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Intelligent Medicine Box For Patient Care

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Abstract- Medication management plays an important role in maintaining good health, especially for elderly individuals and patients undergoing long-term treatment. Forgetting medication times or improper organization of medicines can lead to serious health issues. A smart medicine box is developed to assist users in managing daily medication schedules in an efficient and reliable manner. The system operates using a microcontroller (Arduino) integrated with a real time clock to monitor predefined medication timings and generate timely reminders. Multiple medicine compartments are provided to store different medicines separately, reducing the chances of confusion and incorrect usage. Visual and audio alerts notify users at scheduled times, ensuring regular intake of medicines. The system also monitors medicine availability and provides alerts when medicine levels become low, helping users refill medicines on time. Simple controls and a user- friendly interface make the system suitable for home use without requiring technical knowledge. The smart medicine box enhances medication adherence, improves patient safety, and reduces dependence on caregivers. Such a system is especially useful in households with elderly people and patients requiring continuous medication, offering an effective solution for organized and timely medicine management.

Keywords – Smart medicine box, Medication management, Elderly care, Long-term treatment, Timely reminders, Visual alerts, Audio alerts, Medicine compartments, Patient safety, User-friendly interface.

I. INTRODUCTION

In today's busy lifestyle, many patients, especially elderly people, often forget to take medicines at the correct time, leading to health complications. Proper medication management plays an important role in effective treatment and patient safety. To address this issue, an Intelligent Medicine Box is developed for patient care.

The Intelligent Medicine Box for Patient Care is a smart system designed to assist patients by providing timely reminders and alerts for medication intake. Electronic components and intelligent control mechanisms help ensure medicines are taken as prescribed. Regular reminders reduce missed doses and improve adherence to medication schedules.

The main aim of the mini project is to design and implement a reliable and user-friendly medicine management system for patients and caregivers. Such a system is especially beneficial for elderly individuals, chronic patients, and people requiring long- term medication. Overall, improved medication compliance leads to better healthcare outcomes and enhanced patient well- being.

The intelligent medicine box also supports caregivers and family members by reducing the need for constant

supervision. Automated reminders and organized storage help minimize human error in medication intake. By combining technology with healthcare needs, the system promotes independence for patients while ensuring safe and effective medicine usage in daily life .

Common reasons include forgetting to take medicine, confusion between tablets, inability to remember dosage timings, and lack of supervision. This problem is more severe among elderly patients who may suffer from memory loss, vision problems, or physical limitations. In rural and semi-urban areas, limited access to healthcare facilities further increases the risk of improper medicine intake. As a result, there is a growing demand for smart and automated healthcare solutions that can support patients in their daily medication routines.

The Intelligent Medicine Box is a smart device that stores medicines in separate compartments and provides reminders to patients at the correct time. The system uses a microcontroller- based platform to control alarms, displays, and sensors. When it is time to take a particular medicine, the system alerts the patient using sound, light, or display notifications. This helps the patient remember the correct medicine and dosage at the right time. By automating the reminder process, the system minimizes the chances of missed doses and incorrect medication intake.

This dependency can be reduced with the help of an automated system that works reliably without constant supervision. The device can be especially beneficial for elderly people living alone, patients with chronic diseases, and individuals undergoing long-term treatment. It ensures that medicines are taken regularly, which leads to better treatment outcomes and faster recovery.

II. LITERATURE REVIEW

Existing System

Chen et al. (2025) developed a Bluetooth-enabled smart pillbox that provides real-time notifications through a mobile application to assist patients in maintaining proper medication schedules. The system uses wireless communication to send alerts, dosage reminders, and confirmation messages, thereby reducing missed doses. Their study emphasized user-friendly design and low power consumption, making the system suitable for long-term patient care and home healthcare environments.

Deshpande et al. (2022) proposed an IoT-connected smart pill box that integrates sensors, cloud connectivity, and alert mechanisms to automate medication reminders. The system tracks medicine intake and sends notifications to patients and caregivers, ensuring improved compliance Gardare et al. (2022) designed and implemented a medicine reminder box combined with basic health monitoring features such as temperature and pulse measurement. Their work demonstrated that integrating health parameters with reminder systems enhances patient safety and provides additional support for elderly and chronically ill patients. The study highlighted automation as a key factor in improving healthcare service quality.

Kumar et al. (2021) presented the design of a smart drug box aimed at minimizing errors related to missed or incorrect medication intake. The system used programmable schedules and alarm-based notifications to alert patients at predefined times. Their study showed that the proposed system was reliable, cost-effective, and easy to operate, making it suitable for daily healthcare applications.

Mehta et al. (2026) developed a wearable-integrated medicine reminder system with voice assistance to support elderly and visually impaired patients. The system provided

audible reminders and wearable alerts, improving accessibility and usability. Their research emphasized the growing importance of wearable technology and intelligent interfaces in future healthcare monitoring systems.

Patel et al. (2022) introduced a medication management system using GSM and RFID technologies to ensure secure identification and controlled access to medicines. The system enabled remote alerts and monitoring, reducing the chances of misuse and incorrect dosage. Their work demonstrated how communication technologies can improve reliability and security in automated healthcare systems.

Philip et al. (2020) developed an automatic medicine dispenser using IoT technology to automate the dispensing process without continuous human supervision. The system utilized sensors and cloud services to monitor medicine levels and alert users.

In the existing system, patients generally use traditional medicine boxes or simple pill organizers to store their tablets. These boxes are only used for storage purposes and do not provide any automatic reminder, alert, or monitoring feature. The responsibility of remembering the correct medicine timing completely depends on the patient or caregiver. In many cases, especially for elderly people, patients with memory problems, or those undergoing long-term treatment, it becomes difficult to remember multiple medicines at different times of the day. This often leads to missed doses, delayed intake, or taking the wrong medicine at the wrong time. Such mistakes can reduce the effectiveness of treatment and may cause serious health complications.

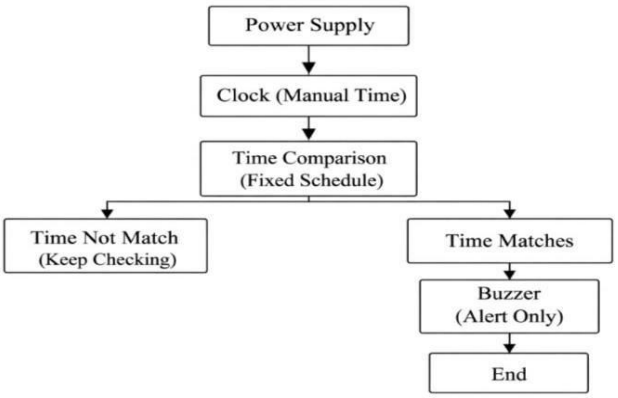

Figure 1. Existing System

III. PROPOSED SYSTEM

The proposed system is an Intelligent Smart Medicine Box developed to improve patient care by providing automatic and accurate medicine reminders. It is designed using a microcontroller such as Arduino, along with a Real-Time Clock (RTC) module to maintain accurate timing. The medicine schedule is programmed into the system according to the doctor's prescription. The RTC continuously monitors the current time and compares it with the stored medicine timings. When the scheduled time is reached, the system automatically activates a buzzer and displays a message on the LCD screen to remind the patient to take the correct medicine. This audio and visual alert ensures that the patient does not miss the dose.

The proposed system is also cost-effective compared to advanced medical monitoring devices. It uses commonly available electronic components, which helps keep the overall cost low. This affordability makes the system suitable for widespread adoption in developing countries, where access to advanced healthcare facilities may be limited.

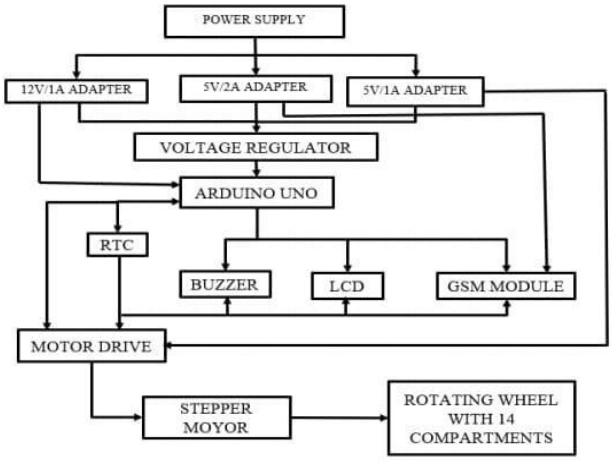

Figure 2. Block diagram of the Proposed System

IV. DEVELOPED MODEL

1.1 Working model

The working procedure of the proposed system begins when power is supplied through the 18650 lithium-ion battery, and the DC–DC step-down converter regulates the voltage to suitable levels for all components. The Arduino UNO initializes the Real Time Clock (RTC), GSM module, LCD display, buzzer, and stepper motor. The system continuously reads the current time from the RTC and compares it with the predefined medicine schedule stored in the microcontroller.

When the scheduled time is reached, the buzzer is activated to alert the patient, and a reminder message is displayed on the LCD. The Arduino then controls the stepper motor to rotate and align the correct medicine compartment, allowing the medicine to be dispensed automatically in a controlled manner. After dispensing, the LCD updates the system status to confirm successful medicine delivery. The system then checks the availability of medicine in the compartments, and if the medicine level is found to be low or empty, an SMS notification is sent to the caretaker through the GSM module. Finally, the system returns to monitoring mode and continues this process for the next scheduled medicine time, ensuring continuous and reliable operation.

2.1 Hardware Components

Arduino UNO

Arduino UNO acts as the central controller of the intelligent medicine box system. It controls and coordinates the operation of all connected components such as the GSM module, LCD display, buzzer, and motor. The medicine timing logic and alert conditions are programmed into the Arduino. Based on the real-time schedule, it triggers alarms,

sends SMS alerts, and controls the locking or unlocking mechanism. Its ease of programming, low cost, and reliability make it suitable for healthcare-based embedded applications.

Figure 3. Arduino UNO

SIM800L GSM Module

The SIM800L GSM module is used to provide communication capability to the system. It enables the system to send SMS alerts to caregivers or family members when it is time to take medicine or when a dose is missed. This feature allows remote monitoring of the patient and improves safety. The GSM module operates using a mobile SIM card and communicates with the Arduino through serial communication.

Figure 4. SIM800L GSM Module

18650 Lithium-Ion Battery

The 18650 lithium-ion battery serves as a portable power source for the entire system. It provides sufficient power backup to ensure uninterrupted operation even during power failures. This makes the intelligent medicine box suitable for home use, travel, and rural areas where power supply may be unstable.

Stepper Motor (28BYJ-48)

A water pressure sensor is an electronic device used to measure the pressure of water in pipes, tanks, or underwater systems. It converts pressure into an electrical signal for monitoring and control.

Figure 5. Stepper Motor (28BYJ-48)

DC-DC Step-Down Converter

The DC-DC step-down (buck) converter is used to regulate voltage from the battery to safe operating levels required by the Arduino, GSM module, and motor. Since

Buzzer different components require different voltage levels, this converter ensures stable and efficient power distribution, protecting components from damage due to overvoltage.

Figure 6. DC-DC Step-Down Converter

To protect these components and ensure proper operation, a DC–DC step-down (buck) converter is used. This converter reduces the battery voltage to safe and stable levels like 5V. Supplying regulated voltage is very important because voltage fluctuations can cause system malfunction, communication errors, or damage to sensitive components.

16×2 LCD with I2C Interface

Figure 7. 16×2 LCD with I2C Interface

The 16×2 LCD display is used to show system status and information such as current time, medicine reminder messages, and alert notifications. The I2C interface reduces the number of connecting wires, making the circuit simpler

and more compact. This display helps users clearly understand when and which medicine to take, improving ease of use, especially for elderly patients.

The buzzer acts as an audio alert device in the system. When the scheduled medicine time is reached, the Arduino activates the buzzer to notify the patient. The sound continues until the patient responds, ensuring the reminder is not ignored. This audible alert is particularly useful for patients who may not continuously observe the display.

Figure 8. Buzzer

H. Connecting Wires

Connecting wires, also called jumper or hookup wires, are used to establish electrical connections between components in circuits. They come in various colors, lengths, and types: male- to-male, female-to-female, or male-to-female. Commonly used in prototyping with breadboards, Arduino, and electronics projects, they allow quick, flexible, and reliable connections without soldering, simplifying circuit testing and assembly.

Figure 9. Connecting Wires

V.RESULTS AND DISCUSSION

The proposed automated medicine dispensing system was tested under various operating conditions to verify its performance, accuracy, and reliability. Initially, the power supply unit was tested by operating the system using the 18650 lithium-ion battery to ensure stable and uninterrupted power delivery. The DC–DC step-down converter was observed to regulate the voltage efficiently and supply safe operating voltages to the Arduino UNO, GSM module, LCD display, buzzer, and stepper motor without fluctuations. The Real Time Clock (RTC) module was tested for time accuracy, and the system was verified to trigger alerts precisely at the predefined medicine schedules. This confirmed that the time- based monitoring and comparison logic functioned correctly.

The alert mechanism was tested by checking the buzzer and LCD display during scheduled medicine times. The buzzer produced a clear and audible alert, while the LCD displayed appropriate messages such as “Time to Take Medicine” and “Medicine Dispensed,” ensuring effective audio and visual communication. The stepper motor operation was tested to verify accurate rotation and proper alignment of medicine compartments. During repeated test cycles, the motor rotated smoothly to the correct position without misalignment. The medicine dispensing mechanism was also tested multiple times and successfully dispensed medicines from the correct compartments in a controlled manner.

The GSM module was tested to evaluate SMS notification functionality. When the system detected empty or low medicine conditions, alert messages were successfully sent to the registered caretaker’s mobile number. Minor delays were observed due to network conditions; however, message delivery was reliable. Finally, continuous operation testing was conducted by running the system for extended durations. The system functioned without failure,

unexpected resets, or performance degradation. The test results confirm that the proposed system meets the design requirements and operates reliably, making it suitable for automated medicine dispensing and healthcare applications.

The system responded correctly to repeated dispensing cycles without any loss of accuracy or performance. The integration of both hardware and software components was found to be stable throughout the testing process. These results demonstrate that the proposed system is robust and suitable for real-time medication management applications.

The buzzer provided clear and timely audible alerts at each scheduled interval, ensuring that the patient was effectively notified. Simultaneously, the LCD display accurately showed reminder messages and system status updates such as “Time to Take Medicine” and “Medicine Dispensed,” which improved user interaction and system transparency.

VI.CONCLUSION

The proposed automated medicine dispensing system provides an efficient and reliable solution for timely medication management. By integrating an Arduino-based control unit with a real-time clock, GSM communication module, LCD display, buzzer, and stepper motor, the system ensures accurate scheduling, controlled dispensing, and effective alert generation. The inclusion of SMS notifications enhances remote monitoring by informing caretakers about medicine status and refill requirements. The system reduces human error, improves patient compliance, and offers a user-friendly and cost-effective approach to healthcare assistance. The successful testing of the system confirms its suitability for home healthcare and assisted living applications.

This mini project demonstrates an automated medicine dispensing and reminder system using an Arduino-based setup. The system integrates components such as an IR sensor, GSM module (SIM800L), LCD display, and a rotating pill container to ensure that medicines are taken on time. It works by displaying the scheduled day and time on the LCD, rotating the container to the correct slot, and alerting the user through a buzzer and GSM communication if needed. The collecting box allows easy access to the dispensed medicine, while the sensors ensure accurate positioning.

Overall, the project is effective in improving medication adherence, especially for elderly or forgetful patients. It reduces human error, provides timely reminders, and adds a level of automation to healthcare routines. This system can be further enhanced with features like mobile app integration, real-time monitoring, and multiple dosage control, making it a practical and scalable solution for smart healthcare applications.

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