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Smart Medicine Box

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Abstract: *Introducing a revolutionary solution to combat the widespread problem of medication forgetfulness, especially prevalent among individuals of all ages, notably impacting seniors grappling with memory challenges. This innovative smart medicine box is meticulously designed to offer a compact and cost-effective remedy. Boasting a user-friendly knob interface, users or caregivers can effortlessly set medication timings, thereby activating a timely alarm alert. Whether the medication is essential for medical conditions, cosmetic enhancements, or supplemental needs, this ingenious device serves as an unwavering ally, fostering consistent adherence to prescribed regimens amidst the chaos of modern-day lifestyles. It is made by using the Raspberry pi 3 along with the servo motors, 16*2 LCD display and LEDs related to the output indication of the process.*

Keywords: Raspberry pi 3, Servo motor, LCD, LED

I. INTRODUCTION

In today's advancing healthcare landscape, an increasing number of diseases are being diagnosed and treated through various means such as surgery and medication. Medications are often prescribed post-surgery to maintain the body's immune response and address various health concerns ranging from vitamin deficiencies to chronic illnesses, genetic disorders, and the effects of old age. Individuals, both young and old, seek relief from symptoms like nausea, pain, and headaches through prescribed medication after consulting healthcare professionals. However, amidst the demands of daily life or other factors, patients sometimes forget to take their medication, exacerbating their conditions and impacting their quality of life. For instance, young children, prone to distraction, may forget to take their medication, leaving it up to parents who may also forget due to work or stress. The introduction of a smart medication box provides a solution, allowing parents to set alarms to remind their children to take medication even when they are not present. Similarly, adults and teenagers balancing work, studies, and other responsibilities can benefit from this device as a reminder to take their medication. While setting alarms on phones is an option, there's a risk of ignoring reminders amidst busy schedules. The portable nature of the smart med box ensures it can be carried anywhere, with the alarm prompting immediate medication intake. If ignored, a notification is sent to the designated guardian, ensuring adherence to medication schedules. This device is particularly invaluable for the elderly, who may experience memory decline due to age-related factors or conditions like Alzheimer's disease and Parkinson's disease. Missing even a single dose can result in significant discomfort, especially for those living alone or with limited caregiver support. The smart medicine box alleviates the burden on both the elderly and their caregivers by serving as a reliable reminder for medication intake.

II. METHODOLOGY

An external power source is essential for the device's operation, with the Raspberry Pi 3 Model B serving as its primary component. This device stores necessary data and medication-related code on a small SD card. Connected to the medicine boxes are four servo motors and LEDs, enhancing user interaction through external output sources such as speakers and an LCD display. Operating on programmed principles, the device signals medication times by automatically opening the medicine box, emitting an alarm sound, blinking LEDs, displaying medication information on the LCD, and vocalizing instructions through speakers. Programming flexibility allows users to choose any language according to their preferences and needs. Additionally, the software Real VNC is utilized for Raspberry Pi functioning and acts as the Wi-Fi module. A camera and panic button are also attached to the device. If the patient is unable to take

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medication, pressing the panic button triggers an alert message to the patient's guardian, containing the message "DANGER" and capturing the patient's image. This proactive approach enables immediate action through an application allowing for swift intervention and resolution of potential issues. The methodology for a smart medicine box using Raspberry Pi 3 Model B typically involves designing an IoT-based system to assist patients in managing their medication. The Raspberry Pi 3 Model B, functioning as the main control unit, interfaces with various components such as sensors, a display screen, and alert systems to streamline medication tracking. The process begins by connecting the Raspberry Pi to a real-time clock module to ensure accurate time-based alerts for medication schedules. The box includes a compartmentalized structure, with each compartment assigned to different medications based on the patient's daily regimen. Sensors or weight-detection modules in each compartment can monitor whether a pill has been removed at the scheduled time, which allows the system to detect missed doses and alert patients accordingly. When it's time to take medication, the system sends visual and auditory reminders using LEDs and buzzers controlled by the Raspberry Pi's GPIO pins. Additionally, the system can send notifications through WiFi to a connected mobile application, which may include reminders, alerts for missed doses, and even direct notifications to caregivers or family members in case of repeated noncompliance. For development, Python or C programming is often used to code the system, integrating libraries that manage GPIO input and output, time scheduling, and network connections for data transmission. Data from each session, such as compliance logs and medication history, can be stored locally on the Raspberry Pi or on cloud storage for later review. This setup enables real-time monitoring and helps improve patient adherence to prescribed medication schedules, addressing the common issue of forgotten doses in home healthcare.

III. LITERATURE REVIEW

A literature review on a smart medicine box using Raspberry Pi 3 Model B highlights recent advancements in healthcare IoT applications, emphasizing automated medication systems that address issues of patient non-adherence and missed dosages. Smart medicine boxes equipped with IoT and microcontroller units like the Raspberry Pi 3 Model B have become popular for their adaptability and processing capabilities, enabling real-time monitoring and alerts. These systems incorporate sensors, such as RFID for pill identification and load cells to measure remaining doses, and are often linked with mobile or cloud-based platforms for remote access by caregivers or medical personnel. The literature shows that the integration of databases and software applications with these systems allows for scheduling, patient-specific alerts, and reminders. For example, studies detail applications where the system triggers alarms or sends notifications to smartphones when it's time to take medication, with cloud storage providing secure logging of adherence data. These advancements improve patient outcomes by reducing human error and ensuring timely medication intake, especially in elderly and chronic care settings. Many designs utilize Python-based scripts to control the Pi's GPIO pins, connecting sensors and actuators for functions like locking mechanisms, audible alarms, and light indicators, thus fostering an intuitive user experience. Additionally, research highlights the importance of scalability, allowing these boxes to serve various types of medication needs across different patient groups. Machine learning algorithms, sometimes incorporated for predictive analytics, offer potential for adaptive dose adjustments based on patient history, though privacy and data security remain critical concerns. Overall, smart medicine boxes demonstrate a practical application of IoT for advancing accessible, personalized, and reliable healthcare solutions. Recent research has explored the development of smart medicine boxes using Raspberry Pi 3 Model B to improve medication adherence and patient care. These systems typically incorporate features such as automated medication dispensing, timely reminders, and remote monitoring capabilities. By leveraging the Raspberry Pi's computing power and connectivity, these devices can provide personalized medication management solutions, especially for elderly individuals and those with chronic conditions. However, challenges remain in areas such as ensuring accurate medication delivery, userfriendly interfaces, and robust security measures to protect sensitive health information.

IV. EXISTING AND PROPOSED SYSTEM

• Existing System: The existing smart medicine box systems primarily rely on IoT and microcontroller-based architectures, often using Raspberry Pi and other components like Arduino. These systems are designed to manage medication schedules, providing reminders to users to ensure timely intake of medications. Using sensors, many of these boxes monitor whether the medicine compartments are accessed at the scheduled times. Notifications, often

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through mobile applications, alert users about missed doses. However, existing solutions sometimes lack robust real-time health monitoring or emergency alerts that can assist in critical situations, especially in home care for elderly or chronic patients.

• Proposed System: The proposed smart medicine box leverages the Raspberry Pi 3 Model B to improve upon existing designs, adding comprehensive features for medication adherence and patient safety. This system integrates real-time health monitoring, using sensors to track health metrics like heart rate or temperature, which are sent to a mobile application via Wi-Fi or Bluetooth. If irregularities or missed doses are detected, the system sends alerts to caregivers or healthcare providers, enhancing safety and communication. The Raspberry Pi's processing power enables a responsive interface, and its expandability supports additional features like emergency alerts and compliance logging for better healthcare management.

V. WORKING

A smart medicine dispenser utilizing IoT technology ensures accurate and timely medication administration through connected devices and sensors. Users input their medication schedule, including details such as names, dosages, and administration times, into a companion app or web interface. The dispenser uses sensors to monitor medication levels and track usage, detecting factors like pill count, liquid volume, or container weight. Connected to the internet via Wi-Fi or other protocols, it communicates with smartphones or a central server, enabling real-time monitoring and alerts for missed doses or low medication levels. Automatic refill reminders are sent to the user's application or designated caregivers. The dispenser may have a user-friendly interface with an LED display or buttons for manual interaction, allowing users to acknowledge reminders or dispense medication manually. Data on adherence, usage patterns, and refill history is collected for analytics and reporting, providing insights for healthcare providers or caregivers to better manage the user's health. Security features, such as encryption and secure authentication, protect sensitive medical information, ensuring data privacy and preventing unauthorized access. This system offers a convenient, reliable solution for managing medication adherence, enhancing patient safety, and improving health outcomes.

VI. COMPONENTS

• RASPBERRY PI 3: The Raspberry Pi 3 is a compact single-board computer manufactured by the Raspberry Pi Foundation. It boasts a quad-core ARM Cortex-A53 processor, 1GB of RAM, and integrated Wi-Fi and Bluetooth connectivity. With HDMI output, USB ports, GPIO pins, and a range of compatible accessories, it's widely used for diverse projects including DIY electronics, home automation, and small-scale servers. Its open-source nature and affordability have made it a favourite among hobbyists, educators, and professionals alike. The Raspberry Pi 3, featuring a quad-core Cortex-A53 processor, is touted as delivering significantly improved performance compared to its predecessor, the Raspberry Pi 1. Performance benchmarks indicate that the Raspberry Pi 3 is approximately 80% faster than the Raspberry Pi 2 when executing parallelized tasks. This enhanced processing power opens up new possibilities for users seeking to undertake more demanding projects and applications with their Raspberry Pi devices.

• LCD Display: An LCD 16x2 (16 characters by 2 lines) is a common type of alphanumeric display module used in various electronic projects and devices. It consists of a liquid crystal display panel with 16 characters arranged in 2 rows, with each character typically composed of 5x8 dots. These modules also include a backlight for improved visibility in low-light conditions.

• Servo Motor: A servo motor is a type of rotary actuator that enables precise control of angular position. It consists of a motor coupled with a feedback mechanism, typically a potentiometer, which provides information about the current position of the motor shaft. This feedback loop allows servo motors to accurately move to a desired position and maintain that position with minimal error.

• Speaker: USB speakers are audio output devices that connect to a computer or other compatible device via a USB port. Unlike traditional speakers that require a separate power source and audio input connection, USB speakers draw power and audio signals directly from the USB port, simplifying setup and eliminating the need for additional cables.

• Buzzer: A buzzer is an audio signaling device that produces a continuous or intermittent sound when an electrical current passes through it. It typically consists of an electromechanical transducer, such as a coil or piezoelectric

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element, housed in a plastic or metal enclosure. When activated, the buzzer generates vibrations that create audible sound waves.

• LED's : LEDs, or Light Emitting Diodes, are semiconductor devices that emit light when an electric current passes through them. They are small, energy-efficient, and durable, making them widely used for various lighting application.

• Software Python Idle: Python stands out as the leading multi-purpose, high-level programming language in today's tech landscape. Its versatility enables programming in both Object-Oriented and Procedural paradigms, with Python code typically being more concise compared to languages like Java. This succinctness is owed partly to the language's indentation requirement, which ensures readability at all times

• Panic Buttons: A panic or emergency button is a device designed to quickly and easily alert others in case of an urgent situation or emergency. It typically consists of a button or switch that, when pressed, triggers a pre-defined response or action, such as sounding an alarm, sending a notification to emergency contacts, or activating security measures.

VII. BLOCK DIAGRAM

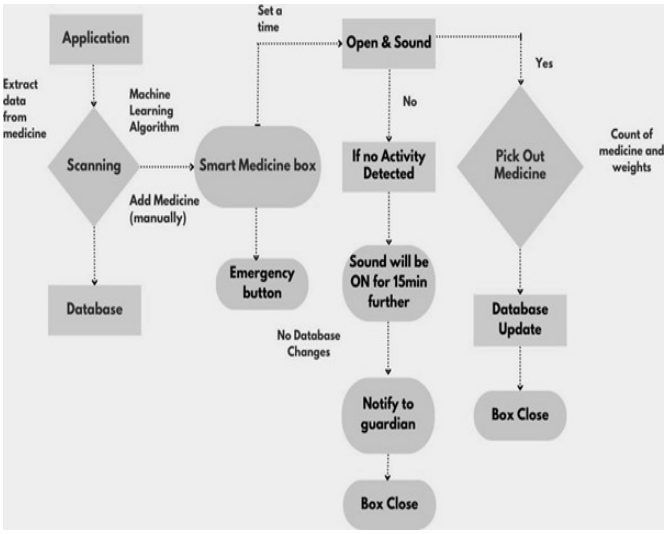

Fig. 1. Block Diagram

VIII. CHALLENGES AND FUTURE SCOPE

Smart medicine boxes face several challenges, including data privacy and security concerns, as they handle sensitive patient data, necessitating robust encryption and secure protocols to prevent unauthorized access. Usability and adoption also pose issues, especially for older adults, requiring intuitive interfaces and potential training support. Ensuring reliability and accuracy in sensors is critical, as any discrepancies could lead to incorrect reminders; however, continuous calibration adds to the device's complexity and cost. Integration with healthcare systems is challenging due to varying data standards, while affordability remains a barrier, making it crucial to develop cost-effective models. Technical limitations such as battery life, storage, and connectivity in remote areas can affect functionality. Future scope includes AI-driven personalized reminders and enhanced interoperability with healthcare systems for better monitoring and intervention. Improved user interfaces with voice or touch-free commands could aid accessibility, while predictive analytics could alert caregivers to health risks associated with non-adherence. Dual connectivity models combining Wi-Fi and cellular networks could enhance reliability in low-connectivity areas. Modular designs could reduce costs by allowing users to select necessary features, and integration with wearable devices could offer a holistic health profile. Advanced biometric authentication for data security and emergency alerts in case of missed doses could further enhance privacy and responsiveness.

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IX. RESULTS

A smart medicine box designed using the Raspberry Pi 3 Model B for an IEEE paper can significantly contribute to healthcare by improving medication adherence and safety. This innovative system leverages the processing power and connectivity features of the Raspberry Pi to ensure efficient and user-friendly medication management. The medicine box is equipped with sensors to monitor and detect medication usage, including pill counts and container weights. Users set up their medication schedule through a custom-built web or mobile interface, which connects seamlessly to the Raspberry Pi. The system sends real-time alerts and reminders to patients or caregivers when it is time to take medication, ensuring doses are not missed. If a patient fails to take their medication on time, the system automatically sends notifications to designated contacts or healthcare providers. Additionally, the medicine box features a user-friendly LCD display for showing essential information, and it may include an alarm system to provide auditory reminders. By integrating cloud connectivity, the device allows data synchronization and remote monitoring, helping caregivers and medical professionals access adherence reports and adjust medication plans as necessary. The Raspberry Pi 3 Model B's capabilities for IoT applications, such as Wi-Fi and Bluetooth connectivity, make it an ideal choice for this smart medicine box project. The system is designed to be cost-effective and efficient, making it suitable for widespread deployment in both home and clinical settings. The device also incorporates security measures, such as encryption protocols and secure access controls, to safeguard sensitive medical data and prevent unauthorized use. Moreover, the data collected by the medicine box is analysed for generating detailed adherence reports, which can highlight patterns in medication-taking behaviour and identify potential issues before they become serious health problems. These reports can be shared with healthcare professionals to facilitate timely interventions. Additionally, the box's modular design allows easy customization and expansion to accommodate various medication types, from pills to liquid medicines. Overall, this smart medicine box built on the Raspberry Pi 3 Model B demonstrates how IoT technology can revolutionize medication management, promote better health outcomes, and support proactive healthcare by ensuring that patients receive their medication as prescribed.

X. CONCLUSION

The smart medicine box is a promising solution for improving medication adherence and supporting individuals who need consistent, accurate intake of their prescribed medicines. By integrating IoT, machine learning, and a mobile application, this device offers a modern approach to healthcare, allowing real-time monitoring and immediate alerts for missed doses. The smart medicine box can track medication consumption patterns, send personalized reminders, and provide caregivers with remote access to data, ensuring that users stay on track with their treatment regimens. Machine learning algorithms within the system allow it to learn from user behaviour and adjust reminder schedules, improving adherence over time. Predictive features, such as reminders for low medication stock, add convenience and prevent disruptions in treatment. The React Native mobile app further enhances usability, enabling seamless access for patients and caregivers across platforms. Looking to the future, there is room for enhancement in areas such as data security, where features like biometric authentication could protect against unauthorized access. Additionally, incorporating advanced analytics and emergency notifications could further support patients with chronic conditions or elderly users, making the smart medicine box an even more integral part of healthcare management. In conclusion, this technology not only supports medication adherence but also fosters a stronger, more connected network of caregivers and healthcare providers, ultimately enhancing patient outcomes and quality of life.

XI. STATEMENT

A smart medicine box leveraging Raspberry Pi 3 Model B serves as an efficient, technology-driven solution for enhancing medication adherence and patient care. The system harnesses the processing power and connectivity features of the Raspberry Pi 3 Model B to automate and optimize medication dispensing. At the core of the setup is a robust software platform that allows users to input and manage their medication schedules through an intuitive interface accessible via a web or mobile application. The user can specify medication details, including names, dosages, and the timing for administration, and this information is stored and synchronized with the Raspberry Pi. The device is integrated with sensors that monitor the dispensing process, ensuring that the correct dosage is released at the scheduled time. These sensors can measure parameters like pill count and container weight to maintain accuracy. Additionally, the

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system includes audiovisual cues, such as LED indicators and sound alerts, to notify the user when it is time to take their medication, promoting adherence and preventing missed or incorrect doses. The Raspberry Pi 3 Model B, equipped with built-in Wi-Fi and Bluetooth capabilities, enables seamless connectivity with smartphones or other devices for real-time communication and remote monitoring. Furthermore, the smart medicine box supports advanced features such as automated alerts for refill reminders, which are triggered when medication levels are detected to be low. This ensures that patients or caregivers are aware of the need for timely refills, reducing the risk of running out of essential medication. The system also has a data logging function, where information on medication adherence, usage patterns, and refill history is stored and can be analysed to generate comprehensive reports. These reports can be shared with healthcare providers, allowing for better monitoring of the patient's health status and making informed treatment decisions. Security and data privacy are prioritized, with the implementation of encryption and secure authentication mechanisms to safeguard sensitive medical information from unauthorized access. By combining the versatility of the Raspberry Pi 3 Model B with advanced IoT technology, the smart medicine box not only simplifies medication management but also provides a scalable, customizable solution that can be tailored to individual patient needs, contributing to better health outcomes and overall well-being.

REFERENCES

[1] Bhati, S., Son, H., Vijayrajsinh, Z., Vyas, P., "Smart Medicine Reminder Box," IJSTE International Journal of Science Technology Engineering, vol. 3, issue 10, pp. 172-177, April 2017.
[2] Bhatt, D., Verma, S., Ghongade, R. B., "Smart Medicine Box," International Journal of Industrial Electronics and Electrical Engineering, vol. 6, issue 3, pp. 47-50, March 2018.
[3] Daou, R. A. Z., Karam, K., Zeidan, H., Hayek, A., Borcsok, J., "Design Of A Safe And Smart Medicine Box," International Journal of Biomedical Engineering and Science, vol. 5, no. 3/4, pp. 1-13, October 2018.
[4] Mohamed Abd-ELfattah, D. S. A., "Smart drugs: Improving Healthcare using Smart Pill Box for Medicine Reminder and Monitoring System," Elsevier B.V, pp. 444-456, November 2018.
[5] Akshaya, C., Jayasowmiya, J., Kanchana, P., Raja, J., "Smart Medicine Box," International Journal of Engineering Research in Computer Science and Engineering, vol. 6, issue 7, pp. 125-128, July 2019.
[6] Doshi, V., Dey, S., Mehta, N., Prasad, R., "An IoT based smart medicine box," International Journal of Advance Research, Ideas and Innovations in Technology, vol. 5, issue 1, pp. 205-207, 2019.
[7] Fatima, N., Hipparge, P., "IoT Driven Smart Pill Box to Remind of Consumption," International Research Journal of Engineering and Technology, vol. 6, issue 6, pp. 2943-2946, June 2019.
[8] 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, vol. XII, issue V, pp. 1169-1173, 2020.
[9] Nadzri, N. Z., Yusof, Y., Fazil, A. F. A., "Ibox: Smart Medicine Box With IoT Application," European Journal of Molecular Clinical Medicine, vol. 7, issue 8, pp. 3747-3757, 2020.
[10] Savithaa, N., Savitha, P., Trisha, S., Subhashree, C., "Intelligent medicine box for medication management using IOT," International Research Journal of Engineering and Technology, vol. 8, issue 12, pp. 1390-1392, December 2021.
[11] Sai, D. K., SwarnaLatha, S., Babu, S., "IoT Based Smart Pill Box Using Arduino Microcontroller," International Journal of Emerging Technologies and Innovative Research, vol. 8, issue 1, pp. 370-375, January 2021.
[12] Harshitha, V., Sandeep, K., Jain, T. J. S., "An Interactive Pill Box using IoT," International Journal of Engineering and Advanced Technology, vol. 9, issue 3, pp. 2436-2438, February 2020.
[13] Rosli, E., Husaini, Y., "Design and Development of Smart Medicine Box," Conference Series: Materials Science and Engineering, vol. 341, 2018.
[14] "Arduino Medicine Reminder," Circuit Digest, [Online]. Available: https://circuitdigest.com/microcontroller-projects/arduinomedicinereminder.