate portions. The system also has audio-visual reminders that help the user to take his/her medications when required and is particularly useful among the elderly users who might forget a complex medication schedule.

One of the Automated Medicine Dispenser's key strengths is its IoT integration, allowing for real-time monitoring. With that inter connectivity with caregivers and healthcare providers, medication adherence can be monitored ensuring that a patient does not miss a dose or takes the wrong one, managing receiving timely updates and alerts.

Along with bringing their design-based challenges the Automated Medicine Dispenser is intended to be low-resource and scalable, so they can expand its reach into healthcare delivery, especially in elderly care. Used in any medication and patient need, making it adaptable to meet different medical conditions. It also improves patient satisfaction, removing the task of manually managing multiple medications and overall quality of life for ageing population.

By melding IoT technology with a user-facing design, the Automated Medicine Dispenser is a comprehensive response to an essential question in geriatric healthcare: medication compliance. It reduces the burden on caregivers and healthcare professionals resulting in better healthcare efficiency along with patient care.

II. LITERATURE SURVEY

A literature survey, generally known as a literature review, is an examination of existing information on a certain topic or area of study. In addition to offering a thorough understanding of the current state of understanding regarding the subject, it aims to recognize and examine the literature that seems to be available at the moment.

[1] This paper has focused on the implementation of the elder-care cost-effective technology solution. A smart medicine dispenser was developed using programmable hardware and software to automatically dispense the required doses of medicine to elderly patients. It is coupled with a mobile application that sends the alert in real-time to caregivers, if a patient misses his dose, thereby ensuring prompt intervention. Cloud-based services are also employed for remote monitoring, which allows caregivers the flexibility and peace of mind knowing that they cannot be present to monitor their patient in person.

[2] This paper proposes a solution to the critical issue of drug non-adherence, especially in elderly patients. The proposed smart medical box has dispensation of medicines with prescribed times, as well as a monitoring system for checking important vital signs such as temperature, oxygen levels, and heart rate. The device, with a Raspberry Pi in control and equipped with biometric recognition, verifies that the right patient gets the medicine. Alerts are sent via SMS only once the medicine has been dispensed.

[3] This research paper involves developing MEDIC, a smart medication dispenser for the elderly to take their medications on their own. The system is comprised of an applied microcontroller as well as an OLED display, stepper motors, and alarm systems in order not to miss a dose or miss due time. Prescriptions may be input by care providers while alerting messages are received by the user through visual, audio, and SMS messages. The MEDIC comes with an additional compartment for cooling vaccines and fingerprint authentication to make it safer. It is in a quest to try to improve adherence to medication and mitigate the risks associated with health care among elderly patients.

[4] It is an automated drug dispensing system meant for elderly and disabled members of nuclear families. It uses a peristaltic pump to accurately dispense liquid medicines so that the user takes his scheduled doses with minimum family support. It can be very easy to use, light in weight by using a battery, and suitable for different liquid medicines. The system has reported better medication use compliance and it requires roughly 2500 to make.

[5] The research paper analyses the effects of advanced AI-driven tools on healthcare management and their roles in improving patient care and operational efficiency. The applications reviewed include predictive analytics, patient monitoring, and other related uses. It tackled ethical considerations and biases in AI algorithms through its treatments. Inferences made from the treatment indicated that the use of these tools could have a profound impact on health outcomes and processing by simplifying them to benefit patients and providers alike.

[6] The primary aim of the smart medication management system is to help older adults tackle issues such as complex dosing routines, numerous prescriptions, and memory lapses. The system combines Internet of Things (IoT) devices like smart pillboxes and sensors, along with a web or mobile app for distant monitoring by healthcare professionals and caregivers. It issues alerts to remind patients to take their medications punctually, monitors medication consumption, and enables caregivers to confirm compliance instantly. This strategy seeks to enhance medication compliance, lower the chance of skipped doses, and guarantee correct medication delivery, thus offering a safety net for elderly individuals.

[7] This paper emphasizes the increasing demand for dependable, technology-supported medication management for patients with chronic illnesses, including diabetes, hypertension, and heart disease, as their intricate medication routines frequently result in non-compliance. It evaluates current medication management technologies, highlighting their shortcomings, and suggests a cloud-based approach to enhance accessibility, scalability, and real-time tracking. The system facilitates effortless updates to medication regimens by healthcare professionals and provides interfaces for both patients, who get reminders and scheduling support, and providers, who are able to monitor adherence from a distance. The writers contend that this cloud-based method overcomes the limitations of conventional systems, improving patient involvement and resulting in improved health results and decreased pressure on healthcare.

[8] The paper examines the creation of a smart pillbox equipped with IoT technology aimed at enhancing medication adherence, especially for elderly individuals who struggle with intricate dosing schedules. The intelligent pillbox incorporates sensors that recognize when the medication compartment is accessed, sending this information to a mobile application that provides users with reminders and alerts for missed doses. Utilizing cloud technology, the system facilitates remote oversight by caregivers and healthcare professionals, allowing them to monitor medication compliance and take action if needed. The authors underscore the pillbox's adaptability, imagining its application for different patient populations, particularly those with long-term conditions. The system seeks to boost patient independence, increase compliance, and lower healthcare risks, ultimately enhancing health results.

[9] The authors suggest an IoT based health tracking system that employs wearable sensors to monitor vital parameters including heart rate, blood pressure, blood glucose levels, and body temperature. The system sends information to a cloud platform for immediate analysis and remote access by healthcare professionals, allowing for ongoing monitoring and prompt notifications for urgent health concerns. Utilizing machine learning algorithms, it forecasts possible health issues derived from historical data, assisting in tailored treatment. The flexible system accommodates different health metrics and numerous users, allowing it to be suitable for managing chronic illnesses. It guarantees lower healthcare expenses, enhanced patient treatment, and a revolutionary approach to managing chronic illnesses.

[10] The intelligent medical box created in this research aids patients, particularly seniors and individuals with chronic illnesses, in ensuring they stick to their medication regimen. It includes sensors and IoT components that oversee medication

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availability, monitor dosing schedules, and offer automatic reminders. Connected to a mobile app, it notifies patient and healthcare professionals in the event of missed doses or improper use. Cloud technology allows healthcare professionals to store and access data in real-time to track patient compliance. Algorithms in machine learning identify patterns to enhance reminder systems and patient treatment. This system seeks to enhance health results, minimize medication mistakes, and facilitate remote patient monitoring, improving patient autonomy and caregiver oversight.

III. Tools/ Hardware Required

A. Arduino Board (Arduino Uno)

Fig. 1. Arduino Uno

The Arduino Uno stands out as one of the most widely used and easy-to-use microcontroller boards for beginners. It utilizes the ATmega328P microcontroller and features 14 digital input/output pins (6 of which can function as PWM outputs) along with 6 analog inputs. It functions at 5V and features a 16 MHz quartz crystal, a USB interface for programming and power, a power socket, and a reset switch. The Uno is small and has a compact size that makes it perfect for minor projects, and it is commonly utilized for prototyping in robotics, automation, and the Internet of Things.

B. LCD Display

An LCD (Liquid Crystal Display) is a flat-panel screen technology that uses liquid crystals and a backlight to create images. It is made up of multiple layers, featuring a backlight that shines through the screen from the rear. The liquid crystal layer adjusts light by orienting its molecules in various ways when exposed to electrical currents, thereby regulating the

Fig. 2. LCD Display

brightness and color shown. Every pixel is segmented into red, green, and blue subpixels using color filters. An LCD can produce a complete spectrum of colors and images displayed on the screen by modifying the orientation of liquid crystals within each subpixel.

C. Servo Motor(SG90)

Fig. 3. Servo Motor(SG90)

The SG90 is a compact, lightweight, and commonly utilized servo motor perfect for projects that demand accurate movement and regulation. It functions with three primary wires: power (usually 5V), ground, and a control wire that accepts PWM (Pulse Width Modulation) signals to determine the rotation angle. The SG90, featuring a standard rotation range from 0 to 180 degrees, is capable of accurate angular positioning, which contributes to its popularity in robotics, hobby projects, and DIY tasks. It features plastic gears, approximately 1.8 kg/cm of torque, and a compact design, making it ideal for lighter tasks and small areas.

D. Buzzer

Fig. 4. Buzzer

A buzzer is a sound signaling device that generates noise through vibration when an electrical current flows. Frequently utilized in alarms, timers, and electronic projects, it can be categorized into two types: active or passive. An active buzzer contains an internal oscillator that enables it to generate sound persistently when it is powered on. In comparison, a passive buzzer needs an external pulse signal to generate sound, allowing greater control over tone and frequency.

E. LED

A Light Emitting Diode is a semiconductor component that produces light when an electric current passes through it. LED's are energy-efficient, have a long lifespan, and are available in various colors. Commonly utilized for indicators, displays, and lighting, LED's are sensitive to polarity and need to be connected with the correct orientation positive to positive power, and negative to operate effectively.

F. Push Button

A pushbutton is a basic, temporary switch that closes a circuit upon being pressed and opens it when released. Typically utilized in electronic projects for user interaction, it enables current to pass through only when pressed. Push buttons are usually linked to a digital input on a micro controller, allowing them to sense presses for different control applications.

G. Breadboard and Jumper Wires

A breadboard is a solder less, reusable platform utilized for prototyping electronic circuits. It features linked rows and columns of metal strips beneath its surface that permit

Fig. 5. LED

Fig. 6. Push Button

components to be inserted and connected without the need for soldering. Jumper wires connect components on a breadboard or with outside devices, allowing circuits to be easily built, tested, and adjusted without permanent links.

H. Power supply (USB cable)

A USB cable can act as a handy power source for electronic projects, delivering a consistent 5V output from a

Fig. 7. Breadboard and Jumper Wires

Fig. 8. USB Cable

computer, power bank, or USB charger. USB power adapters are frequently utilized with microcontrollers such as Arduino, Raspberry Pi, or various low-power gadgets, as they provide a secure and consistent current. USB cables generally consist of four wires: two designated for power (5V and ground) and two for data, although only the power wires are utilized when connecting devices solely for power.

IV. Methodology

The process starts by clearly defining the system's architecture, making choices on key hardware components like the microcontroller, sensors, servo motor, LEDs, buzzer, LCD, and button interface. Every part is selected according to particular needs, like precision, dependability, and suitability for the IoT structure. The design of the architecture enables smooth interaction among components, ensuring cohesive functioning within the system.

A. Development of Software and Firmware

The following stage includes coding the micro controller and incorporating it with additional hardware elements. This software layer involves configuring timers, handling input from sensors, and managing outputs such as the servo motor for dispensing medication, LEDs, and buzzers. The firmware is created to work independently, managing tasks like time monitoring, alert activation, and LCD display updates using current data.

B. Effective Time Management and Scheduling

Precise management of time is crucial due to the system's main purpose of dispensing medication at designated times. The method sets up a timing system in which the micro controller constantly checks the current time against a pre-determined schedule. This stage requires implementing logic to decide whether the medication should be given before or after meals and ensuring that the appropriate alerts and actions are carried out accordingly.

C. User Interaction Design

A crucial aspect of the approach involves creating user interface components, like LEDs, buzzers, and an LCD screen, in order to communicate information efficiently. The system needs to notify users when medication time is up, show visual cues for pre- or post-meal meds, and let users confirm dosage intake by pressing a button. These engagements are created to be straightforward and easy to understand, particularly for seniors or those with minimal technical knowledge.

D. Data Flow and Status Updates

To enhance transparency and user-friendliness, the system has a feature that informs the user about the current status, like if a dose has been given. The procedure describes a process in which data is sent to the LCD screen to show the current time and medication status. After the user confirms the dose, the status is reset to ”Waiting.” This feedback loop in real-time is crucial for monitoring medication adherence and giving caregivers dependable information.

E. System Validation and Testing

Validation and testing are important components of the methodology used in this project. Functional testing of each component, such as servo motor, LEDs, and buzzer, is carried out in the system to ensure they are functioning as anticipated. Furthermore, timing precision is examined to guarantee that

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medicines are delivered at the exact designated moments. User testing evaluates the interface's usability to confirm the effectiveness of alerts and the ease of the confirmation process.

V. Proposed Architecture

The following flowchart illustrates the proposed methodology for the Automated Medicine Dispenser.

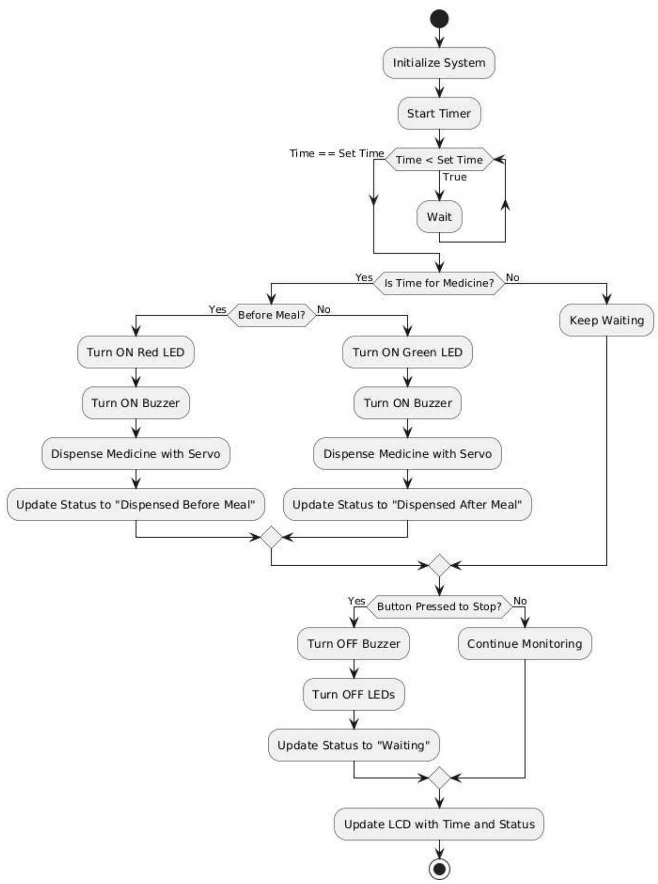

Fig. 9. Proposed Methodology for the Automated Medicine Dispenser.

A. System Initialization and Setup

The initial step in the automated medicine dispenser's function is to set up the hardware and software components. The process starts by setting up necessary hardware like LEDs for visual signals, a servo motor for releasing medication, a buzzer for notifications, and an LCD for showing time and status. Moreover, the software module starts a timer to monitor medication schedules, an essential function in the system's operation. This timer consistently operates in the background, preparing for the upcoming actions in the procedure.

B. Time Management and Waiting Mechanism

Accurately monitoring time is essential in every automated dispenser. Once the user or caregiver sets the medication time in the system, the dispenser will continuously check the current time compared to the preset value. If the current time is not yet the designated time, the system will continue to wait. The system will only move on to the next step when the current time corresponds to the scheduled medication time. This ongoing time-monitoring process guarantees that medication is delivered promptly and without delay by the system responding at the correct moment.

C. Detection of Meal-Related Timing

One important aspect of this medication dispenser is its capacity to distinguish between the medication needed prior to eating and after eating. This distinction is made by the user input, in which the patient or caregiver indicates if the medication should be given pre or post meal. The system adheres to a specific pathway according to this input. This capability to make decisions adds flexibility to the dispenser, allowing it to serve different medications that need to be taken at specific times in relation to meals.

D. Dispensing Mechanism

When the system decides it's time to give medication, it will turn on either the red or green LED depending on whether the medicine should be taken before or after a meal. In addition to this visual signal, the system also triggers a buzzer to audibly notify the user that it is time to take their medication. After that, the servo motor is activated to release the medication dose with precision. Safety is a top priority; the system includes checks to make sure only the correct dose is given, reducing the chance of mistakes and guaranteeing the user gets the right amount.

E. Status Update Mechanism

In order to give clear information to the user and caregivers, the system displays its status on an LCD screen after each dispensing action. This update indicates if the medication was given prior to or following a meal, to ensure it was administered as scheduled. This screen not just validates the completion of distribution but also boosts responsibility, allowing caregivers to check the situation if necessary.

F. User Interaction and Confirmation

The system has a feature that is easy for users and enables patients to verify they have received their medication. This is done by providing a button for the user to press in order to confirm that they have received the dispensed dosage. When the button is pressed, both the LED and buzzer are turned off, indicating the completion of that specific medication cycle. Moreover, the system is set back to "Waiting" status in order to be ready to begin monitoring for the next planned dose. This interaction prevents the system from alerting the user unnecessarily once the medication has been taken, improving user convenience.

G. LCD Display Update

The LCD screen is a crucial communication tool in the system, showing the current time and the dispenser's updated status. This live data is essential for both the user and caregivers, as it offers insight into the timing of the next dose and the status of the previous dose. The display is constantly refreshed to show any modifications, making it a useful tool for monitoring the medication timetable.

H. Continuous Monitoring and System Maintenance

After each dose, the system goes back to continuously monitoring until the next medication time. Continuous monitoring is crucial for the system to operate independently for extended periods of time. Furthermore, regular maintenance inspections are implemented to guarantee the system's dependability. These checks could include software diagnostics or alerts for any problems with parts, guaranteeing that the dispenser stays reliable and functioning well for extended periods of time.

I. Summary and Prospects for Improvement

In conclusion, this method details a strong and dependable process for an automatic medication dispenser that guarantees precise and prompt medication delivery. The system is designed to meet the diverse needs of users, including the elderly, by allowing medication to be dispensed before and after meals and offering clear, up-to-date information on the dispenser's status. Possible enhancements to the system include implementing remote notifications for caregivers, integrating machine learning for medication scheduling optimization, or utilizing user compliance data to personalize alerts according to past interactions.

VI. Implementation

The Automated Medication Dispenser system is based on an Arduino Mega microcontroller, aimed at enhancing medication adherence via prompt notifications and automated dispensing. Essential elements, such as an LCD screen, LEDs, a buzzer, and a servo motor, are combined to simplify the medication procedure. The LCD showcases the medication timetable, utilizing a formatTime function that depends on the Arduino's built-in timer to remove the necessity for a real-time clock module, thus streamlining the hardware configuration.

To manage dispensing intervals, the system is configured with predetermined durations of 1, 2, and 3 minutes for various medications. The millis() function of the Arduino precisely monitors these periods, activating notifications when it's time for a dose. Upon reaching an interval, the LCD refreshes the status, particular LEDs (red for pre-meal and green for post-meal) illuminate, and a buzzer activates to notify the user. The servo motor is programmed to rotate and dispense a dose at designated intervals, with a medicineDispensed indicator stopping multiple dispensations during the same interval. The button acts as a recognition tool, halting the alerts when it is pressed while not disrupting the ongoing medication monitoring.

In the primary loop, the Arduino oversees timing, screen refreshes, and notification systems, facilitating smooth engagement with the senior user. The design of the system emphasizes reliability and simplicity, utilizing minimal hardware parts such as the internal pull-up resistor for the button and omitting complicated external devices. This small, easy-to-use system efficiently merges user interaction with automated delivery, providing a strong solution for elderly assistance.

In summary, the implementation of the Automated Medicine Dispenser utilizes Arduino's features to develop a dependable, affordable solution for medication compliance. The system is designed to cater to elderly users by combining alerts and dispensing functions with minimal hardware, guaranteeing straightforwardness and user-friendliness. The modular strategy, which employs separate elements for timing, notification, and dispensing, boosts the system's capabilities while ensuring it remains user-friendly and manageable for those without technical expertise. This design prioritizes prompt engagement while simplifying processes, providing a flexible framework that can be tailored to different healthcare environments, which may lower the chances of human error and enhance medication adherence.

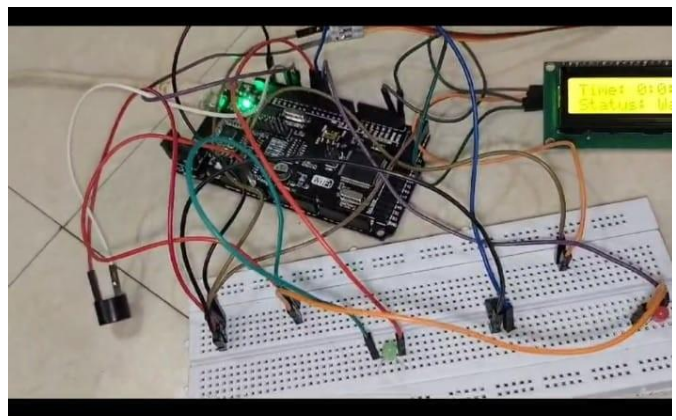

Fig. 10. Hardware Connections

VII. Results

The automated medicine dispenser system functions as intended, providing timely medication at set intervals while guiding the user with clear audio-visual prompts. At each designated interval, the servo motor rotates to release a single dose, ensuring that the user receives their medication without the need for manual intervention. The LCD continuously

Fig. 11. Medicine status

shows the time along with status updates, allowing the user to see when the last dose was dispensed or if the system is in standby mode. The red and green LEDs are used effectively to differentiate between doses, with the red LED signalling a dose

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before a meal and the green LED after a meal. Additionally, the buzzer provides an alert sound to draw attention when medication needs to be taken.

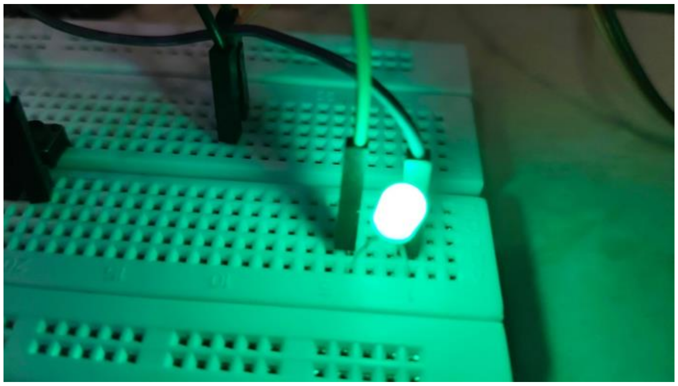

Fig. 12. Green Light Indication

Upon pressing the button, the user can deactivate the buzzer and LEDs, confirming that the alert was acknowledged, while the system continues to track the next scheduled interval seamlessly. This setup delivers reliable medication reminders and automated dispensing in a user-friendly, compact design. The integration of time tracking, dispensing, and notification elements creates a comprehensive solution for medication management, providing peace of mind for users who may need regular reminders and assistance in maintaining a consistent medication routine.

Fig. 13. Medicine Dispensed

References

[1] Shree, SR Bhagya, et al. ”Automated medication dispensing system.” 2014 Eleventh International Conference on wireless and optical communications networks (WOCN). IEEE, 2014.

[2] Nasir, Zara, et al. ”Design of a smart medical box for automatic pill dispensing and health monitoring.” Engineering Proceedings 32.1 (2023): 7.

[3] YR, Manjunatha, N. Lohith, and Bindushree SV. ”MEDIC-the SmartMedicine dispenser.” Proceedings of the second international conference on emerging trends in science technologies for engineering systems (ICETSE-2019). 2019.

[4] Narendra, Pardeshi Aman, et al. ”Medicine Dispensing Unit.”

[5] Philip, Jyothis, et al. ”Automatic medicine dispenser using IoT.” International Journal of Engineering Research Technology 9.08 (2020): 342-349.

[6] A.Ranjan and P.Kumar,“IoT-Based Smart Medication Management System for Elderly Patients,” ASME International Design Engineering Technical Conferences,vol.3B,pp.V003T03A024Aug.,2021.

[7] F.Mohammed,A.Ali,and H.Alshahrani,“Cloud-Based Medication Management System For Chronic Disease Patients,”Journal Of Cloud Computing:Advances,Systems And Applications,vol ..9,no ..1pp ..15 -25Jan .,2020 .

[8] T.H.A Nguyen,N.T.D Nguyen,“Designing a Smart Pillbox with IoT Integration,” Proceedings of the IEEE International Conference on Electronics Technology (ICET), pp .234 -239 May .,2022.

[9] T.Kumar,A.Sharma,and P.Kaur,“IoT-Based Health Monitoring System for Chronic Disease Patients,”Journal of Healthcare Engineering,vol.2022Article ID1234567Jan.,2022.

[10] K.Manjuatha,P.S.Kumaravelan,“MEDIC: A Smart Medicine Dispenser for Elderly Patients”, IEEE Transactions on Biomedical Engineering Vol.66, No.12, December ,2019.