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Medicare the Smart Medication Distribution System

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Abstract

The prevalence of chronic illnesses and the aging population have led to an increasing demand for efficient medication management systems. In response to this need, we present an innovative solution, an Automatic Medicine Dispenser with an Alert System, designed to simplify and enhance the medication administration process. Automatic Medicine Dispenser (AMD) systems have emerged as innovative solutions to address the complexities associated with medication management, In this proposed system, it presents the design, development, and evaluation of an Automatic medicine dispenser system integrated with an ESP32 microcontroller, RTC module, Relay, IR Sensor, Blynk App(cloud), LCD 16x2 display. The AMD system demonstrates promising results in improving patient compliance, medication administration efficiency, and overall healthcare quality. The primary objective of the AMD system is to enhance medication adherence by providing accurate and timely dispensing of doses while minimizing the risk of medication errors. This system contributes to the growing body of literature on automated medication dispensing technologies and underscores the potential of AMD systems to revolutionize medication.

Keywords: Automatic medicine dispenser, RTC module, sensor, ESP32 microcontroller, LCD display

INTRODUCTION

The IR detects if the medication compartment is empty, The Blynk app connects to the ESP32 over the internet and allows the user to monitor and control the system remotely Creating an IoT-based automatic medicine dispenser machine using ESP32 microcontroller, RTC module, Servo motor, Stepper motor, LCD display, Switch, IR Sensor, Battery, and Blynk app involves integrating these components ensure ease of use while maintaining the integrity of specifications.ESP32 Microcontroller: The ESP32 microcontroller coordinates the functions of the device. It controls the timing and dispensing of medication according to the schedule set by the user or healthcare provider. Real -Time Clock (RTC) Module: An RTC (Real-Time Clock) plays a very important role in an automatic medicine dispenser system by ensuring accurate timekeeping and scheduling of medication doses. IR Sensor The integration of an Infrared (IR) sensor within the automatic medicine dispenser (AMD) serves multiple crucial functions aimed at enhancing its functionality and usability.

The IR sensor facilitates user presence detection, ensuring that medication dispensing occurs only when the user is in proximity to the device, thereby minimizing the risk of dosage errors and enhancing user safety protocols. Motor The motor in an automatic medicine dispenser serves the primary function of dispensing the medication at the scheduled time intervals or upon user request. Here's how the motor is utilized in this context. LCD Display: The LCD 16×2 in an automatic

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medicine dispenser serves to display important information to the user, such as the current time, scheduled medication doses, and alerts for upcoming doses. Switch A momentary push button switch is the best choice for this project because it is simple to use and can be mounted in a variety of locations. This makes it easy for the user to manually dispense medication if needed. Momentary push button switches are relatively inexpensive. This makes them a good choice for this project, which is designed for beginners. The ESP32 microcontroller-powered automatic medication dispensers with integrated Wi-Fi connectivity allow for easy remote access to dispenser functions. Through a secure network, caregivers or medical professionals can establish a remote connection to the dispenser, enabling real-time monitoring and control from any location with internet access [7–10]. Utilizing Wi-Fi connectivity makes the following features possible:

Remote Configuration: Without having physical access to the device, caregivers can remotely adjust dispenser settings such as dosage amounts, medication schedules, and dispensing frequencies to meet patients' changing healthcare needs.

Updates for software: Over-the-air (OTA) software updates are available for ESP32-based dispensers, guaranteeing that the system stays current with the newest features, security patches, and bug fixes without the need for manual intervention.

LITERATURE SURVEY

In [1] the development of a smart medicine dispenser that helps individuals take their medications on time. The dispenser uses technology like Raspberry Pi3, GSM module, IR sensor, pill box, and humidity sensor it has improved Medication Adherence, and this also has a caretaker notification feature. It has temperature humidity monitoring feature as well but it has limited functionality, and it has major dependency on technology and in this lot of customization is not possible.

In [2] The document discusses the development of a Smart Medicine Planner (SMP) for visually impaired people the SMP consists of a dispenser system that automatically fills a smart medicine box (SMB) and an alerting system that reminds the user of dosage times. It Provides a user-friendly system for visually impaired individuals to manage their medication. This paper tells us that the project satisfies the factors of cost, simplicity, and portability, outperforming existing systems in the study. This paper also tells the Difficulties faced by individuals with low skills in using the device, such as opening compartments and understanding voice commands. It is battery dependent battery consumption in the smart medicine box affects its performance. Although the Smart Medicine Planner (SMP) project makes great strides toward resolving the problems associated with medication management for people who are blind or visually impaired, more innovation and improvement are needed to maximize the tool's usefulness, dependability, and practical application. The SMP can successfully fulfill its promise of offering a user-friendly and efficient solution for medication management among people with visual impairments by addressing usability barriers and optimizing battery performance.

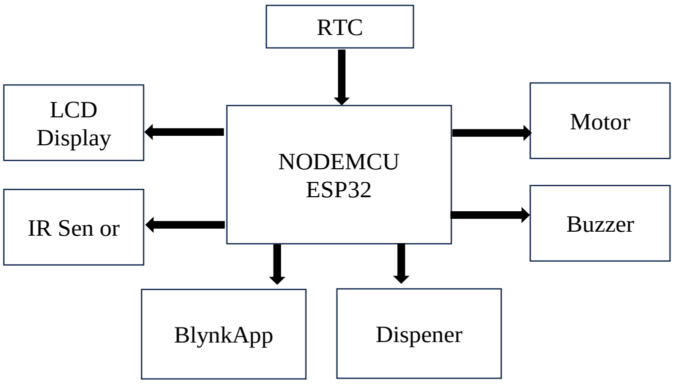

Figure 1. Automatic medicine dispenser block diagram.

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In [3] the Design and Implementation of a Smart Medicine Dispenser is discussed the development of a device to help patients, especially the elderly, in taking their medications correctly on time. It has some of this features Stock checking feature, Daily reminders, Alerts for emergencies, Easy dosage scheduling. But it has limited to dispensing pills up to 3 times a day and requires manual refilling of pill containers.

In [4] it presents a real-time support system to address the problem faced by patients who forget or mislead with their prescribed medication dosage. It Ensures patients take the right number of drugs at the specified time, reducing the risk of administration errors or missed doses (Figure 1).

METHODOLOGY

In automatic medicine dispenser system, the dispenser relies on a sophisticated network of sensors, actuators, and control mechanisms to execute its functions seamlessly. When a scheduled dose is due, the dispenser's internal clock triggers the activation of its dispensing mechanism [5].

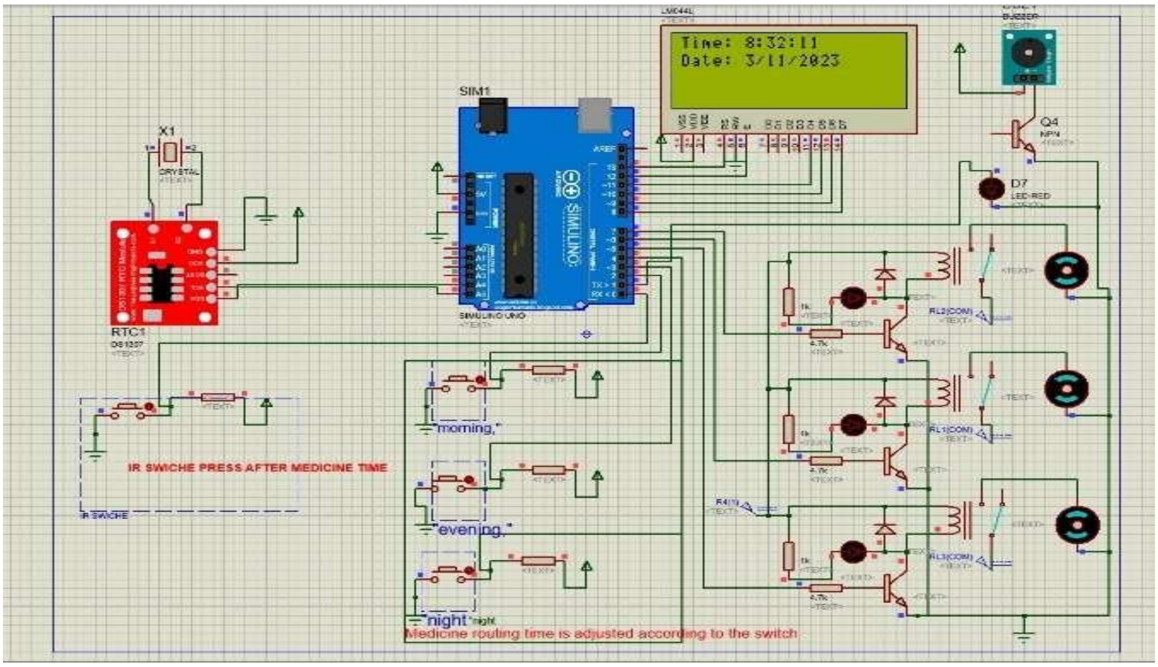

Figure 2. Interfacing Diagram for AMD System.

The Figure [2] shows the design of the system. The interfacing diagram of the Automatic Medicine Dispenser (AMD) system shows the important pin connections to the microcontroller (ESP32), enabling efficient control and communication. The motor that dispenses the drug controls rotation and direction by connecting to digital output pins. The IR sensor attaches to digital input ports and relays signals that indicate the status of the container when it detects the presence of medication. For data transfer and operational control, the LCD display, which serves as the user interface, communicates with the GPIO pins of the microcontroller (ESP32). Precise timekeeping depends on the Real-Time Clock (RTC) module, which connects to specified microcontroller pins and communicates via SPI or I2C protocols. Motor and sensor signals are used to indirectly control the pill box, which is located within the dispenser. Precise wiring and setup are essential for a smooth AMD system, guaranteeing consistency in drug delivery and timing [6].

The ESP32 board is a versatile microcontroller widely utilized in automatic medicine dispensers for its robust features and connectivity options. through its Wi-Fi connectivity, the ESP32 enables remote monitoring and control of the dispenser, allowing caregivers or healthcare professionals to track medication adherence and receive real-time alert. the IR sensor, strategically positioned within the dispenser, detects the presence of medication containers and verifies their alignment before dispensing. Low Power Consumption: The ESP32 is appropriate for battery-powered applications because of its efficient design, which uses little power in both active and idle states.

Rich Peripheral Interface: It provides flexibility for integrating with a variety of sensors, actuators, and other peripherals by offering a broad range of peripheral interfaces, such as SPI, I2C, UART, ADC, and DAC. The user interface is provided by the LCD display, offering real-time information on medication schedules, dosage instructions, and system status. When triggered by the ESP32, the dispenser's motor engages to precisely measure and dispense the prescribed medication into the designated container. Through careful wiring and logical connections, the ESP32 coordinates the communication and operation of these components, ensuring seamless interaction and reliable functionality of the automatic medicine dispenser system. ESP32 microcontroller serves as a robust backbone for automatic medicine dispensers, providing advanced features, reliable connectivity options, and enhanced security, thereby facilitating remote monitoring, improving medication adherence, and ultimately enhancing healthcare outcomes. From monitoring medication adherence to facilitating user interaction, each component plays a vital role in optimizing the dispenser's performance and enhancing patient care.

RESULTS

The actual results could differ based on variables like user involvement, system dependability, integration with current workflows in healthcare, and implementation strategy. Validating the effectiveness and impact of ESP32-based solutions in automatic medicine dispensers requires extensive testing and real-world deployment (Figures 3,4).

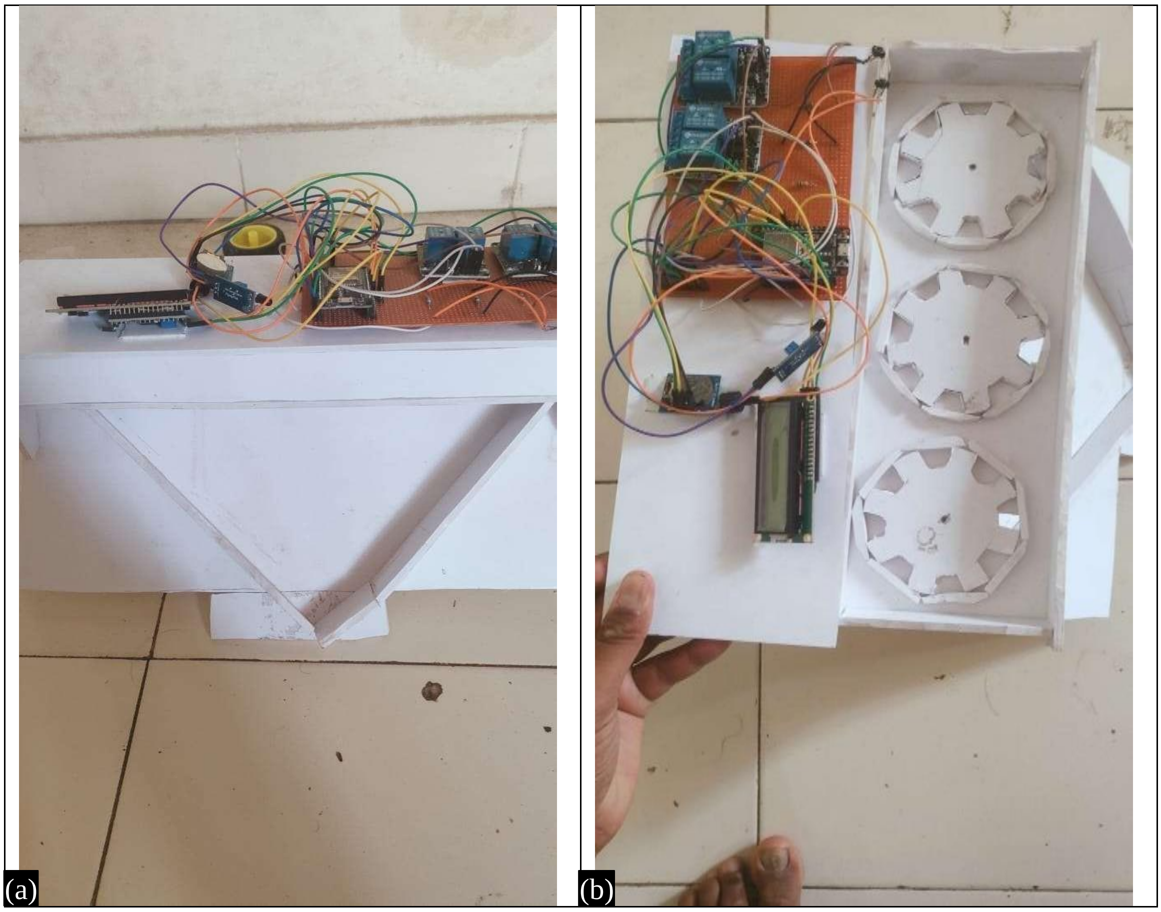

Figure 3. (a,b) Working setup of the system.

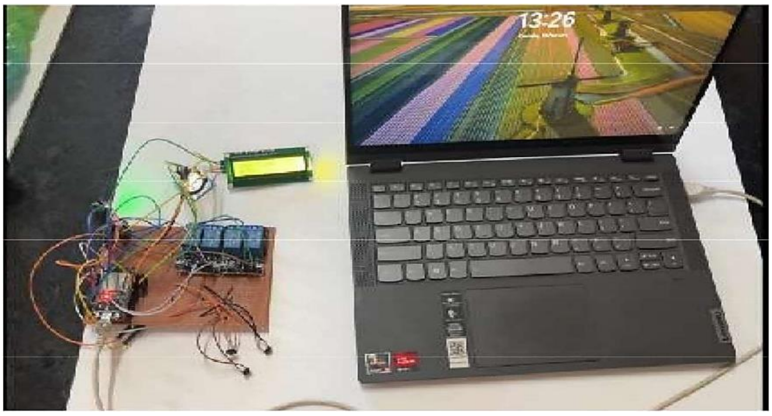

Figure 4. Connection setup of the system.

Flowchart

The design flow in this aims to visually represent the sequential steps involved in the automatic medicine dispenser system (Figure 5).

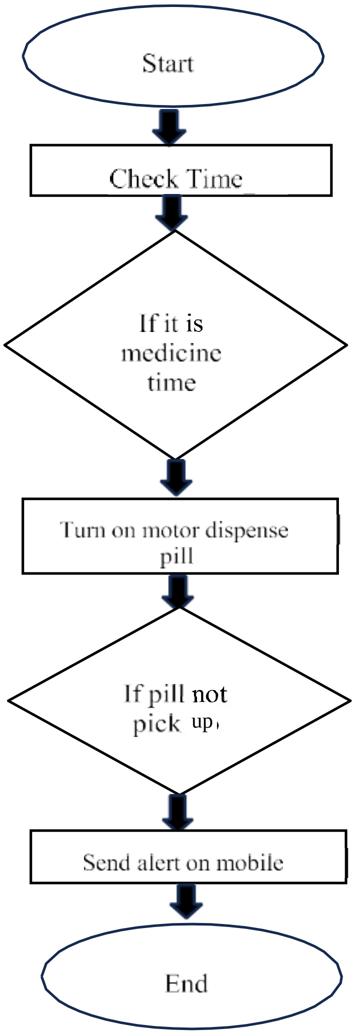

Figure 5. Workflow of the AMD system.

The flowchart provides a structured framework for visualizing the system's functionality and The dispenser will operate as follows: The ESP32 microcontroller will read the RTC module to determine the current time and date. The ESP32 microcontroller will then compare the current time and date to the prescribed medication times. If it is time to dispense medication, the ESP32 microcontroller will activate the servo motor to rotate the disk with medication compartments to the correct position. The ESP32 microcontroller will then activate the stepper motor to dispense the correct dosage of medication. The IR will be used to detect if the medication compartment is empty. If it is empty, the ESP32 microcontroller will send an alert to the user's phone using the Blynk app. The Blynk app can also be used to manually dispense medication, and to view the history of medication dispensed. This system has the potential to improve the medication management of patients, especially elderly patients and patients with multiple medications. It can also help to reduce risk of medication errors**.**

CONCLUSIONS AND FUTURE SCOPE

From this system we acknowledge that by automating the medication dispensing process and providing timely alerts, this system can significantly reduce the risk of medication errors and ensure that patients receive their medications on time. This is particularly important for individuals with chronic conditions who rely on a complex medication regimen to manage their health. They can remotely track medication adherence and respond promptly to any issues, ultimately leading to better health outcomes.

Future scope includes potential enhancements such as integrating advanced sensors for real-time health monitoring, incorporating machine learning algorithms for personalized medication scheduling. The AMD system holds promise for revolutionizing medication management and promoting better health outcomes for patients worldwide.

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