S.VEERASAMY CHETTIAR COLLEGE OF ENGINEERING AND TECHNOLOGY

(9526)

Department of Computer Science and Engineering

<u>TITLE</u>

Medical Inventory Management

Team ID: NM2025TMID01146

Team Size: 4

Team Leader: Akalya M

Team member: Gayathri Selvi P

Team member: Mercy Beulah R

Team member: Bhuvana M

Submitted by,

M. Akalya

Reg no :952622104002

NM Id: aut22svccse02

Medical Inventory Management

Introduction

The **Medical Inventory Management System** is a software solution designed to efficiently manage and monitor medical supplies, equipment, and pharmaceuticals within healthcare facilities such as hospitals, clinics, and pharmacies. Managing medical inventory manually can lead to challenges such as stockouts, overstocking, expired medicines, and inaccurate record-keeping. This project aims to automate these processes, ensuring that healthcare providers always have the right materials available at the right time.By implementing this system, healthcare institutions can improve patient care, reduce operational costs, and maintain compliance with healthcare regulations through accurate and timely inventory tracking.

Purpose of the Project

The primary purpose of the **Medical Inventory Management Project** is to **streamline the management of medical resources** and ensure that supplies are efficiently tracked, stored, and replenished.
Specific objectives include:

- To automate the process of tracking inventory levels, usage, and expiry dates.

- To reduce waste caused by expired or unused medicines.

- To enable real-time access to stock information for faster decision-making.

- To ensure timely reordering and restocking based on demand and consumption trends.

- To enhance accountability and transparency in inventory handling.

Key Features

The Medical Inventory Management System includes several key features designed for efficiency, accuracy, and ease of use:

1. **Inventory Tracking:**
   Real-time monitoring of available medicines, equipment, and consumables.

2. **Automated Alerts:**
   Notifications for low stock levels, near-expiry items, and pending restocks.

3. **Barcode/QR Code Integration:**
   Fast scanning and updating of inventory data to reduce manual entry errors.

4. **User Management:**
   Role-based access control for administrators, pharmacists, and staff.

5. **Supplier & Purchase Management:**
   Record and manage suppliers, purchase orders, and delivery details.

1.Ideation Phase

The **Ideation Phase** is the initial stage of the project where the concept of the Medical Inventory Management System is conceived and developed.
During this phase, the team identifies the key problems faced by healthcare institutions in managing medical supplies, such as:

- Manual tracking leading to errors or data loss.
- Overstocking or shortage of essential medicines.
- Difficulty in monitoring expiry dates and supplier details.
- Lack of real-time information and delayed decision-making.

The goal in this phase is to **generate ideas and potential solutions** that can overcome these challenges. After brainstorming and research, the concept of an automated inventory management system for medical resources was selected. The system aims to simplify stock handling, improve accuracy, and ensure timely replenishment of supplies.

Outcome of Ideation Phase:

A clear project idea — to develop a **Medical Inventory Management System** that automates stock tracking, reduces wastage, and improves healthcare supply efficiency.

Mind Map Diagram

2. Project Planning Phase

In the **Project Planning Phase**, the objectives, scope, and roadmap of the project are defined. This phase involves setting timelines, identifying team roles, selecting development tools, and planning the project workflow

- **Defining project scope:** Managing medicines, medical equipment, suppliers, and stock levels.

- **Timeline creation:** Dividing the project into milestones (design, development, testing, deployment).

- **Resource allocation:** Assigning tasks among developers, designers, and testers.

- **Technology stack selection:** Choosing suitable technologies such as

    o Frontend: HTML, CSS, JavaScript (or React)

    o Backend: Python (Django/Flask), PHP, or Java

    o Database: MySQL or Firebase

- **Risk analysis:** Identifying potential risks like data breaches or inaccurate stock records, and planning preventive measures.

Outcome of Planning Phase:

A structured project plan detailing the schedule, technologies, and deliverables required for the successful completion of the Medical Inventory Management System.

Flow Diagram

Diagram Type: Timeline or Gantt Chart

Purpose: To represent project scheduling and planning tasks.

Structure:

Project Planning Timeline

Phase	Duration
Ideation	Week 1

Requirement Analysis   Week 2–3

System Design   Week 4–5

Development   Week 6–8

Testing   Week 9–10

Deployment & Maintenance Week 11–12

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3. Project Design Phase

The **Design Phase** focuses on translating the functional requirements into a clear system architecture and interface layout.In this phase, both **system design** (backend logic) and **user interface (UI/UX)** design are developed.

Key activities include:

- **System Architecture Design:**

  - Designing modules such as Inventory Management, Supplier Management, Expiry Tracking, and Reporting.

  - Establishing database schemas to handle data efficiently.

- **User Interface Design:**

  - Creating intuitive screens for adding, viewing, and updating medical stock.

  - Designing dashboards that display key metrics such as available stock, low-stock alerts, and expiry warnings.

- **Data Flow Diagrams (DFD) and ER Diagrams:**

  - Visualizing how data moves between system components.

Outcome of Design Phase:
A complete blueprint of the system, including architecture diagrams, database structure, and UI mockups that guide the development team.
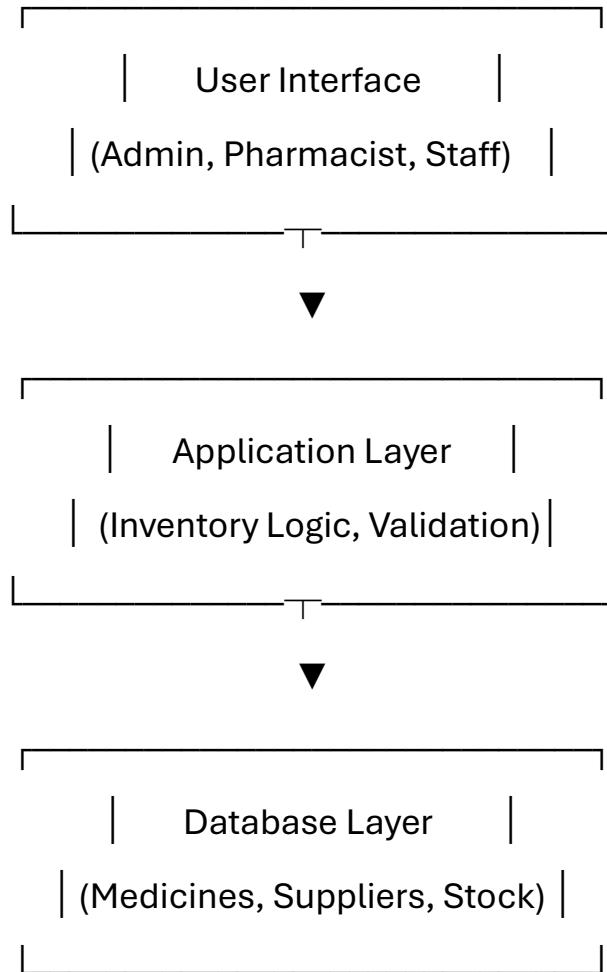
System Architecture Diagram

Diagram Type: Block Diagram (System Architecture)
Purpose: To show how different components of the system interact.

Structure:

```
┌─────────────────────────────┐
│      User Interface         │
│   (Admin, Pharmacist, Staff) │
└──────────────┬──────────────┘
               ▼
┌─────────────────────────────┐
│      Application Layer       │
│   (Inventory Logic, Validation) │
└──────────────┬──────────────┘
               ▼
┌─────────────────────────────┐
│      Database Layer          │
│   (Medicines, Suppliers, Stock) │
└─────────────────────────────┘
```

4. Requirement Analysis

The **Requirement Analysis Phase** involves gathering, studying, and documenting all the functional and non-functional requirements of the project.
This ensures that the final system meets user expectations and business needs.

Functional Requirements:

- The system should allow users to add, update, and delete inventory items.

- It should generate alerts for low stock and expiring medicines.

- It should maintain supplier details and purchase history.

- It should generate reports on stock usage and inventory value.

Non-Functional Requirements:

- The system should be secure and protect sensitive data.

- It should have a user-friendly interface.

- It should support scalability for larger data volumes.

- The system should ensure accuracy and reliability of records.

Outcome of Requirement Analysis:
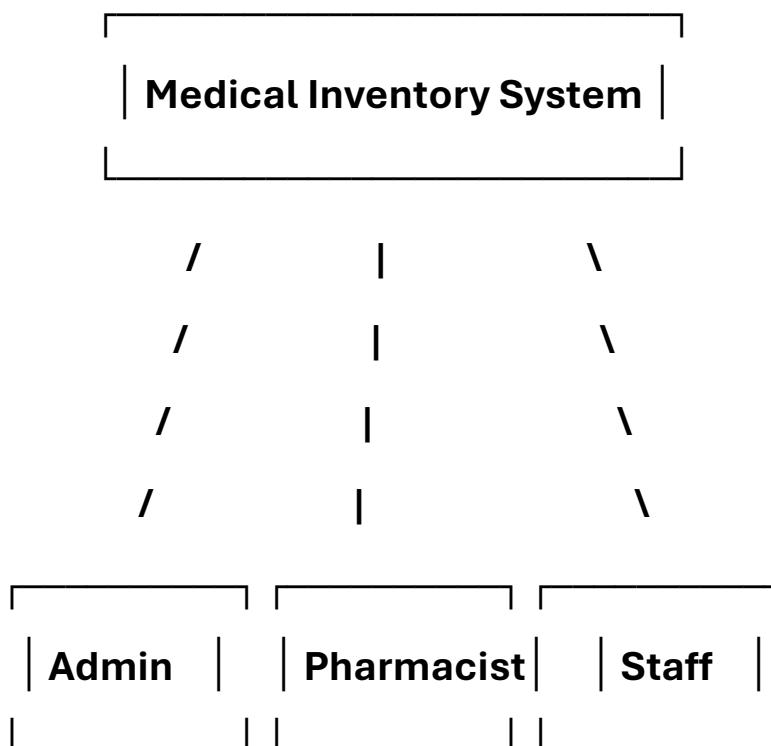
A clear and detailed **Software Requirements Specification (SRS)** document outlining system functionality, constraints, and performance expectations.

Use Case Diagram

Diagram Type: Use Case Diagram (UML)
Purpose: To show interactions between users and the system.

Structure:

```
            ┌─────────────────────────────┐
            │  Medical Inventory System   │
            └─────────────────────────────┘
                 /        |        \
                /         |         \
               /          |          \
              /           |           \
     ┌──────────┐  ┌──────────────┐  ┌──────────┐
     │  Admin   │  │  Pharmacist  │  │  Staff   │
     └──────────┘  └──────────────┘  └──────────┘
```

Use Cases:

- Add/Update/Delete Inventory

- Track Expiry Dates

- Generate Reports

- Manage Suppliers

- View Stock Levels

5.Performance Testing

The **Performance Testing Phase** ensures that the Medical Inventory Management System functions efficiently under expected workloads.
This phase evaluates the system's **speed, stability, and scalability** to ensure it can handle real-world scenarios.

Key testing aspects include:

- **Load Testing:** To check how the system performs when multiple users access it simultaneously.
- **Stress Testing:** To test system behavior under heavy data loads or unexpected conditions.
- **Response Time Measurement:** To ensure quick page loads and database operations.
- **Database Performance:** To verify that inventory searches, updates, and reports generate efficiently.
- **Scalability Testing:** To ensure the system can handle increased data volume as the hospital or pharmacy grows.

   Outcome of Performance Testing:
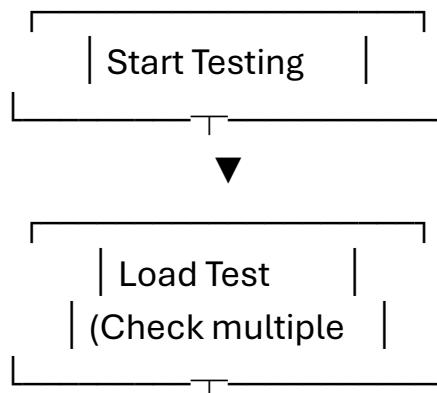
   A reliable and optimized system that can manage large medical inventories without lag or failure, ensuring seamless operations in real healthcare environments.
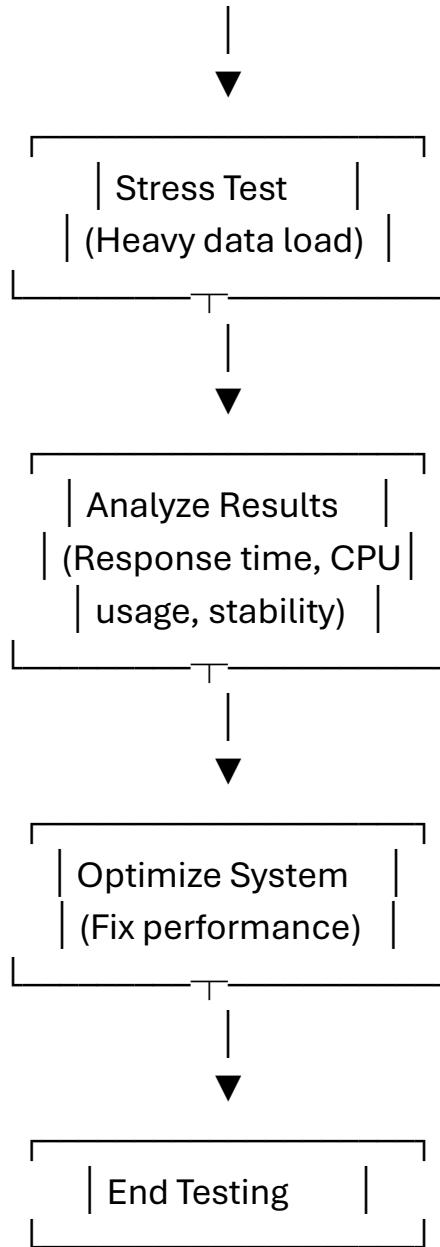
Flow Diagram

Diagram Type: Process Flow Diagram
Purpose: To represent the steps of performance testing.

Structure:

```
┌─────────────────────────┐
│   Start Testing     │
└────────────┬────────────┘
             ▼
┌─────────────────────────┐
│  Load Test          │
│  (Check multiple    │
└────────────┬────────────┘
```

```
          │
          ▼
┌─────────────────────┐
│ Stress Test         │
│ (Heavy data load)   │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│ Analyze Results     │
│ (Response time, CPU │
│  usage, stability)  │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│ Optimize System     │
│ (Fix performance)   │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│ End Testing         │
└─────────────────────┘
```

Conclusion

The Medical Inventory Management System is a vital tool for modern healthcare facilities, designed to streamline the management of medical supplies efficiently and accurately. By automating inventory tracking, monitoring stock levels, and generating timely alerts for low or expired items, the system minimizes manual errors, reduces wastage, and ensures the continuous availability of essential medicines and equipment.