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Automated Medicine Reminder & Dispensing

(With help of the PillPal Android Application Development)

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Abstract: This project aims to develop a medication reminder and automated dispensing system tailored for senior citizens and hospital patients. The goal is to help users manage complex medication schedules and improve adherence to treatment plans.

The system will incorporate various hardware and software components. Hardware may include user-friendly interfaces, such as digital pillboxes with compartments for medications, and notification systems with visual alerts and audible reminders.
On the software side, an intuitive app will allow users or caregivers to input medication information, track dosages, and schedule reminders. It will send alerts when medication is due and confirm when doses are taken, aiding in accurate adherence. Additionally, the system may include reporting features for caregivers and healthcare professionals to monitor compliance and enhance patient care.
By integrating these components, the system aims to empower users to manage their health better, reduce medication errors, and improve treatment outcomes.

Keywords: Automated Medicine Dispenser, Microcontroller, PillPal Application.

1. INTRODUCTION

The main goal of this project is to develop and implement a comprehensive medication reminder and automated dispensing system tailored to the needs of older adults and patients in hospital settings. The emphasis is on creating a solution that helps these individuals manage their complex medication regimens and improve adherence to prescribed treatments.

To accomplish this goal, the system will incorporate various hardware and software elements. The hardware may include user-friendly devices, such as digital pill dispensers or automated units with separate compartments for different medications, as well as alert systems that provide visual signals (e.g., lights or displays) and audible notifications (e.g., alarms or spoken reminders).

On the software side, the system will feature an easy-to-use application that allows users or their caregivers to enter medication information, monitor dosages, and set up reminders. This software will not only deliver timely notifications to users when it's time to take their medications, but also provide reminders. Still, it will

also confirm that medications have been taken, ensuring adherence to prescribed schedules. Additionally, the system might include a reporting tool that allows caregivers and healthcare providers to track medication compliance and make informed decisions about patient care.

By integrating these components, the medication reminder and automated dispensing system aims to empower senior citizens and hospital patients to take greater control over their health, thereby reducing the risk of medication errors and improving overall treatment outcomes.

2. OVERVIEW

PillPal is the most flexible **Automated Medicine Reminder and Dispensing** system for efficient management of controlled medication doses and high-value supplies. The PillPal AMRD Main Cabinet is designed for various care settings, offering secure, scalable, and space-efficient medication management solutions. Ideal for long-term care facilities and acute care environments such as ambulatory surgery centres, EMS, and urgent care, the PillPal AMRD ensures timely access to needed medication doses, which is essential for rapid patient response.

The Main Cabinet safeguards as needed. By replacing inefficient storage practices such as e-kit tackle boxes, safes, or locked closets, PillPal provides advanced security and tracking, ensuring accurate inventory and user accountability.

With PillPal AMRD in your med room, your facility's medication security heightens: caregivers can quickly access the precise dose they need for prompt patient care, and pharmacy and management always have visibility to what's inside, who has access, and what was dispensed for each patient or procedure. With the PillPal Automated Medicine Reminder & Dispensing system**, your inventory, medication security, and patient safety are protected**.

2.1 Benefits of Pillpal Automated Medicine Reminder & Dispensing.

- ***Essential On-Time Care:*** Access to 1st/Stat doses and controlled medications when needed for prompt administration.
- ***Enhanced Security:*** Tamper-evidence technology and cloud-based monitoring eliminate manual storage and log books, ensuring regulatory compliance.
- ***Essential Track & Trace:*** Full inventory and interaction data tracked via cloud-based monitoring.
- ***Customizable Workflow Prompts:*** Adaptable for any care setting's needs and the caregivers' workflow.
- ***Cost-Effective:*** Approx. 40% less expensive than the alternative Automated Dispensing Cabinets.

3. METHODOLOGY

The proposed automated medication reminder and dispensing system utilises a systematic methodology that includes requirement analysis, system design, hardware integration, software development, cloud connectivity, and testing to ensure effective medication reminders, user acknowledgement, and remote monitoring.

A. System Architecture Design: The system employs a client-server architecture, with the hardware unit as the client and Firebase as the cloud server. An Android application serves as the user interface for configuration and monitoring, while the NodeMCU ESP8266 connects all components and facilitates communication.

B. Time-Based Reminder Scheduling: A Real-Time Clock (RTC) module keeps accurate time. Medication schedules are set in the Android application and stored in Firebase, enabling NodeMCU to compare the RTC time with scheduled medication times to provide prompt reminders.

C. Alert Generation Mechanism: When reminders are due, the system activates audiovisual alerts via a buzzer and LEDs, and displays medication information on an LCD screen to accommodate users with hearing or vision impairments.

D. User Confirmation Detection: The system uses infrared (IR) sensors to detect user interactions near the dispensing unit and sends acknowledgement signals to Firebase for monitoring.

E. Remote Configuration and Monitoring: Caregivers or users can remotely update medication schedules via the Android app, which syncs changes in real time with the hardware unit via Firebase.

F. System Validation and Testing: The system is tested for timing accuracy, sensor responsiveness, network latency, and alert reliability under various test conditions to confirm performance and robustness.

4. IMPLEMENTATION

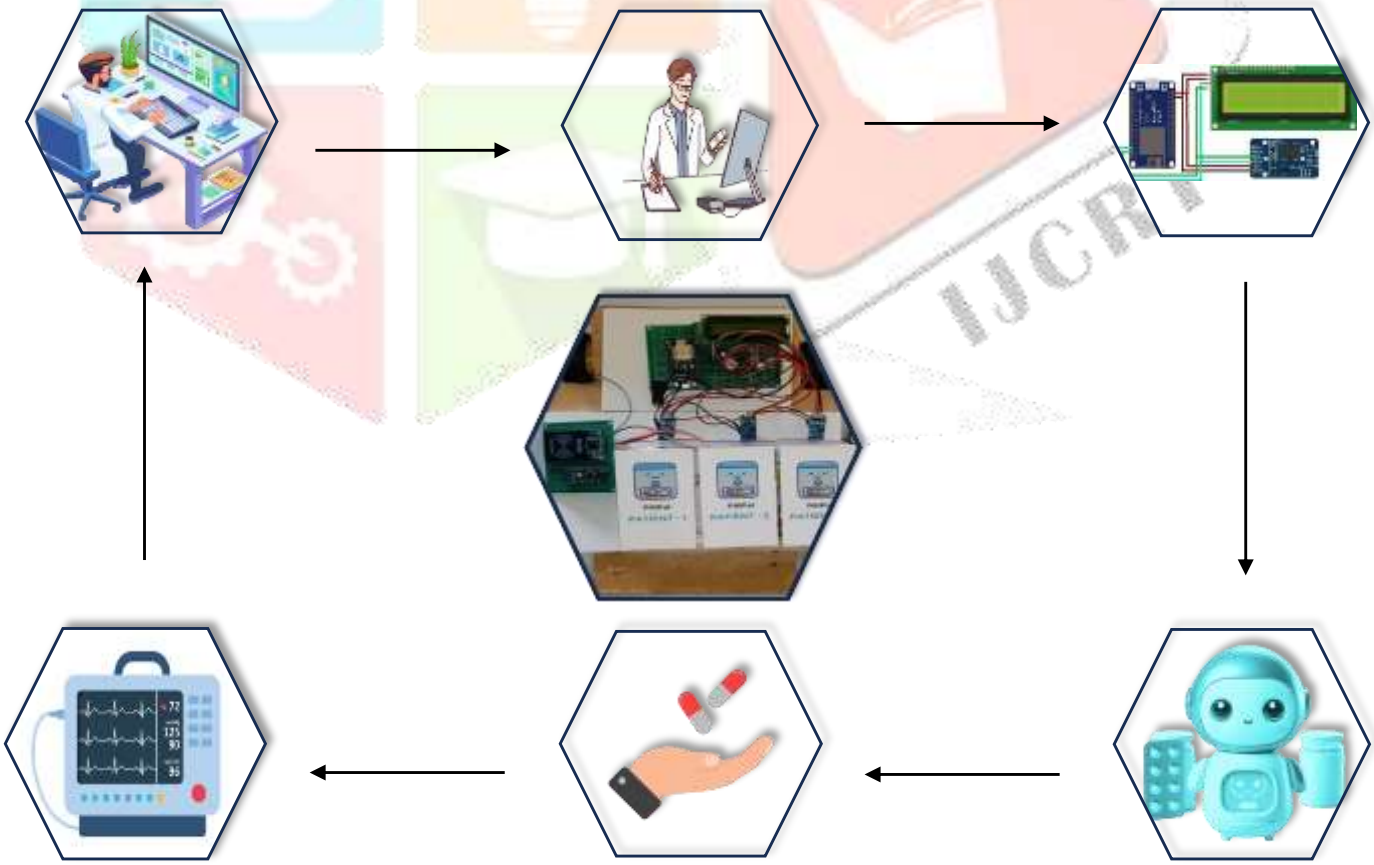
The implementation involves hardware assembly, firmware programming, mobile application development, and cloud integration.

A. Hardware Implementation: The NodeMCU ESP8266 interfaces with the RTC module, LCD, IR sensors, LEDs, and buzzer, ensuring proper power supply and grounding. The hardware is enclosed in a user-friendly casing for elderly users.

B. Firmware Development: Firmware for the NodeMCU is developed in the Arduino IDE, including hardware initialisation, Wi-Fi setup, Firebase authentication, time synchronisation, reminder logic, and IR sensor monitoring.

C. Android Application Development: Developed in Android Studio, the application allows users to manage medication schedules and confirmations and communicates with Firebase for updates.

D. Firebase Cloud Integration: The Firebase Realtime Database stores medication schedules and acknowledgement data. The NodeMCU continuously monitors database changes for real-time updates and employs secure authentication to protect patient information.



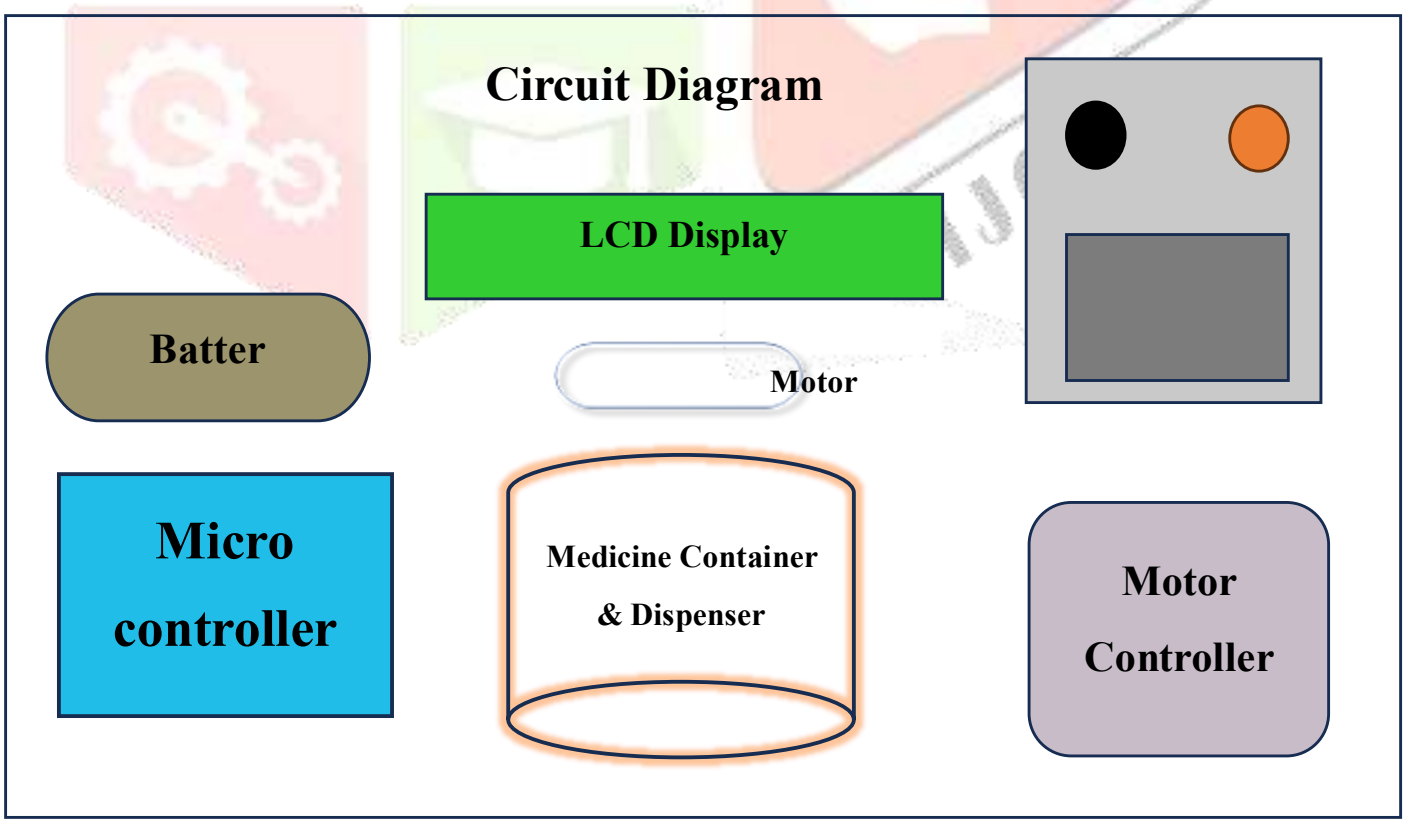
5. CUSTOMER REQUIREMENTS

The major requirements of customers who use this unit are performance, serviceability, reliability, cost and safety. The performance required is lightweight, ease of use for both the caretaker and the patient, good construction to avoid potential tampering, a Bright warning LED, 70+ decibel audio alerts and a good display unit.

The product is durable and easy to repair. The software is reliable, and mechanical devices are encased for safety and durability. The main features are lightweight, small dimensions, and the ability to reset the system. A locking mechanism is required in many cases to avoid misuse of the unit. Components such as the electrical SMPS and Motors need to be enclosed for safety.

6. DESIGN CONSIDERATIONS

The system is designed to provide precise medication reminders, user-friendly interfaces for older adults, low power consumption, reliable wireless connectivity, distinct audiovisual notifications, secure data management, and scalability for future enhancements.



7. CONCLUSIONS

The Automated Medicine Reminder and Dispensing System was designed to tackle medication non-adherence in elderly individuals and hospital patients. It incorporates real-time monitoring, automated alerts, and controlled dispensing to ensure accurate medication intake.

Featuring an RTC module, Arduino controller, LCD display, buzzer, and servo mechanism, the system requires minimal human intervention and enhances safety through a user confirmation feature. Experimental results show it operates with high accuracy and low power consumption, making it ideal for long-term home care and medical facilities. Overall, this cost-effective and user-friendly system improves patient compliance, minimizes medication errors, and supports better healthcare management.

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