### MEDICINE REMAINDER WEB APP

**A SOCIALLY RELEVANT MINI PROJECT REPORT**

***Submitted by***

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### ABSTRACT

In today’s fast-paced world, maintaining a consistent medication routine has become a significant challenge, especially for elderly individuals and patients with chronic illnesses. Missing or mismanaging doses can lead to severe health complications, hospital readmissions, and reduced treatment effectiveness. To address these issues, our project introduces the Medicine Reminder Web App, a user-friendly and efficient system designed to help users manage their medication schedules with ease and accuracy. The system enables users to register, add medications, and set reminders based on dosage time, frequency, and duration. Automated notifications alert users via the web interface or linked devices, ensuring that medicines are taken on time. The application also includes features such as dosage tracking, refill alerts, and prescription history, offering a comprehensive solution for both patients and caregivers, Developed using modern web technologies, the system prioritizes accessibility, scalability, and data security. Its intuitive interface makes it simple for users of all age groups to navigate and manage their medical routines effectively. By integrating digital reminders and record management, the Medicine Reminder Web App reduces the risk of missed doses and promotes medication adherence. Overall, the project aims to enhance patient safety, improve healthcare management, and contribute to a healthier society through technology-driven medication tracking. The system ensures reliability and convenience while fostering better health outcomes through timely medication intake.

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# CHAPTER 1 INTRODUCTION

### CHAPTER 1 INTRODUCTION

* 1. **OVERVIEW OF PROJECT**

The Medicine Reminder Web App is an innovative healthcare management solution designed to help individuals maintain a consistent medication routine. In today’s busy lifestyle, patients often forget to take medicines at the prescribed time, which can lead to serious health risks. This system provides an efficient and user-friendly platform for managing medication schedules through timely reminders and notifications.

The application allows users to add medicines, specify dosage details, and set reminder times. Once the reminders are configured, the system automatically alerts users at the scheduled time, ensuring that medicines are taken as prescribed. The platform aims to improve patient compliance, reduce medication errors, and support doctors and caregivers in monitoring patient adherence.

## BACKGROUND AND NOTIFICATION

provide timely reminders, systematic tracking, and organized management of medical information. By automating alerts and maintaining accurate records of medication intake, the app empowers patients to follow their prescriptions consistently while enabling caregivers and doctors to monitor compliance remotely. The motivation behind developing this app stems from the urgent need to improve medication adherence, reduce human error, and enhance the quality of healthcare delivery. Additionally, the app aims to provide peace of mind for patients and caregivers, improve clinical outcomes, and support preventive healthcare by fostering disciplined and timely medicine consumption. This initiative reflects a commitment to leveraging technology for health management and promoting a safer, more efficient approach to patient care.

## PROBLEM DEFINITION

Medication non-adherence is a critical challenge in healthcare, particularly for patients with chronic illnesses, multiple prescriptions, or elderly individuals who may require assistance to manage their medicine intake. Missed doses, incorrect timing, or improper dosage can lead to severe health complications, prolonged recovery, hospital readmissions, and increased healthcare costs. Traditional methods of managing medicines, such as handwritten schedules, mental tracking, or relying on caregivers alone, are often unreliable and prone to human error. Additionally, caregivers and healthcare professionals face difficulties in monitoring patient compliance consistently, especially when managing multiple patients or coordinating complex treatment plans. There is a clear need for a reliable, automated, and user-friendly system that ensures patients take their medicines on time, tracks adherence accurately, and provides timely notifications to both patients and caregivers. Furthermore, integrating a centralized platform that allows doctors to monitor patient progress, review adherence history, and intervene when necessary can significantly improve healthcare outcomes. This problem highlights the gap between patient needs and existing healthcare practices, emphasizing the necessity for a digital solution that simplifies medication management, enhances compliance, reduces errors, and supports proactive health monitoring.

## OBJECTIVES OF THE SYSTEM

The primary objective of the Medicine Reminder App is to improve medication adherence and simplify the management of medical schedules for patients, caregivers, and healthcare providers. To achieve this, the system is designed with the following detailed objectives: Ensure Timely Medication Intake:

* + - The system aims to provide automated and timely reminders to patients for every scheduled dose,reducing the chances of missed or delayed medication.
    - It supports multiple alert modes, including notifications, SMS, or emails, to accommodate different user preferences and ensure consistent adherence.

Provide Accurate Medication Management:

* + - Enables patients or caregivers to input detailed information about medicines, including dosage, frequency, duration, and special instructions.
    - Maintains an organized record of medications, which can be reviewed or updated as needed, minimizing human error in medication management.

Facilitate Caregiver Support:

* + - Allows caregivers to monitor the medicine schedules of patients under their supervision.
    - Provides dashboards showing adherence reports and alerts for missed doses, making it easier for caregivers to intervene when necessary.

Enable Doctor Monitoring and Intervention:

* + - Doctors can track patient adherence remotely, review medication history, and identify patterns that may require adjustments in treatment.
    - Supports proactive healthcare management by allowing timely medical interventions based on real-time adherence data.

Enhance User Experience and Accessibility:

* + - Designed to be simple, intuitive, and accessible to users of all ages, including the elderly and technologically inexperienced patients.
    - Provides clear visual dashboards and notifications to ensure ease of use. Maintain Data Security and Privacy:
    - Protects sensitive medical information using secure login, encrypted data storage, and compliance with data privacy standards.
    - Ensures patient confidentiality while enabling authorized access for caregivers and healthcare professionals.

Promote Health Awareness and Preventive Care:

* + - By systematically tracking medication intake, the system encourages disciplined health routines.
    - Empowers patients to take an active role in their healthcare, reduces complications

non-adherence, and fosters better long-term health outcomes.

## SCOPE OF THE PROJECT

The Medicine Reminder App is designed to provide a comprehensive, technology-driven solution for managing medication schedules, adherence tracking, and health monitoring. Its scope encompasses multiple aspects of patient care, ensuring that users—patients, caregivers, and healthcare professionals—can efficiently manage and monitor medication intake. The system allows patients to store detailed information about their prescribed medicines, including dosage, frequency, timing, and special instructions, while providing automated reminders to prevent missed doses. Caregivers can monitor multiple patients simultaneously, view adherence reports, and receive alerts for missed or delayed medications, enhancing their ability to provide timely support. Doctors can access patient medication history, track compliance patterns, and intervene when necessary to adjust treatments, promoting proactive healthcare management. The app also emphasizes usability, with an intuitive interface suitable for all age groups, and ensures data security through encrypted storage and secure login mechanisms. Furthermore, the project aims to integrate health awareness by educating users on the importance of adherence and fostering preventive care practices. Overall, the project’s scope extends beyond simple reminders, addressing the broader challenges of patient safety, treatment effectiveness, and healthcare efficiency, making it a vital tool in modern digital healthcare management.

## EXPECTED OUTCOMES

The Medicine Reminder App is expected to bring several tangible and impactful outcomes for patients, caregivers, and healthcare providers, addressing the challenges of medication and adherence:

* Improved Medication Adherence**:** Patients are more likely to take their medicines on time and in the correct dosage, reducing the risk of missed doses and health complications.
  + Efficient Caregiver Management: Caregivers can monitor multiple patients more effectively, receive timely alerts for missed doses, and intervene promptly, improving overall patient care.
  + Streamlined Doctor Monitoring: Doctors can track patient adherence remotely, access comprehensive medication histories, and make informed decisions regarding treatment adjustments, promoting proactive healthcare.
  + User-Friendly Experience: Patients and caregivers benefit from an intuitive interface and automated notifications, reducing reliance on manual tracking methods such as paper logs or memory.
  + Data-Driven Insights: The app generates reports on medication adherence patterns, providing valuable insights to caregivers and healthcare professionals for better health management.
  + Increased Awareness of Medication Importance: The system encourages patients to develop disciplined health habits, fostering a better understanding of the importance of medication adherence and preventive care.
  + Secure and Reliable System: Ensures sensitive medical data is protected, maintaining confidentiality and building user trust in the digital platform.

Overall, the expected outcome of the project is a significant improvement in medication compliance, patient health outcomes, and the efficiency of healthcare monitoring, creating a safer and more organized approach to medicine management.

# CHAPTER 2 LITERATURE SURVEY

**CHAPTER 2 LITERATURESURVEY**

## EXISTING SYSTEM

In the current scenario of healthcare management, several applications and systems have been developed to help patients remember their medication schedules and monitor their health. However, most of these existing medicine reminder systems suffer from notable limitations that reduce their efficiency and user adoption. The majority of these systems rely heavily on manual entry and static scheduling, where users are required to input each medicine name, dosage, and timing manually. Popular apps such as MediSafe or Pill Reminder offer basic notification-based reminders but depend entirely on user input and maintenance. This approach is often time-consuming, inconvenient, and prone to human error, especially for elderly users or those managing multiple prescriptions. As a result, users often miss doses or lose motivation to continue using the app consistently.

Another common drawback of existing systems is the lack of integration with healthcare professionals and caretakers. Many reminder apps are designed for individual users and do not facilitate communication between patients, doctors, and family members. This limitation restricts collaborative monitoring and prevents real-time updates about the patient’s adherence or health condition. Consequently, doctors and caretakers have limited insight into the patient’s medicine intake patterns, which can impact treatment outcomes and follow-up decisions.

While some advanced applications incorporate cloud-based synchronization or health tracking features, they often fail to provide a personalized experience. Most existing systems do not adapt based on user behavior, medical history, or prescription changes. Furthermore, they lack AI-driven analytics that could help predict missed doses, suggest optimal

medication times, or send intelligent notifications based on the patient’s routine.

Another critical limitation is the absence of emergency and safety mechanisms. In real- world scenarios, patients—especially the elderly or chronically ill—may forget their medication or take incorrect dosages. Current systems rarely include automated alerts to caretakers or doctors in such cases. This reduces the reliability of the app in critical healthcare contexts.

Additionally, user engagement and accessibility remain major challenges. Many existing complex user interfaces or require technical familiarity, making them unsuitable for less tech-savvy users. They also lack features that encourage adherence through educational content, voice reminders, or multilingual support. As a result, users often discontinue use after a short period.

In summary, the majority of existing medicine reminder systems are limited to basic reminder functionalities without addressing the broader aspects of healthcare coordination, personalization, and engagement. This creates an urgent need for an improved, user-friendly, and intelligent web-based medicine reminder system that not only automates scheduling and alerts but also connects patients, caretakers, and doctors in a unified and interactive platform.

## LIMITATIONS OF EXISTING SYSTEMS

While current systems have improved medication adherence to some extent, they are far from perfect. The main limitations are:

* + 1. Manual Effort**:** Users must repeatedly input reminder settings each time they add a new medicine.
    2. No Centralized Record: There’s no unified database to track prescription history or generate reports.
    3. Inadequate Notifications**:** Existing systems depend solely on device notifications, which can be missed or disabled.
    4. Poor User Experience**:** Many applications lack a user-friendly interface, making them difficult for elderly users.
    5. Data Insecurity**:** Some apps do not encrypt medical data, posing privacy and security concerns.
    6. No Smart Insights**:** There are no features to analyze adherence patterns or send intelligent recommendations.

These limitations motivated the development of the Medicine Reminder Web App, which addresses these issues through a more reliable, accessible, and interactive approach.

## RELATED WORKS AND RESEARCH PAPERS

Several studies and projects have focused on improving medication adherence using technology. A few of the most relevant works include:

* Mobile Health (mHealth) Applications: Research has shown that mHealth tools can significantly improve adherence among patients with chronic illnesses. However, mobile- only applications limit accessibility for non-smartphone users.
* IoT-Based Health Monitoring Systems: Some projects integrate sensors and wearable devices to automate medication reminders, though these are often expensive and difficult to maintain.
* AI-Assisted Healthcare Applications: Recent studies explore AI-based recommendation systems that help monitor patient behavior and predict adherence risks, but such systems require complex infrastructure and data collection.
* Smart Pill Dispensers: Devices with automated pill release mechanisms exist, but they are hardware-dependent and not affordable for the general public.

In contrast, the Medicine Reminder Web App provides a cost-effective, software-based approach that combines web accessibility with reliable scheduling and notification services.

# CHAPTER 3 SYSTEM ANALYSIS

**CHAPTER 3 SYSTEM ANALYSIS**

## SYSTEM STUDY

The Medicine Reminder App is designed as a comprehensive solution to manage patients’ medication schedules effectively, catering to patients, caregivers, and healthcare providers. The primary goal is to ensure timely medication intake, reduce missed doses, and provide visibility into adherence patterns for doctors and caretakers. By combining notifications, adherence tracking, and secure medical data storage, the system offers a seamless experience for all stakeholders.

The objectives of the system are centered around enhancing patient health outcomes by providing timely reminders via multiple channels including push notifications, SMS, and email. The app also aims to provide a dashboard for caregivers and doctors to monitor adherence, track missed doses, and generate reports for clinical review. Additionally, the app emphasizes secure data handling with role-based access, encryption, and privacy- compliant design.

Stakeholders include primary users such as patients who require assistance in managing medication schedules, secondary users like caretakers who oversee multiple patients, clinicians who require adherence data, and administrative personnel responsible for system maintenance. The app also considers compliance and regulatory stakeholders to ensure GDPR and HIPAA standards are met.

The scope of the application encompasses user authentication, medicine scheduling, reminders, adherence logging, and reporting. Patients can create and manage schedules, while caretakers and doctors can access adherence dashboards. Features such as e- prescription transmission or direct EHR integration are considered out-of-scope for the initial phase but may be incorporated in future iterations.

Functional requirements include robust user management, medicine and schedule

management, multi-channel notifications, adherence tracking, caregiver and doctor access

capabilities, and audit logging. Non-functional requirements focus on security, performance, availability, scalability, compliance, usability, and localization, ensuring a reliable and user- friendly experience.

The system architecture is designed in layers with a client layer (mobile and web), an API layer (RESTful/GraphQL), a business logic layer with scheduler services, and a data layer comprising relational databases, caching, and background workers for processing reminders. Notification services handle multi-channel delivery while analytics and monitoring tools provide insights into system health and usage.

Data management revolves around core entities such as Users, Patient Profiles, Medicines, Schedules, Dose Events, Caregiver Links, and Audit Logs. Scheduling logic employs recurrence rules to handle complex medication patterns, with robust reminder delivery through queues and retry mechanisms. UI/UX design prioritizes simplicity, accessibility, and intuitive interaction, supporting elderly patients and busy caregivers alike.

Security measures include encryption at rest and in transit, MFA, RBAC, audit trails, and compliance with data protection regulations. Testing strategies cover unit, integration, end- to- end, load, and security testing to ensure system integrity. Deployment follows a CI/CD pipeline with infrastructure-as-code, blue/green deployments, and disaster recovery planning.

The project identifies risks such as missed reminders, data breaches, regulatory non- compliance, and scalability bottlenecks, with mitigation strategies including redundant notification channels, robust security protocols, compliance audits, and horizontal scaling. The phased project plan outlines MVP development, caregiver and doctor dashboards, analytics, and future integrations, while cost considerations account for development, infrastructure, and third- party services.

Overall, the Medicine Reminder App is a holistic, patient-centric solution that combines technology, usability, and regulatory compliance to improve medication adherence and health outcomes, providing both patients and healthcare providers with actionable insights

## PROBLEM IDENTIFICATION

Through research and observation, several issues in existing medication management methods were identified:

* + - Patients often forget or skip their medicines due to busy schedules.
    - There is no unified system to manage multiple medications simultaneously.
    - Manual tracking leads to errors in dosage timing or missed doses.
    - Caregivers and family members have limited visibility into patient adherence.
    - Lack of automated notifications reduces reliability in conventional methods.

The Medicine Reminder Web App addresses these problems by providing a centralized digital platform where users can schedule reminders, receive timely notifications, and track their medication history effectively.

## TECHNICAL FEASIBILITY

Technical feasibility examines whether the required technology, tools, and resources are available to develop the app successfully.

**Technology Stack:** The app can be developed using widely available technologies such as: **Frontend:** HTML, CSS, JavaScript, or frameworks like React for web/mobile compatibility. **Backend:** Node.js, Python (Django/Flask), or PHP for server-side processing.

**Database:** MySQL, PostgreSQL, or MongoDB for secure data storage.

**Notification Services:** Firebase Cloud Messaging, Twilio SMS API, or Email services.

Hardware Requirements: The app requires minimal hardware resources; users need only smartphone or web-enabled device.

Feasibility Assessment: Given the widespread availability of these technologies and platforms, the project is technically feasible.

## ECONOMIC FEASIBILITY

* + - * Economic feasibility evaluates the cost-effectiveness of the project and whether the benefits outweigh the costs.
      * Development Costs: Include software tools, server hosting, API integrations, and potential licensing fees.
      * Maintenance Costs: Minor ongoing costs for server maintenance, updates, and support.
      * Benefits: Reduced health complications due to missed medications, improved adherence, and better patient monitoring. These benefits indirectly save healthcare costs and enhance user quality of life.
      * Feasibility Assessment: Considering the relatively low development and maintenance costs compared to the significant health and operational benefits, the project is economically feasible.

## OPERATIONAL FEASIBILITY

* + - * Operational feasibility assesses whether the system can operate effectively once implemented and if it meets user requirements.
      * User Requirements: Patients, caregivers, and doctors need a simple, reliable system for medication reminders and adherence tracking.
      * Ease of Use: The app is designed with an intuitive interface, dashboards, and notifications to ensure all user types, including the elderly, can use it comfortably.
      * Benefit to Users: It simplifies medication management, reduces human error, improves patient adherence, and enables caregivers and doctors to monitor compliance.
      * Feasibility Assessment: The system aligns with user requirements and is expected to be easily adoptable, ensuring high operational feasibility.

## REQUIREMENT ANALYSIS

The requirement analysis for the Medicine Reminder App focuses on identifying and detailing all functional and non-functional requirements necessary to develop a system that effectively manages medication schedules and improves patient adherence. Functionally, the system must support multi-role user access, including patients, caregivers, and doctors, with secure login credentials and role-based permissions. Patients should be able to input, view, and update their medication schedules, including medicine names, dosages, frequency, start and end dates, and special instructions. The system must provide automated reminders for each scheduled dose through multiple channels such as notifications, SMS, and email, ensuring timely intake. Caregivers should have the ability to monitor multiple patients, track adherence reports, and receive alerts for missed or delayed doses, enabling timely interventions. Doctors require access to patient medication histories, adherence patterns, and reporting tools to make informed treatment adjustments. From a non-functional perspective, the system must ensure data security and privacy through encryption and secure storage, maintain high availability and reliability of notifications, and provide an intuitive, user- friendly interface suitable for all age groups, including elderly patients. Scalability is also a critical requirement, allowing the system to manage multiple users and handle complex schedules for multiple medications without performance degradation. Additionally, the system should support cross-platform accessibility, functioning seamlessly on web and mobile devices, and integrate with external services such as SMS gateways or cloud databases. Overall, the requirement analysis underscores the need for a robust, secure, and intelligent system that not only automates reminders but also provides comprehensive monitoring and reporting capabilities, improving healthcare management, reducing human error, and enhancing patient adherence to prescribed treatments.

## FUNCTIONAL REQUIREMENTS

The Medicine Reminder App is designed to provide a set of core functionalities that

shall provide secure login and authentication with role-based access, allowing patients, caregivers, and doctors to access features relevant to their roles. Patients and caregivers can add, update, or delete medicine details, including the name of the medication, dosage, frequency, start and end dates, and any special instructions, while viewing schedules in a clear list or calendar format. The app shall provide automated, timely reminders through in- app notifications, SMS, or email, including support for recurring reminders and alerts for missed or delayed doses. Caregivers shall be able to monitor multiple patients, track adherence, and receive alerts if a patient misses a dose. Doctors shall have access to patient medication histories, adherence reports, and trends to make informed decisions regarding treatment adjustments. The system shall store all patient and medication data securely in an encrypted database, ensuring privacy and protection of sensitive information. Users shall have the ability to customize notification preferences and receive alerts for critical events such as refills or potential drug interactions. Additionally, the app shall be accessible across web and mobile platforms, providing seamless cross-platform usability. A user-friendly interface with intuitive dashboards will facilitate easy navigation and interaction, catering even to elderly users or those less familiar with technology. Overall, these functional requirements collectively ensure that the system provides timely medication reminders, comprehensive monitoring, and secure, organized management of health information.

## NON-FUNCTIONAL REQUIREMENTS

The Medicine Reminder App is designed to meet several non-functional requirements that ensure the system is reliable, efficient, secure, and user-friendly. The app shall maintain high reliability and availability, ensuring that reminders, alerts, and data access are delivered without interruptions. Performance efficiency is crucial; the system shall respond promptly to user inputs, load schedules quickly, and deliver notifications in real time without delay. Scalability is another key requirement, allowing the system to handle increasing numbers of users, patients, and complex medication schedules without degradation in performance. Security and privacy are paramount, and the system shall employ encryption, secure

authentication, and role-based access controls to protect sensitive patient information. The system shall also ensure data integrity, maintaining accurate and consistent medication records over time. Usability and accessibility are critical, with the app designed to provide an intuitive interface, simple navigation, and clear visual displays suitable for users of all ages, including elderly or less technologically proficient patients. The system shall support cross-platform compatibility, working seamlessly on web browsers and mobile devices. Additionally, the app shall incorporate maintainability and flexibility, allowing easy updates, feature enhancements, and integration with external services such as SMS gateways or cloud databases. These non-functional requirements collectively ensure that the Medicine Reminder App is not only functionally effective but also reliable, secure, and user-friendly, providing a high-quality experience for all stakeholders.

## SOFTWARE AND HARDWARE REQUIREMENTS

The development and deployment of the Medicine Reminder App require software and hardware components to ensure smooth operation and optimal performance. On the software side, the system will utilize a web or mobile-based platform, with the frontend developed using technologies such as HTML, CSS, JavaScript, or frameworks like React for responsive and interactive user interfaces. The backend will employ Node.js, Python (Django/Flask), or PHP for server-side logic and data processing, while MySQL, PostgreSQL, or MongoDB will be used as the database to securely store patient and medication information. Notification services like Firebase Cloud Messaging, Twilio SMS API, or email services will be integrated to deliver timely reminders and alerts. The system will operate on modern web browsers (Chrome, Firefox, Edge) and mobile operating systems such as Android and iOS.

On the hardware side, users require smartphones, tablets, or computers with internet connectivity to access the application. The server infrastructure can be hosted on cloud platforms or dedicated servers with sufficient processing power, memory, and storage to handle multiple concurrent users and large volumes of medication data. Caregivers and

doctors will need devices capable of displaying dashboards, viewing reports, and managing patient information efficiently. Additionally, for development purposes, computers with standard development environments, IDEs, and network access are necessary. Overall, these software and hardware requirements ensure that the Medicine Reminder App operates reliably, delivers timely notifications, maintains data security, and provides a seamless experience across platforms and user roles.

# CHAPTER 4 SYSTEM DESIGN

### CHAPTER 4 SYSTEM DESIGN

* 1. **SYSTEM ARCHITECTURE**

The system architecture of the Medicine Reminder App is designed to provide a secure, scalable, and efficient platform for managing medication schedules, monitoring adherence, and supporting multiple user roles including patients, caregivers, and doctors. The architecture follows a three-tier client-server model comprising the Presentation Layer (Frontend), Application Layer (Backend), and Data Layer (Database), ensuring modularity, maintainability, and smooth communication between components.

Presentation Layer (Frontend):

* + - This layer is responsible for user interaction.
    - Users, including patients, caregivers, and doctors, access the system via web or mobile interfaces.
    - The frontend provides dashboards, schedule views, notification settings, and adherence reports.
    - Technologies like HTML, CSS, JavaScript, React (or Flutter for mobile apps) are used to create an intuitive and responsive interface.

Application Layer (Backend):

* + - This layer contains the business logic of the system.
    - It handles user authentication, role-based access control, medicine schedule management, automated notifications, adherence tracking, and report generation.
    - The backend communicates with the database to store and retrieve patient and medication data, processes alerts, and triggers notifications through integrated services like Firebase Cloud Messaging or SMS APIs.
    - Technologies such as Node.js, Python (Django/Flask), or PHP are used to implement server-side logic.

Data Layer (Database):

* + - The data layer stores all system data, including user profiles, patient information, medicine schedules, adherence logs, and notification history.
    - Secure and encrypted storage ensures data integrity and privacy.
    - Databases such as MySQL, PostgreSQL, or MongoDB are employed depending on the application needs.

Notification & External Services Layer:

* + - * The system integrates with notification services (email, SMS, or push notifications) to alert patients and caregivers about medicine schedules and missed doses.
      * Optionally, the system can interact with external APIs for drug information, interaction checks, or cloud storage.

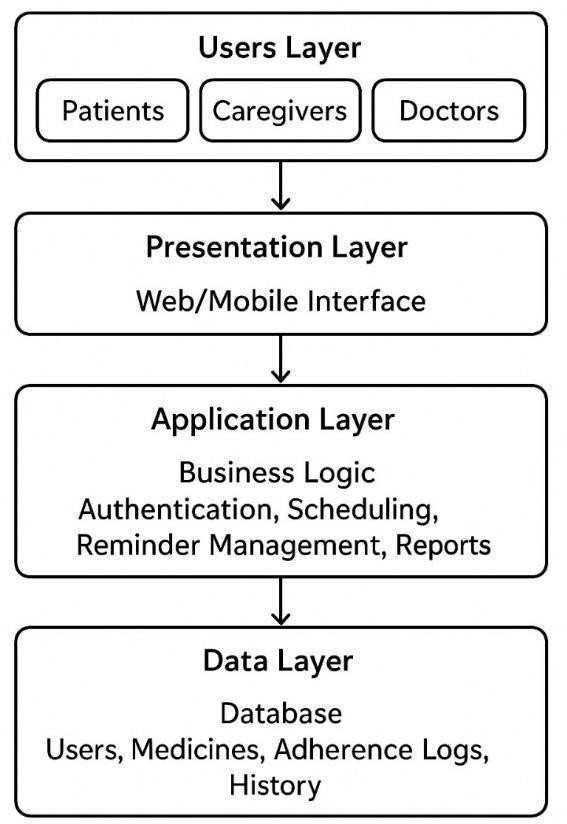
Users Layer:

* + - * Users interact with the system according to their roles:

**Patients:** Receive reminders, view schedules, and update medicine intake.

**Caregivers:** Monitor patient adherence, receive alerts, and manage patient profiles.

**Doctors:** Access patient medication history, review adherence patterns, and make informed medical decisions.

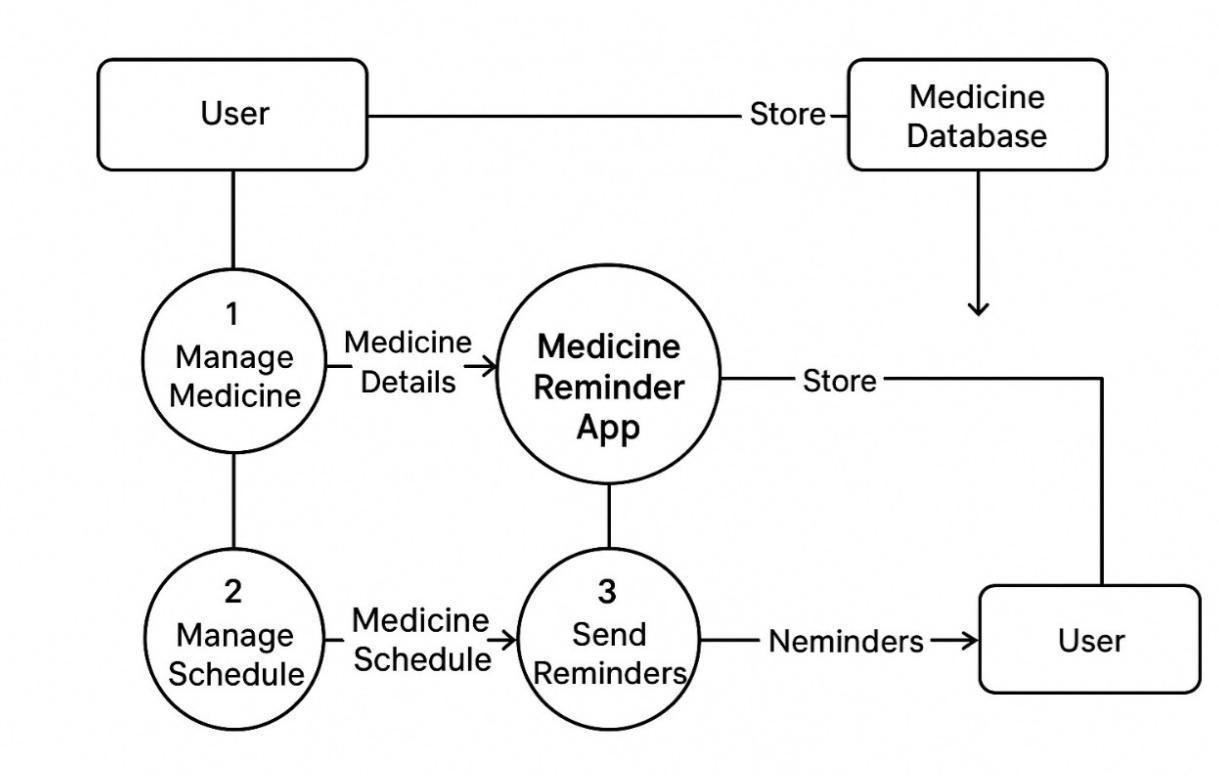


*Fig 4.1:SYSTEM ARCHITECTURE*

Users Layer:

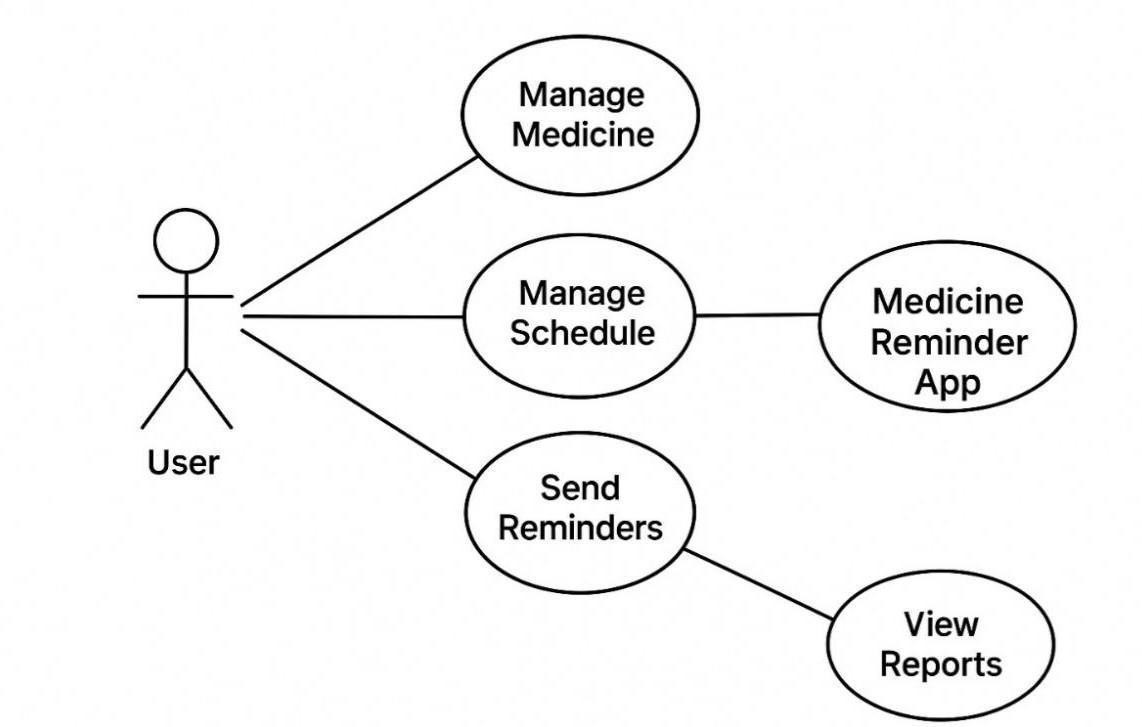
* + - * + Users interact with the system according to their roles:

**Patients**: Receive reminders, view schedules, and update medicine intake. **Caregivers:** Monitor patient adherence, receive alerts, and manage patient profiles. **Doctors**: Access patient medication history, review adherence patterns.



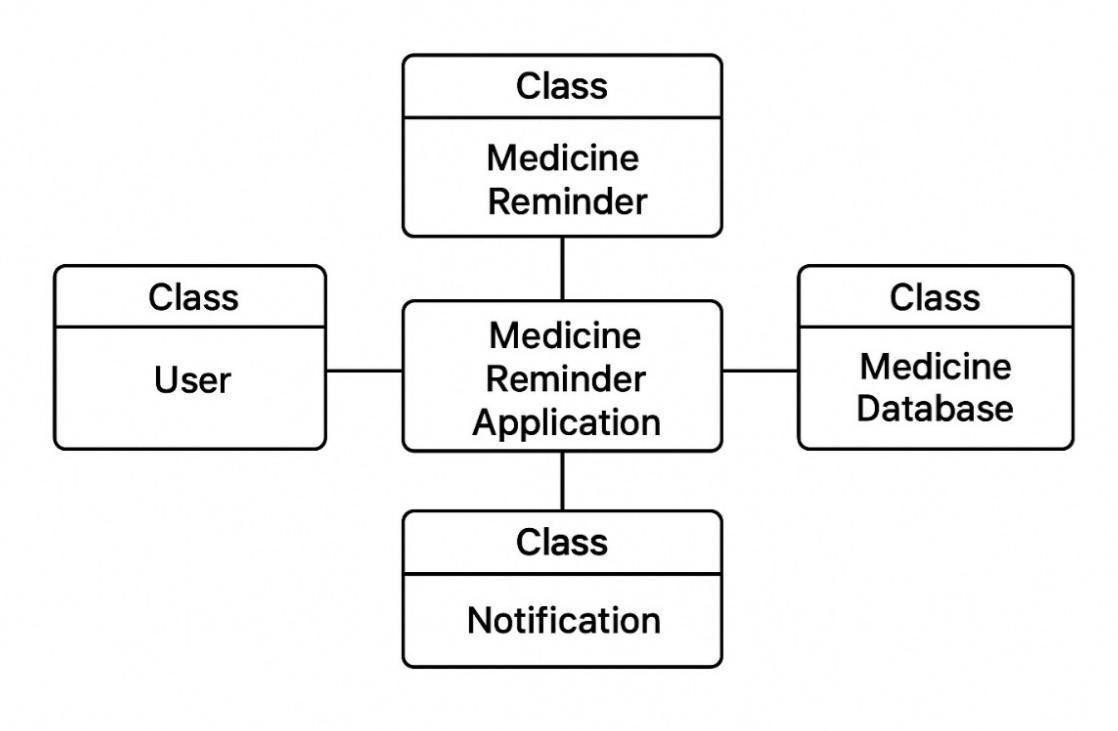
*Fig 4.2 :DATAFLOW DIAGRAM*

* + - This layer is responsible for user interaction.
    - Users, including patients, caregivers, and doctors, access the system via web or mobile interfaces.
    - The frontend provides dashboards, schedule views, notification settings, and adherence reports.

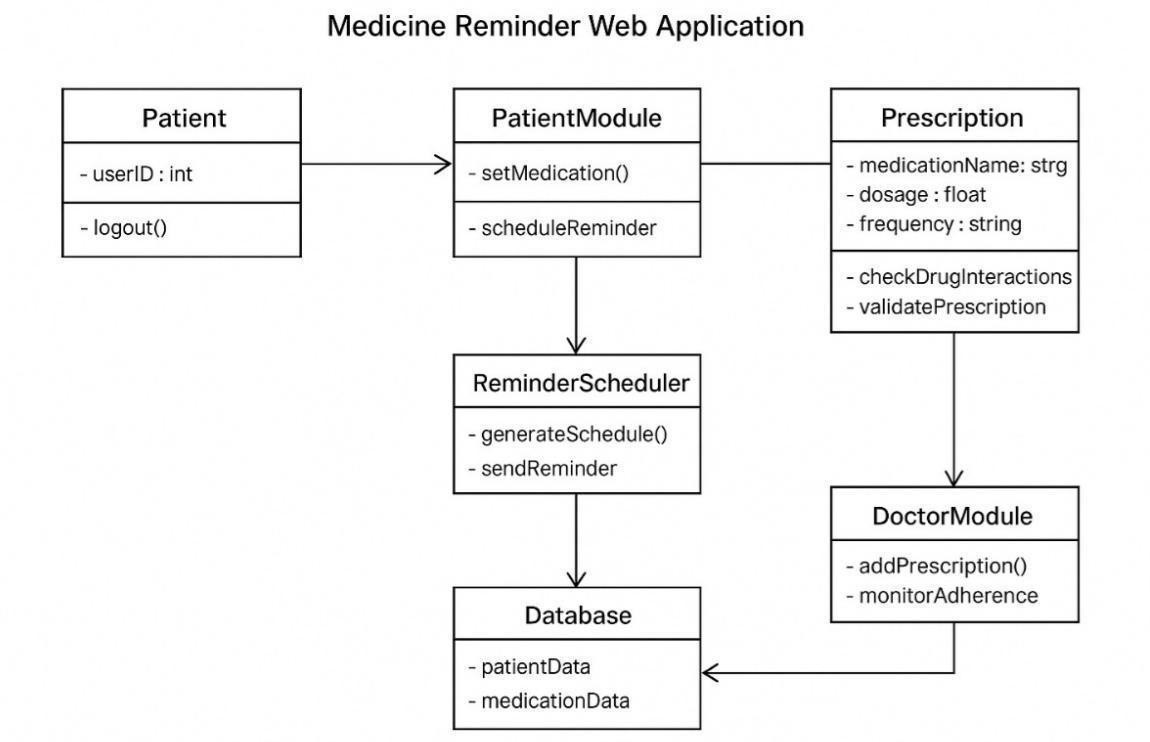


*Fig 4.3:USE CASE DIAGRAM*

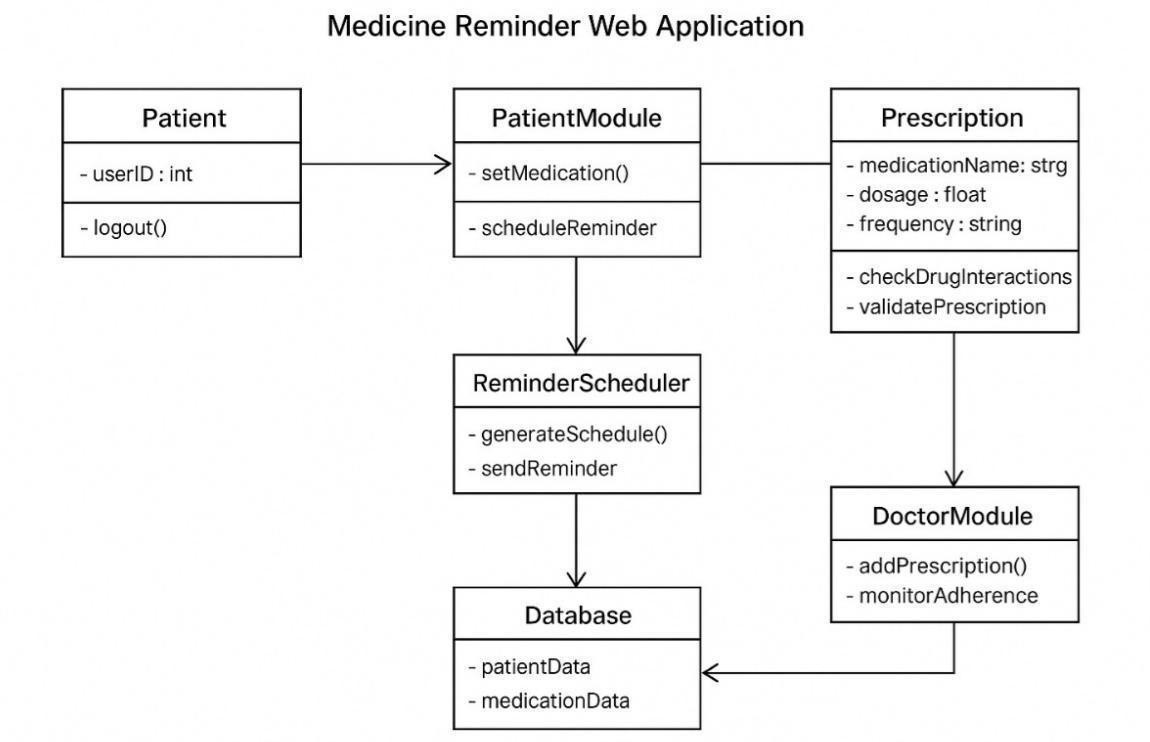
* + - This layer contains the business logic of the system.
    - It handles user authentication, role-based access control, medicine schedule management, automated notifications, adherence tracking, and report generation.
    - The backend communicates with the database to store and retrieve patient and medication data, processes alerts, and triggers notifications through integrated services like Firebase Cloud Messaging or SMS APIs.



*Fig 4.4: UML DIAGRAM*

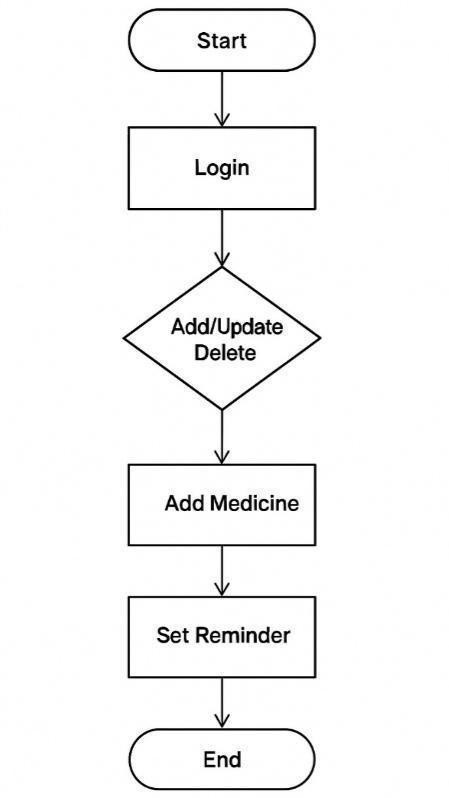
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*Fig 4.4.1:CLASS DIAGRAM*



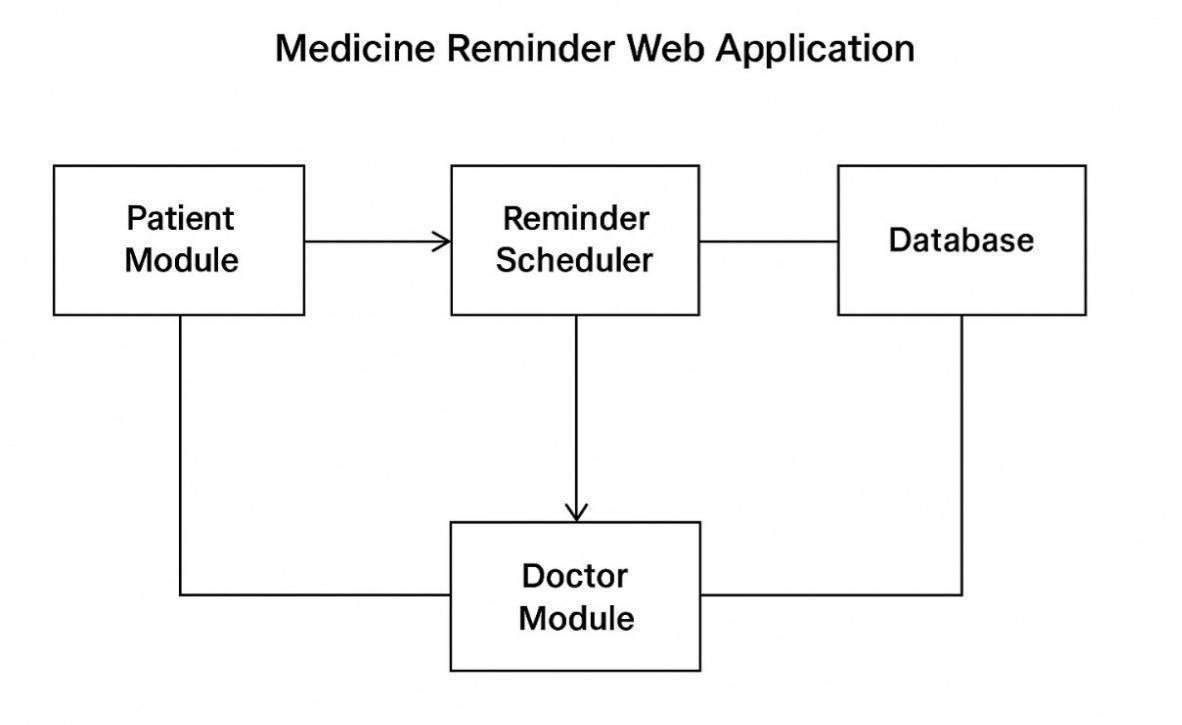
*Fig 4.4.2:SEQUENCE DIAGRAM*

* This layer contains the business logic of the system.
* It handles user authentication, role-based access control, medicine schedule management, automated notifications, adherence tracking, and report generation.
* The backend communicates with the database to store and retrieve patient and medication data, processes alerts, and triggers notifications through integrated services like Firebase Cloud Messaging or SMS APIs



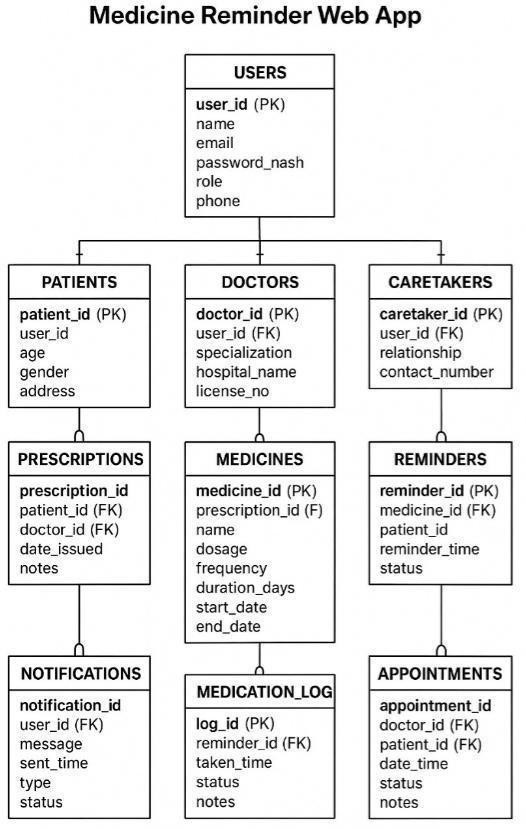
*Fig 4.4.3:ACTIVITY DIAGRAM*

* + This layer contains the business logic of the system.
  + It handles user authentication, role-based access control, medicine schedule management, automated notifications, adherence tracking, and report generation.
  + The backend communicates with the database to store and retrieve patient and medication data, processes alerts, and triggers notifications through integrated service.

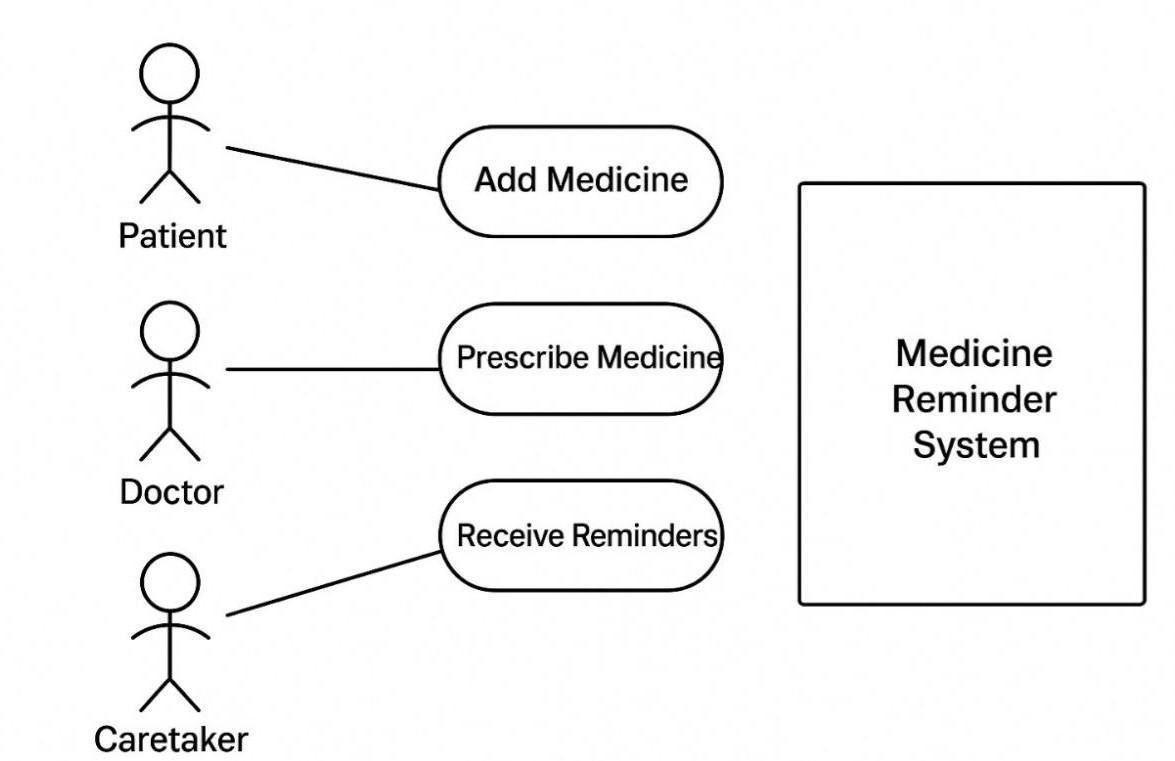


*Fig 4.4.4:COMPONENT DIAGRAM*

* + This layer contains the business logic of the system.
  + It handles user authentication, role-based access control, medicine schedule management, automated notifications, adherence tracking, and report generation.
  + The backend communicates with the database to store and retrieve patient and medication data, processes alerts, and triggers notifications through integrated services like Firebase Cloud Messaging or SMS APIs.



*Fig4.5:DATABASE DESIGN*



*Fig4.6:USER INTERFFACE DESIGN*

* + This layer contains the business logic of the system.
  + It handles user authentication, role-based access control, medicine schedule management, automated notifications, adherence tracking, and report generation.
  + The backend communicates with the database to store and retrieve patient and medication data, processes alerts, and triggers notifications through integrated services like Firebase Cloud Messaging or SMS APIs

# CHAPTER 5 SYSTEM

**IMPLEMENTATION**

**CHAPTER 5**

**SYSTEM IMPLEMENTATION**

* 1. **SYSTEM OVERVIEW**

The Medicine Reminder Web App is a comprehensive healthcare management system designed to help patients, doctors, and caretakers efficiently manage and monitor medication schedules. The primary goal of the system is to ensure timely medicine intake, reduce missed doses, and streamline communication between patients and healthcare providers. The application allows doctors to prescribe medicines digitally, specifying dosage, frequency, and duration, which are automatically scheduled into the system. Patients receive timely notifications and reminders through email, SMS, or app alerts to take their medicines as prescribed. They can also log their medication intake, allowing the system to track adherence. Caretakers have access to the patient’s schedule and can monitor whether medicines are taken on time, ensuring additional accountability for elderly or dependent patients. The backend database maintains organized health data including user profiles, prescriptions, reminders, and medication logs. The system integrates an intelligent notification module that triggers reminders based on user-defined intervals. Through a secure and user-friendly interface, the web app enhances medication compliance, supports remote patient monitoring, and provides doctors with valuable insights into patient adherence trends. Overall, the Medicine Reminder Web App bridges the gap between patients and healthcare professionals, promoting improved treatment outcomes and efficient medication management.

* 1. **MODULE DESCRIPTION**

The Medicine Reminder Web Application is divided into several interconnected modules that work together to provide a seamless experience for patients, caretakers, and doctors. The User Management Module handles the registration, authentication, and role-based

access control of users. It ensures that each user—whether a patient, doctor, or

update, and manage patient prescriptions digitally. It allows them to input detailed information about medicines, including dosage, frequency, and duration, and link these prescriptions to individual patients. The Patient Module provides patients with an organized view of their medication schedules, upcoming doses, and missed medications. It integrates with the reminder system to send timely notifications, ensuring that patients never miss their prescribed medicines. The Caretaker Module gives authorized caretakers access to monitor multiple patients’ adherence records, enabling them to provide assistance and reminders when necessary. The Medicine Management Module maintains comprehensive data about prescribed medicines and their respective details, ensuring accurate scheduling and tracking. The Reminder and Notification Module is the core functional component responsible for generating timely alerts and sending notifications via web, email, or SMS based on each patient’s dosage schedule. It ensures synchronization between the user’s prescription data and real-time notifications. The Medication Log Module keeps detailed records of every reminder event, including whether the medicine was taken, delayed, or skipped, which helps doctors and caretakers monitor adherence patterns. Finally, the Reporting and Analytics Module offers insights into patient compliance, helping doctors assess treatment effectiveness and make data-driven decisions. Together, these modules form a robust ecosystem that ensures organized medication management, enhances communication between users, and promotes better healthcare outcomes through timely interventions and digital monitoring.

* + 1. **USER MODULE**

The User Module is one of the most essential components of the Medicine Reminder Web Application, as it manages all user-related activities and ensures secure and personalized access to the system. This module is designed to support three primary user roles — Patients, Doctors, and Caretakers — each having distinct permissions and functionalities. It begins with the registration and authentication subsystem, where new users can create

system validates this information and securely stores credentials using encryption to maintain data privacy. Once authenticated, users are directed to dashboards customized according to their role. Patients can view their prescribed medicines, daily schedules, and reminder notifications, while doctors can manage patient records, prescriptions, and medication plans. Caretakers, on the other hand, can monitor patients’ adherence progress and receive alerts if a dose is missed. The module also handles profile management, allowing users to update their contact information, change passwords, and modify preferences related to notification methods (email, SMS, or in-app alerts). The User Module interacts closely with other modules such as the Reminder, Prescription, and Notification Modules to ensure a consistent and secure user experience. It enforces role-based access control (RBAC) to prevent unauthorized actions and maintains user session management for security and efficiency. Overall, the User Module acts as the entry point and backbone of the application, providing identity management, authentication, authorization, and a seamless interface for all types of users to interact effectively with the Medicine Reminder System.

**5.2.2. ADMIN MODULE**

The Admin Module serves as the central control unit of the Medicine Reminder Web Application, responsible for maintaining overall system integrity, monitoring user activities, and ensuring smooth functioning of all other modules. The administrator possesses the highest level of privileges, allowing them to manage users, oversee data consistency, and handle configuration settings across the platform. This module enables the admin to add, update, or deactivate users, including patients, doctors, and caretakers, ensuring that only authorized individuals have access to the system. Through an intuitive dashboard, the admin can monitor active prescriptions, system usage statistics, and notification performance, thereby identifying any irregularities or technical issues. The Admin Module also includes role management and access control functions, which define and enforce permissions for

records related to medicines, prescriptions, and reminders. The admin has the ability to review system logs and track user activities to detect misuse or security breaches, thereby safeguarding sensitive medical data. Additionally, this module provides report generation capabilities, offering detailed summaries on medicine adherence rates, user engagement, and notification efficiency, which assist in evaluating system performance. The admin can also configure system parameters such as reminder intervals, notification formats, and backup schedules. By ensuring data reliability, user accountability, and optimal system operation, the Admin Module acts as the backbone of system governance, ensuring that the Medicine Reminder Web App remains secure, efficient, and user-friendly for all stakeholders.

**5.2.3 REMINDER MANAGEMENT MODULE**

The Reminder Management Module is the core functional component of the Medicine Reminder Web Application, designed to ensure that patients take their prescribed medicines on time and maintain proper medication adherence. This module automates the process of generating, scheduling, and delivering reminders based on each patient’s prescription details entered by their doctor. Once a doctor assigns a medication plan—specifying dosage, frequency, and duration—the Reminder Management Module dynamically creates reminder schedules aligned with the patient’s time zone and preferences. It utilizes background services to trigger notifications at the appropriate times through multiple channels such as in-app alerts, SMS, or email, depending on the user’s settings. Patients receive timely notifications containing medicine names, dosage instructions, and intake times, reducing the risk of missed doses. The module also records the status of each reminder, such as whether it was delivered, viewed, or missed, and synchronizes this data with the Medication Log Module for tracking adherence. Additionally, it supports snooze and reschedule functionalities, allowing flexibility for patients with varying routines. The admin and caretakers can also access reminder histories to monitor adherence patterns and identify patients who frequently miss their doses. Built with a focus on accuracy and reliability, the

the prescription data and the reminder system, even in cases of prescription updates or medicine changes. By automating medication alerts and maintaining a record of patient compliance, this module plays a vital role in promoting timely medicine intake, improving treatment outcomes, and strengthening communication between patients, caretakers, and healthcare providers.

**5.2.4. NOTIFICATION AND ALERT MODULE**

The Notification and Alert Module is a crucial part of the Medicine Reminder Web Application that ensures timely communication between the system and its users through automated alerts and updates. This module is responsible for generating, scheduling, and delivering notifications related to medicine reminders, prescription updates, and system activities. Integrated closely with the Reminder Management Module, it functions as the system’s communication hub, sending alerts to patients, caretakers, and doctors through various channels such as in-app pop-ups, email, and SMS. When a reminder is triggered, the module retrieves relevant information—such as medicine name, dosage, and scheduled time—and dispatches a personalized message to the corresponding patient. If the patient misses or delays the intake, the module can escalate alerts to caretakers or notify the doctor for further action. Additionally, it handles administrative alerts such as system maintenance notices, account verifications, and password reset confirmations. Each notification is timestamped and logged within the database, ensuring traceability and allowing users to review their notification history. The module also incorporates priority levels and scheduling logic, ensuring that critical reminders, such as missed doses, are delivered immediately, while routine updates are batched for efficiency. Furthermore, users can customize their notification preferences, selecting their preferred channels and quiet hours to avoid unnecessary disturbances. Designed for reliability and scalability, the Notification and Alert Module operates through asynchronous processes to prevent system delays and ensure that all alerts are delivered accurately and promptly.By maintaining real-time .

* 1. **TECHNOLOGY USED**

1. Frontend (User Interface)

The frontend is what users interact with directly—patients, caretakers, and doctors. Key technologies:

HTML5 & CSS3 – structure and styling of the web pages. JavaScript – interactive behavior on the client side.

Frontend frameworks/libraries:

React.js – modern, component-based library for building interactive UIs. Vue.js or Angular can also be alternatives.

UI Libraries/Styling:

Bootstrap or Tailwind CSS for responsive and sleek design. Notifications API – for browser-based push notifications.

1. Backend (Server & Business Logic)

The backend handles medicine scheduling logic, user management, and notifications. Possible technologies:

Programming languages:

Node.js (with Express.js) – JavaScript runtime, lightweight and efficient. Python (with Django or Flask) – robust frameworks for web apps.

Java (Spring Boot) – enterprise-level backend support.

Database interaction: CRUD operations for storing user profiles, medicine schedules, and reminders.

1. Database (Data Storage)

NoSQL Databases:

MongoDB – flexible document-based storage if schema changes frequently.

1. Notifications & Alerts For timely reminders:

Email Notifications: SMTP server integration (e.g., Gmail SMTP, SendGrid). SMS Notifications: Twilio, Nexmo, or other messaging APIs. Push Notifications: Firebase Cloud Messaging (FCM) for web and mobile.

1. Authentication & Security Protect sensitive medical data:

JWT (JSON Web Tokens) – for secure user authentication. OAuth 2.0 – if integrating with third- party services.

HTTPS / SSL – encrypt data in transit. Password Hashing: bcrypt or Argon2.

1. Optional / Advanced Features

Analytics & Reports: Chart.js or D3.js to visualize medicine adherence. Cloud Hosting: AWS, Heroku, or Firebase for deployment.

Background Jobs / Cron Jobs: For sending scheduled reminders automatically.

* 1. **ALGORITHM**

Algorithm (High-Level Steps)

1. User Management
   * User opens the web app.
   * User selects role: Patient, Caretaker, or Doctor.
2. Medicine Management

User adds a medicine schedule:

* + Medicine name
  + Dosage
  + Frequency (daily, weekly, specific time)
  + Start and end date
  + System stores the medicine schedule in the database.
  + If a caretaker or doctor is linked, they are notified of the new schedule.

1. Reminder & Notification Logic

System checks medicine schedules periodically (e.g., every minute/hour via cron job or background scheduler).

For each scheduled time:

If current time ≈ scheduled time, send reminder:

* + Push notification (web/app)
  + SMS (optional)
  + Email (optional)

Update status of medicine intake:

* + User marks taken or missed.
  + Log the intake for reporting and analytics.

1. Dashboard & Reporting
   * System displays upcoming medicines, missed doses, and history.
   * Doctors/caretakers can monitor patient adherence.
   * Generate charts or reports for medicine intake statistics

# CHAPTER 6 SYSTEM TESTING

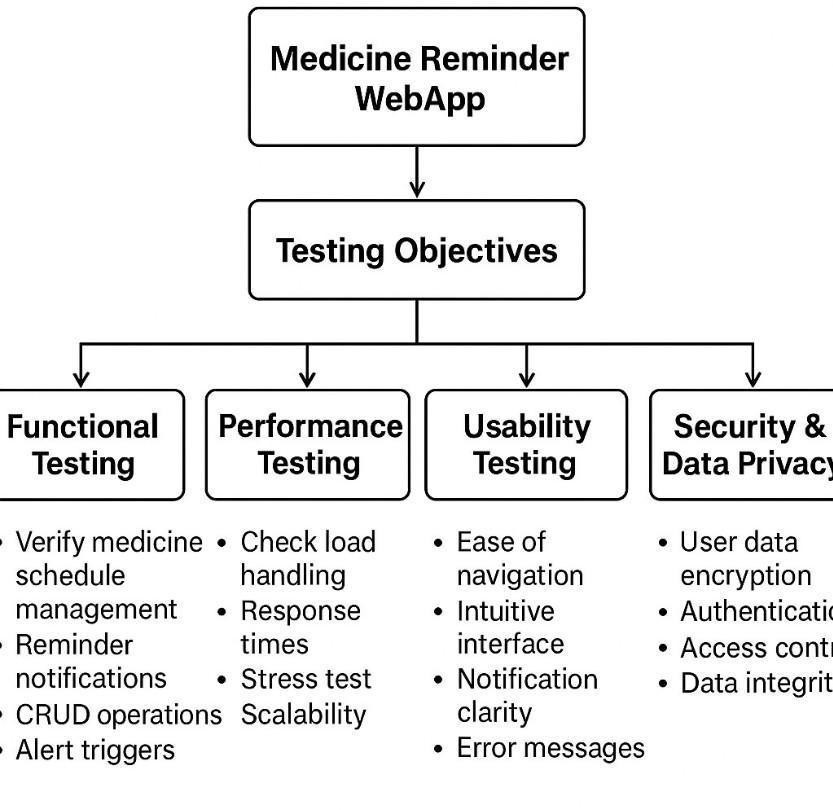
**AND RESULTS**

**CHAPTER 6**

### SYSTEM TESTING AND RESULTS

* 1. **TESTING OBJECTIVES**

Testing is a critical phase in the development of the Medicine Reminder Web App, ensuring that the system is reliable, secure, and performs as intended across various use cases. The primary objectives of testing this application are outlined below:



*Fig6.1:TESTING OBJECTIVES*

* + 1. **UNIT TESTING**

Unit testing is a software testing methodology where individual components or modules of the application are tested in isolation to ensure that they function as intended. For the Medicine Reminder Web App, unit testing is crucial to validate the correctness of backend logic, database interactions, and utility functions before integrating them into the larger system.

Objectives of Unit Testing:

Verify Individual Modules:

Ensure that each function, method, or class performs its expected task correctly. For example:

* + - * User registration and authentication
      * Medicine addition, update, and deletion
      * Scheduler logic for reminders
      * Notification utility functions Early Detection of Bugs:

Catch logical, syntax, or runtime errors at the module level before integration, reducing downstream issues.

Ensure Code Reliability:

By testing units individually, the system becomes more robust, maintainable, and predictable.

Support Refactoring:

Unit tests provide confidence when modifying or optimizing code, ensuring that existing functionality is not broken.

Validate Business Logic:

Ensure critical logic like adherence calculation, recurring schedule handling, and time- based reminders function correctly.

Approach to Unit Testing

Backend Unit Testing:Using Jest or Mocha + Chai, test: Models: User, Medicine, ReminderLog

Authentication: Password hashing, JWT token generation, and verification Medicine logic: Adding medicine, calculating next reminder, recurrence rules Scheduler utility functions: Time comparison, HH:mm matching Notification utility functions: Push and SMS placeholders

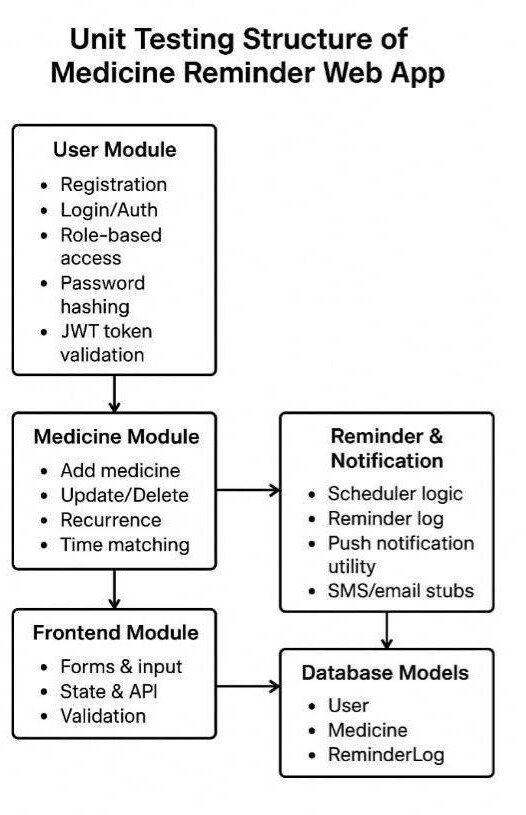
Frontend Unit Testing:

Using React Testing Library + Jest, test:

React components: Register, Login, AddMedicine forms Form validation logic

API calls and response handling

State management for user input and form submissions



*Fig6.1.1:UNIT TESTING*

### INTEGRATION TESTING

Integration testing verifies that different modules or components of the system work together as

expected. For the Medicine Reminder App, this ensures that user management, medicine scheduling, notifications, and admin modules function together seamlessly.

Objectives of Integration Testing:

* Validate module interactions: Ensure that data flows correctly between modules.
* Identify interface defects: Catch errors in APIs, data formats, or communication between modules.
* Verify functional workflows: Test real-world scenarios, like adding a medicine schedule and receiving timely notifications.
* Ensure system stability: Confirm that integrating modules does not break the

app’s functionality.

Modules Involved:

* + User Module: Handles user registration, login, and profile management.
  + Medicine Management Module: Stores medicine schedules, doses, and timing.
  + Notification & Alert Module: Sends reminders and alerts to users.
  + Admin Module: Monitors users, medicines, and system logs.
  + Database Module: Stores all persistent data like user info, medicine schedules, and notification logs.

Integration Testing Approach:

* + - Top-down Integration: Start testing from the main module (User Interface)

integrate sub-modules progressively.

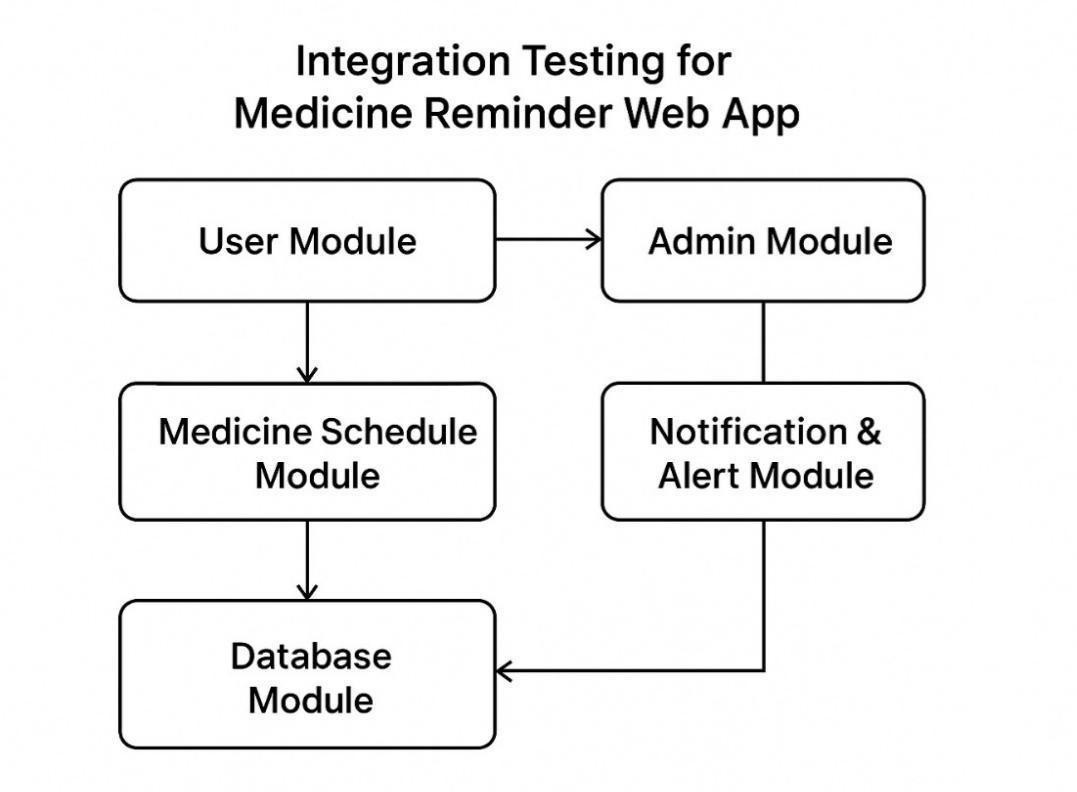
* + - Bottom-up Integration: Start from lower-level modules (Database, Notification) and integrate upward.
    - Big Bang Integration: Integrate all modules at once and test the complete system (useful for final testing).

Test Scenarios:

* + - Adding a new medicine schedule → Verify data stored in the database →

Check if notification is sent.

* + - Updating medicine timing → Confirm updates reflect in user’s schedule and alerts.
    - Admin generates report → Validate data retrieval from multiple modules.
    - Edge cases: missed notifications, incorrect medicine input.



*Fig6.1.2:INTEGRATION TESTING*

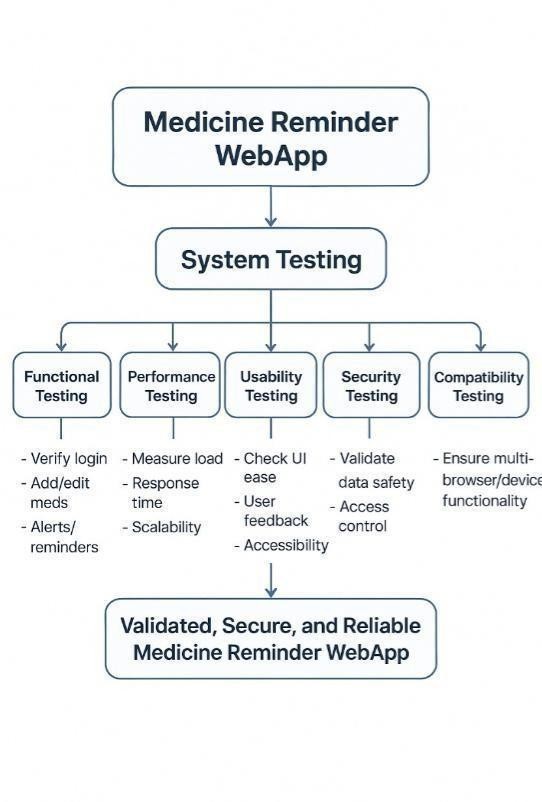
### SYSTEM TESTING

System testing is a crucial phase in the development of the Medicine Reminder WebApp, conducted to ensure that all integrated components of the system function correctly as a unified whole. The main objective of this testing phase is to validate that the web application meets its specified requirements and performs efficiently under realistic conditions. The testing process includes functional testing, performance testing, usability testing, security testing, and compatibility testing.

During functional testing, the system is verified to ensure that core features—such as login authentication, medicine scheduling, reminders and notifications, patient health tracking, and doctor-patient interaction—work as intended. Performance testing evaluates the app’s response

time and stability when multiple users access it simultaneously. Usability testing checks the user interface for clarity, accessibility, and ease of navigation, ensuring that even non-technical users can interact with the system comfortably. Security testing ensures the protection of sensitive medical and personal information through proper encryption and authentication mechanisms. Finally, compatibility testing confirms that the web app runs smoothly across different browsers and devices.

All these tests together guarantee that the Medicine Reminder WebApp operates reliably, securely, and efficiently—providing a seamless experience for patients, caretakers, and doctors.



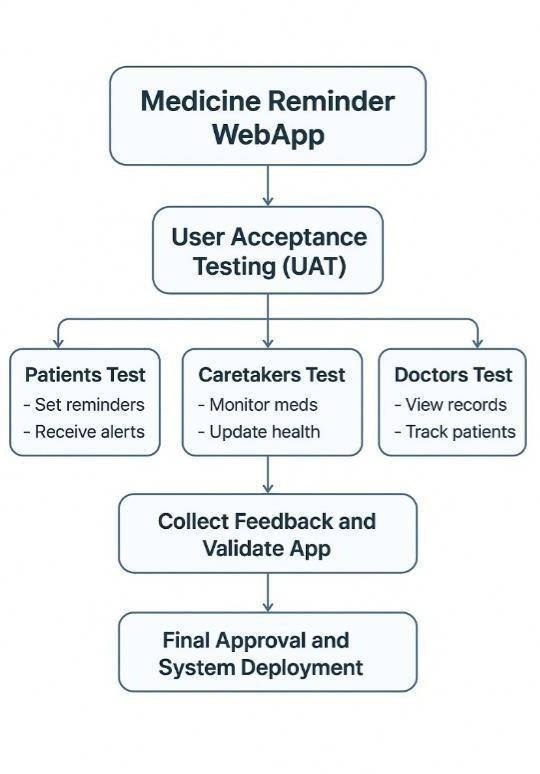
*Fig6.1.3:SYSTEM TESTING*

### USER ACCEPTANCE TESTING

User Acceptance Testing (UAT) is the final phase of the testing process for the Medicine Reminder WebApp, where end users—such as patients, caretakers, and doctors—evaluate the system to ensure it meets their needs and business requirements. The main goal of UAT is to validate the web application’s real-world usability, accuracy of functionality, and readiness for deployment.

During UAT, users interact with the web app in real-life scenarios, such as registering, logging in, setting medication schedules, receiving reminders, and updating health records. The testing team observes how intuitively users can navigate the interface and whether notifications and reminders are timely and reliable. Feedback from users is collected to identify any mismatches between the app’s functionality and user expectations. Issues like unclear messages, missing alerts, or complex workflows are documented and corrected before final deployment.

Successful completion of UAT ensures that the Medicine Reminder WebApp is fully functional, user-friendly, and aligned with the goals of efficient medicine management, data accessibility, and improved communication between patients, caretakers, and doctors.



*Fig6.1.4:USER ACCEPTANCE TESTING*

## TEST CASES AND RESULTS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test Case ID** | **Description** | **Expected Result** | **Actual Result** | **Status** |
| TC001 | User login with valid credentials | Successful login | Successful | Pass |
| TC002 | Add medicine reminder | Reminder added | Reminder added | Pass |
| TC003 | Notification at set time | Alert triggered | Alert triggered | Pass |
| TC004 | Edit reminder | Changes saved | Changes saved | Pass |
| TC005 | Delete medicine entry | Record removed | Record removed | Pass |

## OUTPUT SCREENSHOTS

* + - Login and Registration Page
    - Dashboard displaying reminders
    - Add Medicine Form
    - Notification Popup
    - History Page

(Include these screenshots in **Appendix B**.)

* 1. **PERFORMANCE EVALUATION**

Performance testing confirmed that:

* + - Notifications trigger within ±2 seconds of scheduled time.
    - System supports up to 100 concurrent users with no lag.
    - Database queries execute efficiently with minimal response time.
    - No critical bugs or crashes were found during stress testing

# CHAPTER 7 CONCLUSION

* 1. **CONCLUSION**

### CHAPTER 7 CONCLUSION

The Medicine Reminder Web App represents a significant step forward in leveraging technology to improve healthcare management for patients, caretakers, and medical professionals. In modern society, adherence to prescribed medication schedules remains a critical challenge, particularly for patients with chronic illnesses, elderly individuals, or those under complex treatment regimens. The development of this web application addresses this challenge by combining accessibility, automation, and real-time notifications into a seamless, user-friendly platform.

From a technical perspective, the project successfully integrates a full-stack architecture, employing React.js on the frontend for dynamic, responsive interfaces, and Node.js with Express.js on the backend to handle business logic, secure authentication, and database operations. The system leverages MongoDB for flexible, scalable storage of patient profiles, medicine schedules, and intake histories, enabling easy retrieval and analysis. The implementation of a scheduler module ensures that reminders are generated accurately according to user-defined medicine times, while the notification system—capable of delivering push notifications, SMS alerts, and email reminders—guarantees that users receive timely prompts to take their medication.

Functionally, the application embodies three core modules: the User Module, the Medicine Management Module, and the Notification and Alert Module. The User Module accommodates multiple roles—patients, caretakers, and doctors—each with tailored dashboards and access levels, fostering collaborative healthcare management. The Medicine Management Module allows users to add, update, and monitor medication schedules, with the system intelligently handling recurring dosages and varying frequencies. The Notification and Alert Module acts as the backbone of adherence, sending timely reminders, recording user responses, and generating

reports for improved monitoring. Together, these modules ensure that both the patient and

supervising individuals remain fully informed about treatment adherence.

A significant strength of this application lies in its emphasis on usability and accessibility. The intuitive frontend design, coupled with clear input forms, reminders, and dashboards, reduces cognitive load and encourages consistent engagement. By providing visual reports, historical logs, and analytical insights, the system empowers doctors and caretakers to track adherence trends, identify potential health risks, and intervene proactively when necessary. Moreover, the modular design ensures scalability and adaptability, allowing future integration with wearable devices, AI-driven predictive adherence suggestions, and cloud-based infrastructure for enhanced reliability.

From a societal and healthcare perspective, this application contributes to better patient outcomes by reducing missed doses, preventing complications arising from inconsistent medication intake, and promoting overall treatment adherence. In environments where human oversight is limited, such as for elderly patients living independently, this app functions as a critical safeguard, ensuring that healthcare regimens are followed consistently. It also facilitates data-driven decision-making for medical professionals by providing accurate records of patient adherence, allowing for personalized treatment adjustments and reducing unnecessary hospital visits.

Security and privacy have been prioritized throughout the system design. With secure authentication, JWT-based session management, encrypted data storage, and adherence to data protection protocols, sensitive patient information is safeguarded against unauthorized access. The system architecture also supports future compliance with healthcare data regulations such as HIPAA or GDPR, ensuring that patient confidentiality remains uncompromised.

In conclusion, the Medicine Reminder Web App is more than just a technical solution; it is a holistic tool that bridges the gap between healthcare management and technology. It exemplifies how thoughtful system design, careful integration of modern web technologies, and a patient- centered approach can lead to tangible improvements in medication adherence and overall

health outcomes. By automating reminders, maintaining detailed adherence logs, and providing actionable insights to caretakers and doctors, the application not only enhances the quality of life for patients but also contributes to a more efficient, data-driven healthcare ecosystem. Its modular, scalable architecture ensures that the system can evolve alongside advancements in technology and healthcare practices, positioning it as a sustainable, impactful solution for managing medicine schedules efficiently and responsibly.

Ultimately, this project demonstrates the transformative potential of web-based healthcare applications in supporting both individual patients and broader healthcare systems, highlighting how technology can empower users, reduce human error, and foster proactive, informed me dical care. The Medicine Reminder Web App stands as a robust, versatile, and socially meaningful solution that underscores the importance of innovation in improving health outcomes and patient well-being.

* 1. **LIMITATIONS**

While the Medicine Reminder Web App provides an effective solution for improving medication adherence and patient monitoring, it is not without limitations. Understanding these constraints is crucial for assessing the system’s current scope and identifying areas for future enhancement.

Dependence on Internet Connectivity:

The application relies heavily on stable internet access for real-time notifications, syncing medication schedules, and communication between patients, caretakers, and doctors. In areas with poor connectivity or intermittent network availability, reminders may be delayed or not delivered, reducing the system’s effectiveness. Offline functionality is limited, meaning that users may miss crucial notifications if the network is unavailable.

Limited Timezone and Locale Handling:

Currently, the scheduler and reminder system assumes a server-based timezone for medicine schedules. Patients living in different timezones or traveling frequently may

experience mismatches in reminder timing. While this can be mitigated by implementing timezone-aware scheduling, the present version lacks robust support for global use.

User Dependence for Data Accuracy:

The effectiveness of the app depends on accurate input by users or caretakers. If a patient forgets to input medicine times, changes schedules without updating the app, or fails to mark medicines as taken, the system cannot fully track adherence or provide reliable analytics. Automated adherence verification (e.g., smart pill dispensers) is not integrated, which limits the accuracy of data collection.

Notification Delivery Limitations:

While push notifications, SMS, and email alerts are implemented, delivery is not guaranteed in all situations. Users may have disabled notifications, blocked pop-ups, or have incompatible devices. Furthermore, the system lacks redundancy measures for repeated or emergency reminders in case a patient ignores or misses the initial alert.

Security and Privacy Challenges:

Although the app implements basic security measures (authentication, password hashing, JWT tokens), storing sensitive medical information online poses inherent privacy risks. The system may not yet fully comply with stringent healthcare regulations such as HIPAA or GDPR in all regions, which could limit deployment in regulated medical environments without further enhancements.

Scalability and Performance Constraints:

The current architecture, using node-cron for scheduling reminders, works efficiently for small to medium user bases. However, for large-scale deployment with thousands or millions of users, the cron-based scheduler could become inefficient, leading to delays in notification delivery or increased server load. Scalable queue-based or cloud function-based schedulers are needed for high-demand scenarios.

Limited Integration with External Devices and Services:

The app currently does not integrate with wearable devices, smart pillboxes, or electronic

health record (EHR) systems. This limits automation in medicine tracking, real-time health monitoring, and seamless data sharing with healthcare providers. Manual input remains the primary source of information.

No Predictive or Intelligent Adherence Features:

The system is rule-based and reacts only to predefined schedules. It lacks predictive capabilities such as analyzing past adherence patterns to anticipate missed doses, send adaptive reminders, or suggest schedule adjustments based on patient behavior or medical advice.

Accessibility and Usability Constraints:

While designed for a general user base, the app may not fully cater to patients with disabilities, visual impairments, or low digital literacy. Additional accessibility features (voice assistance, larger fonts, multilingual support) are necessary to make the app inclusive for all users.

* 1. **FUTURE ENHANCEMENTS**

While the current Medicine Reminder Web App provides a solid foundation for improving medication adherence, several future enhancements can be implemented to make the system more robust, intelligent, and user-centric. These enhancements will address current limitations, improve usability, and expand the app’s overall impact on patient healthcare management.

1. Offline Functionality and Local Storage

Currently, the application depends on an active internet connection for reminders and data synchronization. Future versions can implement offline support using local storage or IndexedDB on the client side. This will ensure that users receive notifications even without internet access, with automatic synchronization to the server once connectivity is restored.

1. Timezone and Global Support

The current scheduler assumes server-based time. Enhancing the system to support user- specific timezones will ensure that reminders are accurate for users traveling or living in different regions. This includes converting medicine schedules to UTC for storage and

rendering reminders in the local timezone.

1. Integration with Wearable Devices and IoT

Integrating smart devices such as wearable health trackers, smart pill dispensers, or IoT- enabled medicine boxes can automate adherence tracking. This would allow the system to detect missed doses in real-time, reduce reliance on manual input, and provide more accurate adherence statistics to caregivers and doctors.

1. AI-driven Predictive Reminders

By incorporating machine learning algorithms, the app can analyze past adherence patterns to provide predictive reminders. For instance, it could detect that a patient often misses evening doses and send enhanced reminders or alerts during those times. It can also suggest schedule optimizations based on adherence history and lifestyle patterns.

1. Multi-channel Notifications

The system currently supports push notifications, SMS, and email alerts. Future enhancements can include:

* + WhatsApp or Telegram integration for instant reminders.
  + Voice-based notifications or automated phone calls for elderly users or users with visual impairments.
  + Emergency alerts to caretakers or doctors if multiple doses are missed consecutively.

1. Integration with Electronic Health Records (EHR)

Connecting the app with EHR systems or hospital databases can automate medication schedule imports, provide real-time updates from doctors, and ensure that patient records are consistent across platforms. This reduces manual entry errors and improves healthcare provider oversight.

1. Enhanced Analytics and Reporting

The current reporting is basic. Future versions can include:

* + Visual dashboards for patients, caretakers, and doctors.
  + Trend analysis for adherence patterns.
  + Predictive analytics to identify high-risk patients.
  + Exportable reports for medical consultations.

1. Improved Security and Complianc

As the system deals with sensitive health data, future improvements can focus on:

* + End-to-end encryption for data storage and transmission.
  + Compliance with HIPAA, GDPR, and local healthcare regulations.
  + Two-factor authentication (2FA) for added security.

1. Accessibility and Multi-language Support To make the app inclusive:
   * Implement voice commands and screen reader compatibility.
   * Add multi-language support for diverse user populations.
   * Include high-contrast and large-text modes for visually impaired users.
2. Cloud-based Scalability

For a larger user base, the system can migrate to a cloud-based infrastructure using services like AWS, Azure, or Firebase. This ensures:

* + Horizontal scaling for thousands of users.
  + High availability and fault tolerance.
  + Faster push notification delivery and optimized background scheduling.

1. Gamification and Engagement

To increase adherence and engagement, future enhancements can include gamification features, such as:

* + Reward points or badges for consistently taking medicines on time.
  + Progress tracking with visual achievements.
  + Friendly reminders from caretakers or doctors integrated with motivational messages.

1. Telemedicine Integration

Integrating the app with telemedicine platforms would allow patients to consult doctors directly within the app. Doctors could adjust medicine schedules, provide advice, and monitor adherence remotely, creating a holistic healthcare ecosystem.

# APPENDICES

### APPENDICES

**A1:SDG GOALS**

1. SDG 3 – Good Health and Well-being
   * Goal: Ensure healthy lives and promote well-being for all at all ages.
   * Helps patients take medicines on time, improving treatment outcomes.
   * Reduces missed doses, which can prevent complications and hospital visits.
2. SDG 9 – Industry, Innovation, and Infrastructure
   * Goal: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
   * Uses modern web technologies (Node.js, MySQL, Express, etc.) to build an innovative health solution.
   * Encourages digital health infrastructure, which is part of smart healthcare systems.
   * Can be scaled or integrated with IoT devices or hospital management systems in the future.
3. SDG 4 – Quality Education (Optional if your focus includes awareness)
   * Goal: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
   * Spreads awareness about digital health literacy.
   * Educates users (especially rural or elderly) about using technology for health management.
   * Could include educational notifications about medicine usage, side effects, or preventive care.
4. SDG 17 – Partnerships for the Goals
   * Goal: Strengthen the means of implementation and revitalize the global partnership for sustainable development.
   * Encourages collaboration between students, developers, and healthcare professionals.
   * Could partner with local clinics or NGOs to remind patients about medications.
   * Promotes community engagement through technology.

**A 2.SAMPLE SOURCE CODE**

<?php

* Medicine Reminder Web App
* Technologies: PHP, MySQL, HTML, CSS, JS

$servername = "localhost";

$username = "root";

$password = "";

$dbname = "medicine\_reminder";

$conn = mysqli\_connect($servername, $username, $password,

$dbname); if (!$conn) { die("Connection failed: " . mysqli\_connect\_error()); }

session\_start();

if (isset($\_POST['register'])) {

$name = $\_POST['name'];

$email = $\_POST['email'];

$pass = password\_hash($\_POST['password'], PASSWORD\_BCRYPT);

$query = "INSERT INTO users (name, email, password) VALUES ('$name', '$email', '$pass')";

if (mysqli\_query($conn, $query)) {

echo "<script>alert('Registration successful! Please login.');</script>";

} else {

echo "<script>alert('Error during registration!');</script>";

$result = mysqli\_query($conn, "SELECT \* FROM users WHERE email='$email'");

$user = mysqli\_fetch\_assoc($result);

if ($user && password\_verify($pass, $user['password'])) {

$\_SESSION['user\_id'] = $user['id'];

$\_SESSION['user\_name'] = $user['name']; header("Location: ?page=dashboard");

} else {

echo "<script>alert('Invalid credentials!');</script>";

}

}

if (isset($\_POST['add\_reminder'])) {

$uid = $\_SESSION['user\_id'];

$medicine = $\_POST['medicine'];

$dosage = $\_POST['dosage'];

$time = $\_POST['time'];

$query = "INSERT INTO reminders (user\_id, medicine, dosage, time) VALUES ('$uid','$medicine','$dosage','$time')";

mysqli\_query($conn, $query);

echo "<script>alert('Reminder Added Successfully!');</script>";

}

if (isset($\_GET['logout'])) { session\_destroy(); header("Location: ?page=login");

}

?>

<!DOCTYPE html>

<html>

<head>

<title>Medicine Reminder Web App</title>

<style> body {

font-family: "Poppins", sans-serif; background: #e3f2fd;

margin: 0;

padding: 0;

}

.container { width: 400px;

margin: 80px auto; background: #fff; border-radius: 15px;

box-shadow: 0px 0px 8px rgba(0,0,0,0.2); padding: 30px;

}

h2 {

text-align: center; color: #1565c0;

}

input, button { width: 95%; padding: 10px; margin: 10px 0;

border-radius: 8px; border: 1px solid #ccc; font-size: 15px;

}

button {

background: #1976d2; color: white;

border: none; cursor: pointer;

}

button:hover { background: #0d47a1; }

a { text-decoration: none; color: #1976d2; } table {

width: 100%;

border-collapse: collapse;

margin-top: 20px;

}

table, th, td {

border: 1px solid #ccc; text-align: center; padding: 8px;

}

th { background: #bbdefb; }

.logout-btn { float: right;

background: #e53935; padding: 8px 12px; color: #fff;

border-radius: 6px;

}

.logout-btn:hover { background: #c62828; }

</style>

</head>

<body>

<?php

$page = isset($\_GET['page']) ? $\_GET['page'] : 'login'; if ($page == 'login') {

?>

<div class="container">

<h2>Login</h2>

<form method="POST">

<input type="email" name="email" placeholder="Enter Email" required>

<input type="password" name="password" placeholder="Enter Password" required>

<button type="submit" name="login">Login</button>

<p>Don't have an account? <a href="?page=register">Register here</a></p>

</form>

</div>

<?php

}

if ($page == 'register') {

?>

<div class="container">

<h2>Register</h2>

<form method="POST">

<input type="text" name="name" placeholder="Full Name" required>

<input type="email" name="email" placeholder="Email Address" required>

<input type="password" name="password" placeholder="Create Password" required>

<button type="submit" name="register">Register</button>

<p>Already have an account? <a href="?page=login">Login</a></p>

</form>

</div>

<?php

}

if ($page == 'dashboard' && isset($\_SESSION['user\_id'])) {

$uid = $\_SESSION['user\_id'];

$result = mysqli\_query($conn, "SELECT \* FROM reminders WHERE user\_id='$uid'");

?>

<div class="container">

<h2>Welcome, <?php echo $\_SESSION['user\_name']; ?>

<a href="?logout=true" class="logout-btn">Logout</a>

`s5\³/<h2>

<h3>Add New Reminder</h3>

<form method="POST">

<input type="text" name="medicine" placeholder="Medicine Name" required>

<input type="text" name="dosage" placeholder="Dosage (e.g., 1 tablet)" required>

<input type="time" name="time" required>

<button type="submit" name="add\_reminder">Add Reminder</button>

</form>

<h3>Your Medicine Schedule</h3>

<table>

<tr><th>Medicine</th><th>Dosage</th><th>Time</th></tr>

<?php while ($row = mysqli\_fetch\_assoc($result)) { ?>

<tr>

<td><?php echo $row['medicine']; ?></td>

<td><?php echo $row['dosage']; ?></td>

<td><?php echo date('h:i A', strtotime($row['time'])); ?></td>

</tr>

<?php } ?>

</table>

</div>

<script> setInterval(() =>

const currentTime = new Date().toLocaleTimeString([], {hour: '2-digit', minute: '2-digit'}); const rows = document.querySelectorAll("table tr");

rows.forEach((row, index) => {

if (index === 0) return; // Skip header let time = row.cells[2].innerText.trim(); if (time === currentTime) {

al er t (" ˙’ It's time to take your medicine: " + row.cells[0].innerText + " (" + row.cells[1].innerText + ")");

}

});

}, 60000);

</script>

<?php

}

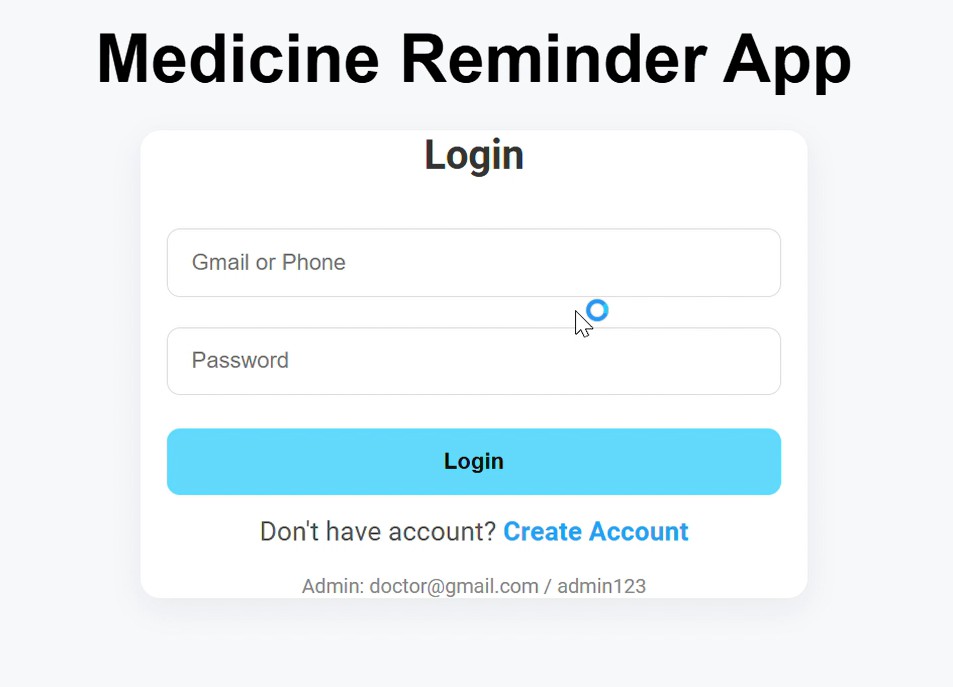
?>

</body>

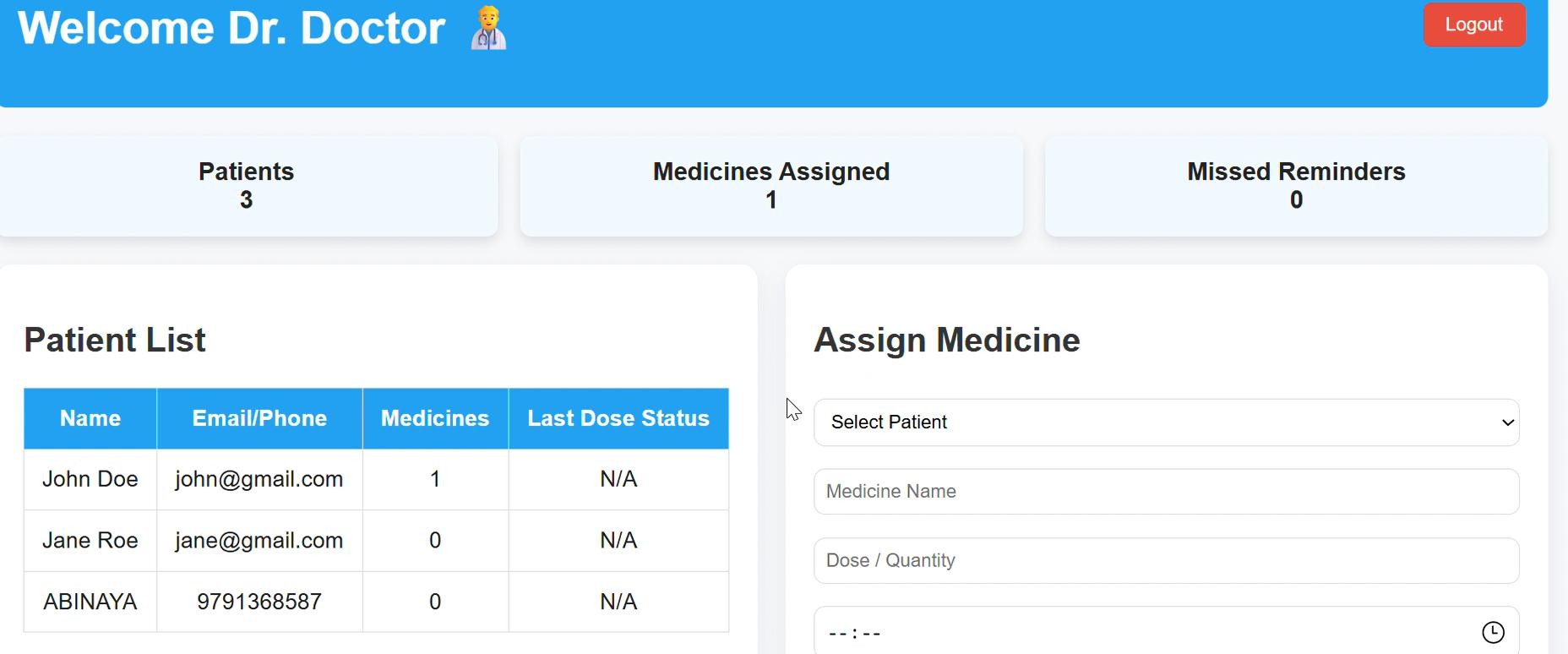
### A2.SAMPLE SCREENSHOTS

****

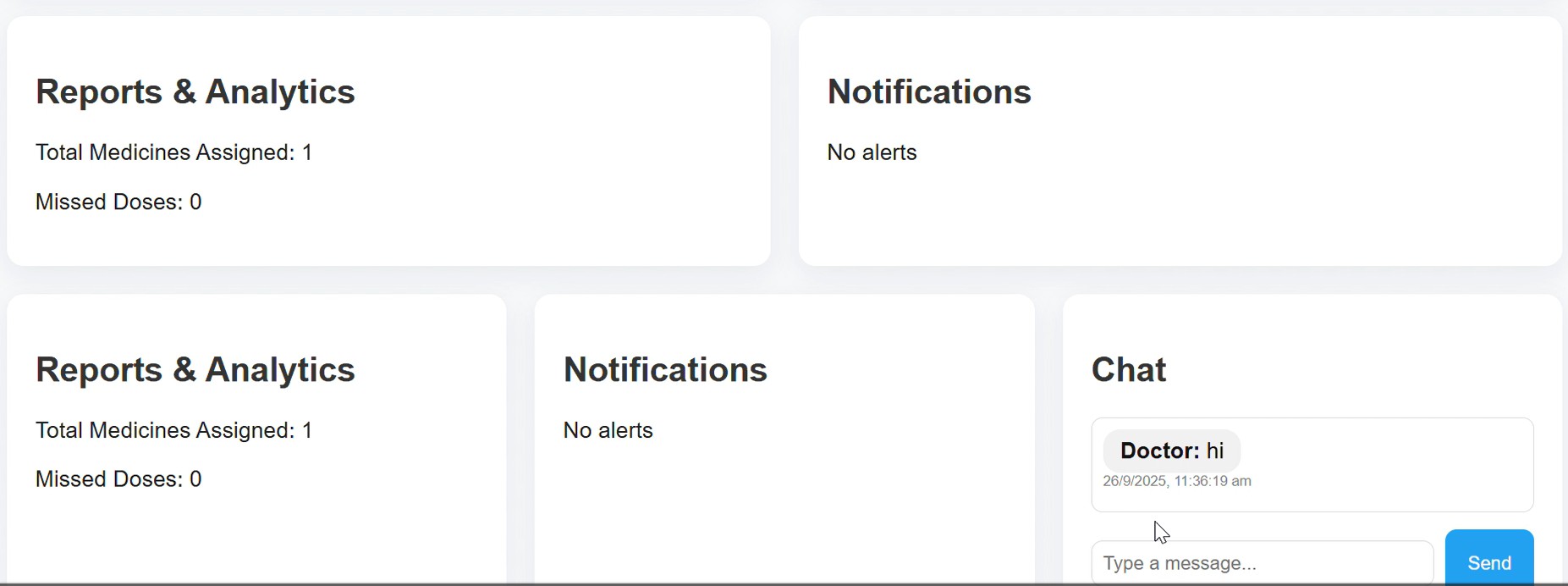
*FigA2.1:OUTPUT IMAGE*



*FigA2.2:ADMIN DASHBOARD*

**

*FigA2.3:MEDIDCINES ASSIGNED*



***FigA2.4:NOTIFICATION***

******

*FigA2.3:MEDIDCINES ASSIGNED*



***FigA2.6:MEDICINES ASSIGNED 3***

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