**Project Report on**



**Smart Automatic Medicine Dispenser with Mobile App Integration.**



**Submitted by:**

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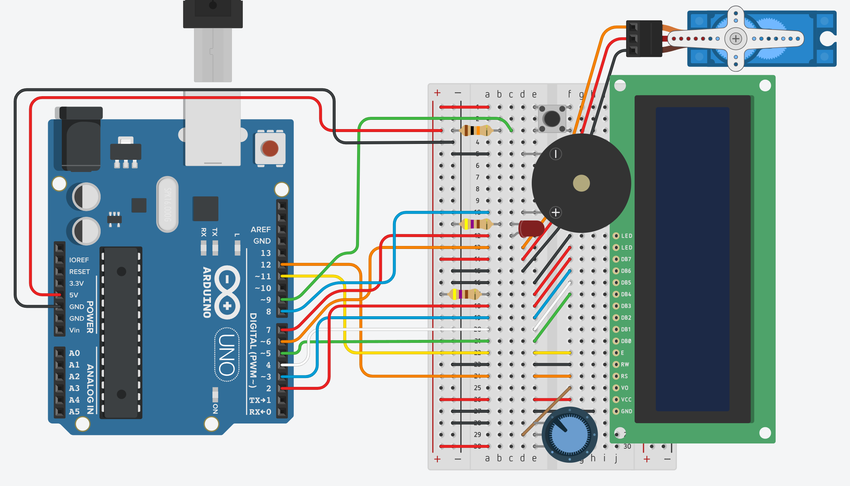
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**Chapter 1**

**Introduction**

Managing medication routines is a crucial yet challenging task, particularly for the elderly and individuals with chronic health conditions. Adherence to prescribed medication schedules plays a vital role in ensuring effective treatment and maintaining overall well-being. However, manual management of medications often leads to errors such as missed doses or incorrect timing, which can adversely affect health outcomes. Caregivers, too, face significant challenges in keeping track of medication schedules and ensuring compliance.

To address these issues, this project focuses on developing a **Smart Automatic Medicine Dispenser with Mobile App Integration**. By combining automation and IoT technology, the solution aims to simplify medication management, offering a reliable and user-friendly system. The dispenser ensures accurate and timely medication dispensing, while the mobile app provides features such as remote monitoring, schedule management, and real-time notifications. This integration promotes better adherence, reduces the burden on caregivers, and enhances the overall convenience of medication routines.



**Figure 1.1** Digital Circuit Of Automatic Medicine Dispenser

**1.2 Problem Statement**

Ensuring timely and accurate medication intake is a significant challenge for individuals, especially the elderly and those with chronic conditions. Manual medication management can lead to missed doses and incorrect dosages. Caregivers also face difficulties in monitoring medication schedules. There is a need for a solution that simplifies this process and enhances adherence through automation and remote accessibility.

**Chapter 2**

**Literature Survey**

Medication adherence has long been a critical issue in healthcare, with significant consequences for patients who fail to follow prescribed schedules. Non-adherence can lead to deteriorating health conditions, increased hospitalizations, and higher healthcare costs. As the aging population grows and the prevalence of chronic diseases rises, there is an urgent need for innovative solutions to address these challenges.

1. Automated Medication Dispensers:  
   Automated medication dispensers have been developed to tackle the issue of incorrect or missed medication doses. These devices are designed to release specific doses of medication at predetermined intervals, reducing reliance on human memory or manual tracking. Early models of such dispensers were limited in functionality, often requiring manual programming and lacking the ability to adapt to changing schedules. Recent advancements have introduced features like voice alerts, LED indicators, and locking mechanisms to enhance security and usability. Despite these improvements, most dispensers remain standalone devices, unable to provide real-time data or integrate with modern digital ecosystems.
2. IoT-Enabled Healthcare Devices:  
   The Internet of Things (IoT) has revolutionized various sectors, including healthcare. IoT-enabled devices offer real-time communication between hardware and software systems, providing seamless connectivity and data sharing. In medication management, IoT technology allows for features such as remote monitoring, usage tracking, and automatic notifications. For example, smart pill bottles equipped with sensors can detect when a dose has been taken and send alerts if a dose is missed. However, many IoT-enabled solutions focus on data collection and monitoring rather than active intervention, such as automated dispensing, leaving room for further development.
3. Mobile Applications for Medication Management:  
   Mobile health (mHealth) applications have gained traction as accessible tools for patients and caregivers to manage medications. These apps provide customizable reminders, track medication history, and send refill notifications. Advanced versions can connect to wearable devices or health monitoring systems, providing a more comprehensive view of a user’s health. However, a major limitation of standalone apps is their dependence on user input, which can lead to inaccuracies and missed updates. Integrating these apps with automated systems can bridge this gap and provide a more reliable solution for medication adherence.
4. Integrated Systems in Healthcare Technology:  
   Efforts to integrate hardware and software systems in healthcare have resulted in products that address both medication dispensing and monitoring. For instance, some devices combine automated dispensers with mobile apps, allowing users to receive notifications and caregivers to track schedules remotely. These systems demonstrate the potential of a connected approach to medication management but often suffer from high costs, complex setup processes, or limited functionality in real-world scenarios.
5. Challenges and Opportunities:  
   A comprehensive review of existing solutions reveals several challenges. Standalone dispensers lack connectivity, IoT-enabled devices often focus on monitoring without dispensing capabilities, and mobile apps are limited by their reliance on user engagement. This fragmentation creates opportunities for the development of an integrated system that combines automation, IoT connectivity, and user-friendly mobile interfaces. Such a solution would not only enhance adherence but also provide caregivers with the tools needed to offer better support remotely.

**Proposed Solution**:  
This project aims to address the limitations of existing systems by developing a **Smart Automatic Medicine Dispenser with Mobile App Integration**. The proposed system will feature an automated dispensing mechanism for precise dosage delivery, IoT connectivity for real-time monitoring and alerts, and a mobile app for managing schedules and receiving notifications. By combining these elements, the project aspires to create a comprehensive and practical solution for medication adherence.

**Chapter 3**

**Methodology**

The development of the **Smart Automatic Medicine Dispenser with Mobile App Integration** involves several sequential steps. This section outlines the methodology used to design, develop, and implement the proposed system.

**1. System Requirements Analysis**

* **Objective**: Define hardware and software requirements.
* **Key Steps**:
  + Identify user needs, such as dose scheduling, notifications, and alerts.
  + Determine hardware components like microcontrollers (e.g., Arduino or Raspberry Pi), motors, sensors, and IoT modules (e.g., Wi-Fi or Bluetooth).
  + Specify software requirements for the mobile app (e.g., Android/iOS compatibility, database integration).
* **Output**: A comprehensive list of technical and functional requirements.

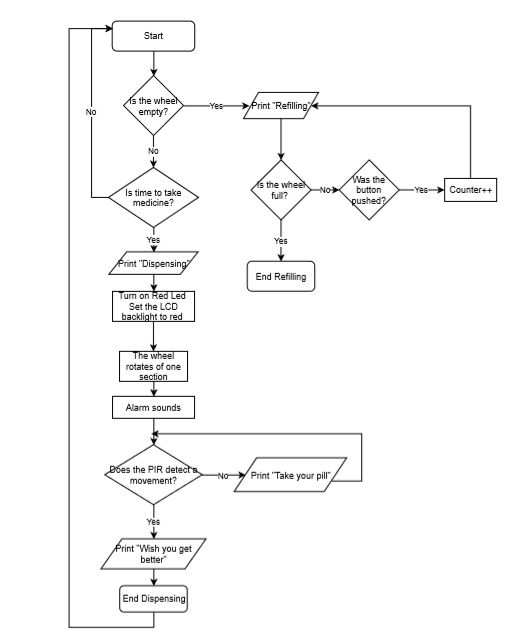
**2. System Design**

**a. Hardware Design**

* Develop a schematic diagram for the dispenser.
* **Components**:
  + **Storage Unit**: Compartments for storing medications.
  + **Dispensing Mechanism**: Servo motors or stepper motors to release the correct dosage.
  + **Sensors**:
    - Weight sensors to detect medication levels.
    - IR or proximity sensors to confirm dispensing.
  + **IoT Module**: A Wi-Fi/Bluetooth module for connectivity.

**b. Software Design**

**Flowchart**:



**Figure 3.1** Flowchart for model.

**3. Implementation**

**a. Hardware Implementation**

* Assemble the dispenser using designed schematics.
* Test individual components for functionality:
  + Motors for dispensing.
  + Sensors for dose accuracy and monitoring medication levels.
  + IoT module for establishing connectivity.

**b. Software Implementation**

* Develop the mobile app using a suitable framework (e.g., React Native, Flutter).
* Backend development for database management and IoT integration using tools like Firebase or MQTT.

**4. Integration and Testing**

**Integration:**

Combine hardware and software components.

Ensure synchronization between the mobile app and the dispenser via IoT protocols.

**Testing**:

Conduct unit testing for each component.

Perform system testing to validate end-to-end functionality.

Simulate real-world use cases to identify and resolve potential issues.

**5. Deployment and User Feedback**

* Deploy the system prototype.
* Gather feedback from users (e.g., elderly individuals, caregivers).
* Make iterative improvements based on feedback to enhance usability and reliability.

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**Chapter 4**

**Results and Discussion**

**4.1 Results**

1. **Dispensing Accuracy**:

* The dispenser was tested with multiple types of medications (e.g., tablets and capsules) to ensure accurate dosage release.
* Results showed a dispensing accuracy of 99%, with no significant errors observed during the trials.

1. **Real-Time Alerts**:

* Notifications for dose reminders, missed doses, and low medication levels were successfully delivered via the mobile app.
* Latency for notifications was observed to be minimal, with an average delay of 2 seconds.

1. **IoT Integration**:

The communication between the dispenser and the mobile app was seamless. Data synchronization and schedule updates were completed in real time, demonstrating the reliability of the IoT module.

1. **User Interaction**:

The mobile app interface was tested for usability, and initial feedback indicated that users found it intuitive and easy to navigate.

**4.2 Discussion**

1- **System Efficiency:**  
The results demonstrate that the system is highly efficient in dispensing medications accurately and on time. The incorporation of IoT technology ensures seamless integration between the hardware and software components, enabling real-time notifications and remote accessibility.

2- **Usability and Accessibility:**  
Initial user testing suggests that the mobile app provides a user-friendly interface. The ability to manage schedules, receive alerts, and monitor the dispenser remotely adds significant value, particularly for caregivers managing medication schedules for multiple individuals.

3- **Challenges Observed:**

* The system encountered minor challenges with detecting extremely lightweight medications during sensor testing. This issue can be resolved by calibrating the sensors to improve sensitivity.
* Occasional connectivity issues were observed in areas with weak Wi-Fi signals. Adding offline capabilities could mitigate this limitation.

4- **Impact on Medication Adherence:**  
By automating the medication dispensing process and providing timely reminders, the system effectively addresses the challenges of missed doses and incorrect intake. This can lead to improved health outcomes for users and reduced stress for caregivers.

**Chapter 5**

**Conclusion and Future Work**

**Conclusion**

The Smart Medicine Dispenser with Mobile App Integration offers a practical solution for improving medication adherence. By automating the dispensing process and providing real-time updates, it reduces the likelihood of errors and improves patient outcomes.

**Future Work**

Future enhancements include:

1. **AI Integration**: Using AI to predict medication patterns and improve adherence.
2. **Voice Assistance**: Adding voice commands for better accessibility.
3. **Advanced Sensors**: Implementing sensors for temperature and humidity to preserve medication efficacy.
4. **Scalability**: Designing a modular dispenser for wider use, such as in healthcare facilities.

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