

Project Title: Medical Inventory Management

Date: November 06, 2025

Team ID: NM2025TMID05285

Maximum Marks: 2 Marks

Phase 3: Project Design Phase - Proposed Solution

Proposed Solution Template

<u>S.No</u>	Parameter	Description
1	Problem Statement (Problem to be solved)	Healthcare facilities face unique challenges including managing critical medical supplies and pharmaceuticals with strict expiration controls, tracking inventory across multiple locations and departments, maintaining optimal stock levels to prevent shortages while minimizing waste, ensuring regulatory compliance and audit readiness, coordinating with multiple suppliers and managing procurement workflows, and lacking integrated systems that connect inventory management, procurement, and compliance operations.
2	Idea / Solution description	A comprehensive Medical Inventory Management system that integrates real-time inventory tracking, expiration date monitoring with automated alerts, automated reordering based on consumption patterns, supplier management with performance tracking, compliance and audit trail capabilities, and business analytics. The system includes barcode/QR code scanning, multi-location stock visibility, role-based security, and automated business rules that prevent data loss and ensure regulatory compliance.
3	Novelty / Uniqueness	The solution addresses healthcare-specific requirements that generic inventory systems cannot handle: tracking batch numbers and expiration dates with FEFO/FIFO rotation, managing temperature-sensitive medications and vaccines, handling controlled substance inventory with DEA compliance, supporting automated reorder point calculations based on consumption patterns, maintaining complete audit trails for regulatory inspections, and integrating expiration waste analytics. Built with healthcare compliance standards (FDA, state regulations, HIPAA) at its core.
4	Social Impact / Customer Satisfaction	The solution enhances patient safety by ensuring medication and supply availability while preventing expired product usage. It reduces medical waste through proactive expiration management, improving environmental sustainability. For healthcare administrators, it reduces inventory carrying costs, prevents emergency procurement, and ensures compliance readiness. Staff benefit from streamlined workflows, reduced stockouts, and automated documentation that saves time for patient care.
5	Business Model (Revenue Model) / Sustainability	The platform serves healthcare facilities from small clinics to large hospital systems. Revenue model includes: subscription-based licensing (tiered by facility size and number of locations), implementation and customization services, training programs for staff, ongoing support and maintenance contracts, and integration services for EHR and procurement systems. The system reduces operational costs through automation, waste reduction, and improved procurement efficiency while improving compliance.

S.No	Parameter	Description
6	Scalability of the Solution	The solution scales from single-location clinics to multi-facility hospital networks with centralized inventory oversight. It can expand to include: integration with electronic health record (EHR) systems for automated consumption tracking, supplier portal integration for direct ordering, temperature monitoring system integration, mobile applications for bedside inventory management, predictive analytics for demand forecasting, and pharmacy automation system integration.

Solution Description

System Architecture

The Medical Inventory Management platform connects key healthcare inventory operations:

- 1. Inventory Tracking & Management:** Comprehensive tracking of medical supplies including SKU, description, category (medication, surgical supplies, equipment), batch/lot number, expiration date, storage requirements (temperature, humidity), supplier information, acquisition cost, current stock levels, location (department, room, cabinet), and status (available, reserved, quarantined, expired).
- 2. Expiration Date Monitoring:** Automated tracking with configurable alert thresholds (90 days, 60 days, 30 days before expiration), FEFO/FIFO rotation schedules, expiration waste analytics by category and department, and automated notifications to responsible staff.
- 3. Automated Reordering & Procurement:** Minimum stock level configuration with lead time consideration, automated purchase requisition generation, consumption pattern analysis, seasonal demand forecasting, supplier selection based on performance metrics, and purchase order tracking from creation to receipt.
- 4. Supplier Management:** Vendor profiles with contact information and certifications, order history and delivery performance tracking, quality metrics and issue documentation, contract management with pricing tiers, and automated performance reporting.
- 5. Compliance & Audit Trails:** Complete transaction history (receipts, dispensing, transfers, adjustments), batch traceability from receipt to usage, regulatory reporting capabilities (FDA, DEA, state health departments), automated documentation generation for inspections, and controlled substance tracking with access logs.

Key Features & Workflow

Barcode/QR Code Scanning: Mobile scanning for rapid receipt processing, inventory counts, dispensing transactions, and location transfers. Integration with existing barcode systems or generation of custom codes.

Multi-Location Inventory Visibility: Real-time stock levels across all departments and storage locations, inter-department transfer workflows, centralized visibility with location-specific access controls, and automated stock balancing recommendations.

Expiration Management Workflow: Automated alerts sent to department managers → FEFO rotation recommendations → usage priority flags in dispensing interface → expired item quarantine process → disposal documentation for compliance.

Automated Reordering Process: Consumption monitoring → minimum stock threshold detection → automated requisition generation → approval workflow (department head → procurement) → supplier order placement → receipt processing → stock level update.

Mobile Access: Staff can check stock availability, record dispensing transactions, perform inventory counts, receive expiration alerts, and process receipts from mobile devices during patient care or storage area inspections.

Business Intelligence: Dashboards showing inventory valuation by department/category, expiration waste metrics and cost analysis, consumption trends and forecasting, supplier performance comparisons, stockout frequency and emergency order tracking, and compliance audit readiness scores.

Security & Compliance: Role-based access control (clinical staff, department managers, procurement, administrators), audit trails for all transactions (especially controlled substances), data encryption for sensitive information, and automated compliance reporting for regulatory requirements.

Implementation Approach

- Phase 1:** Configure database with custom tables for inventory items, suppliers, purchase orders, transactions, and batch tracking with expiration data.
- Phase 2:** Build barcode/QR code scanning module with mobile interface for receiving, dispensing, and inventory counting operations.
- Phase 3:** Implement automated workflows for expiration alerts, reorder point monitoring, purchase requisition generation, and approval processes.
- Phase 4:** Create compliance and audit trail system with batch traceability, transaction logging, and regulatory reporting capabilities.
- Phase 5:** Develop dashboards and analytics using business intelligence tools for inventory management, waste reduction, and supplier performance.
- Phase 6:** Pilot with one department or unit, gather feedback from clinical and administrative staff, refine processes, then roll out to additional departments and locations.

Benefits by Stakeholder

Stakeholder	Benefit
Clinical Staff	Reliable supply availability, reduced time searching for items, automated documentation, mobile access during patient care
Department Managers	Real-time inventory visibility, expiration alerts and waste reduction, automated reordering, reduced stockouts

Stakeholder	Benefit
Procurement Staff	Streamlined ordering processes, supplier performance tracking, automated requisition handling, improved contract management
Hospital Administrators	Reduced inventory carrying costs, compliance readiness, data-driven decision making, improved cash flow management
Patients	Improved care continuity through supply availability, enhanced safety through expiration controls, reduced costs from operational efficiency

Conclusion

The proposed Medical Inventory Management solution addresses the critical operational challenges of healthcare facilities through specialized inventory tracking, expiration monitoring, automated procurement, and compliance capabilities. By providing real-time visibility, automated workflows, and comprehensive audit trails, the platform ensures supply availability for patient care while reducing waste, controlling costs, and maintaining regulatory compliance. The scalable architecture supports facilities from small clinics to large hospital systems, delivering measurable improvements in operational efficiency, patient safety, and financial performance.