

Pharmatrack: Medicine Expiry Tracking And Alert System

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Abstract: *Medicine inventory management requires accurate recording of medicine information, stock quantities, batch details, and expiry dates. Manual monitoring can make it difficult to identify medicines that are approaching expiry and can contribute to avoidable inventory waste. This literature survey reviews existing work on pharmaceutical inventory management and automated medical-store management and uses the findings to motivate the proposed PharmaTrack system. PharmaTrack is designed as a user-oriented system for households and medical shops that stores medicine records, calculates remaining shelf life, classifies expiry status, and generates timely alerts. The proposed methodology includes data collection, validation, database management, automated date processing, alert generation, dashboard presentation, and system testing. The system is intended to provide a simple interface while allowing future extensions such as barcode/OCR-based data entry and advanced inventory analytics.*

Keywords: medicine expiry tracking; pharmaceutical inventory; expiry alerts; medicine database; dashboard; medical-store management; household medicine management.

I. INTRODUCTION

Medicines are time-sensitive products that must be managed carefully during storage and distribution. A pharmacy or household may contain medicines belonging to different batches, with different quantities and expiry dates. When these records are maintained manually, users may have difficulty identifying which items are approaching expiry or have already expired.

Automated inventory systems can reduce this burden by storing medicine information centrally and applying date-based rules. Research in pharmaceutical inventory management has considered both operational inventory policies and computerized medical-store processes. Studies have shown that expiry information is an important component of pharmaceutical inventory decisions, while automated systems can make expiry monitoring and stock reporting more systematic [1], [2]. These findings provide the basis for a practical application focused on direct expiry awareness.

The proposed PharmaTrack system is intended to bridge the gap between complex inventory-management approaches and a simple user-facing expiry tracker. The system will support medicine entry, expiry-date monitoring, status classification, notifications, searching, and dashboard reporting. The same core system can be configured for a household inventory or a medical-store inventory.

II. LITERATURE SURVEY

Existing literature indicates that pharmaceutical inventory problems are closely related to product perishability, uncertain demand, stock availability, and the need to avoid unnecessary expiry. Intelligent inventory-management research has examined perishable pharmaceutical products and developed reinforcement-learning approaches, including



Q-learning and Deep Q-Networks, to determine inventory policies. The reported objective is to achieve suitable service levels while reducing shortage and expiry risks [1].

Other work has focused on practical automation of medical-store management. A computerized inventory-management approach was used to improve stock control, expiry-date monitoring, demand generation, and documentation. The system was designed to be simple and user-friendly, demonstrating the value of automating routine inventory activities rather than depending entirely on manual records [2].

Together, these studies show two complementary directions. The first emphasizes optimization and intelligent decision-making for pharmaceutical supply chains, while the second emphasizes practical computerized inventory control. PharmaTrack adopts the practical monitoring perspective and proposes a focused expiry-alert mechanism that can be used outside large supply-chain environments.

III. RESEARCH GAP

The reviewed studies provide important foundations, but there remains scope for a lightweight application centered specifically on medicine expiry awareness for both medical shops and household users. Advanced inventory models can require substantial data and computational infrastructure, whereas a household or small-shop user may primarily need reliable record keeping and a clear warning when expiry is approaching.

The proposed research therefore focuses on four connected requirements: (1) storing medicine and batch information, (2) automatically calculating expiry status, (3) communicating the status through clear alerts, and (4) presenting the information through an understandable dashboard. A configurable warning period, such as four days before expiry, is proposed for the prototype.

IV. OBJECTIVES OF THE PROPOSED SYSTEM

The major objectives of PharmaTrack are:

To maintain digital records of medicines, batches, quantities, and expiry dates. To automatically calculate the remaining time before medicine expiry.

To identify medicines that are approaching expiry and medicines whose expiry dates have passed. To provide clear status indicators and in-application notifications.

To support medicine searching and filtering for faster inventory review.

To provide a foundation for medical-store stock monitoring and household medicine management.

To create a modular system that can later incorporate barcode/OCR-based data entry and advanced inventory analytics.

V. PROPOSED METHODOLOGY

The proposed methodology for PharmaTrack – Medicine Expiry Tracking and Alert System follows a structured and systematic process for recording medicine information, monitoring expiry dates, classifying medicine status, and generating timely alerts. The system is designed as a web-based application consisting of a presentation layer, application-processing layer, database layer, expiry-analysis engine, notification module, dashboard, and external services.

The main purpose of the proposed methodology is to reduce the risk of using expired medicines, improve medicine inventory management, and provide users with timely information about medicines that are safe, approaching expiry, or already expired.

5.1 System Architecture

The PharmaTrack system follows a layered architecture in which each component performs a specific function. The architecture shown in Figure 1 consists of Users, Front End, Backend/Application Server, Database Layer, Expiry Analysis Engine, Alert and Notification Module, Dashboard and Visualization, and External Services.

The overall workflow of the system can be represented as:



User → Medicine Entry → Validation → Database → Expiry Calculation → Status Classification → Alert Generation → Dashboard/Notification

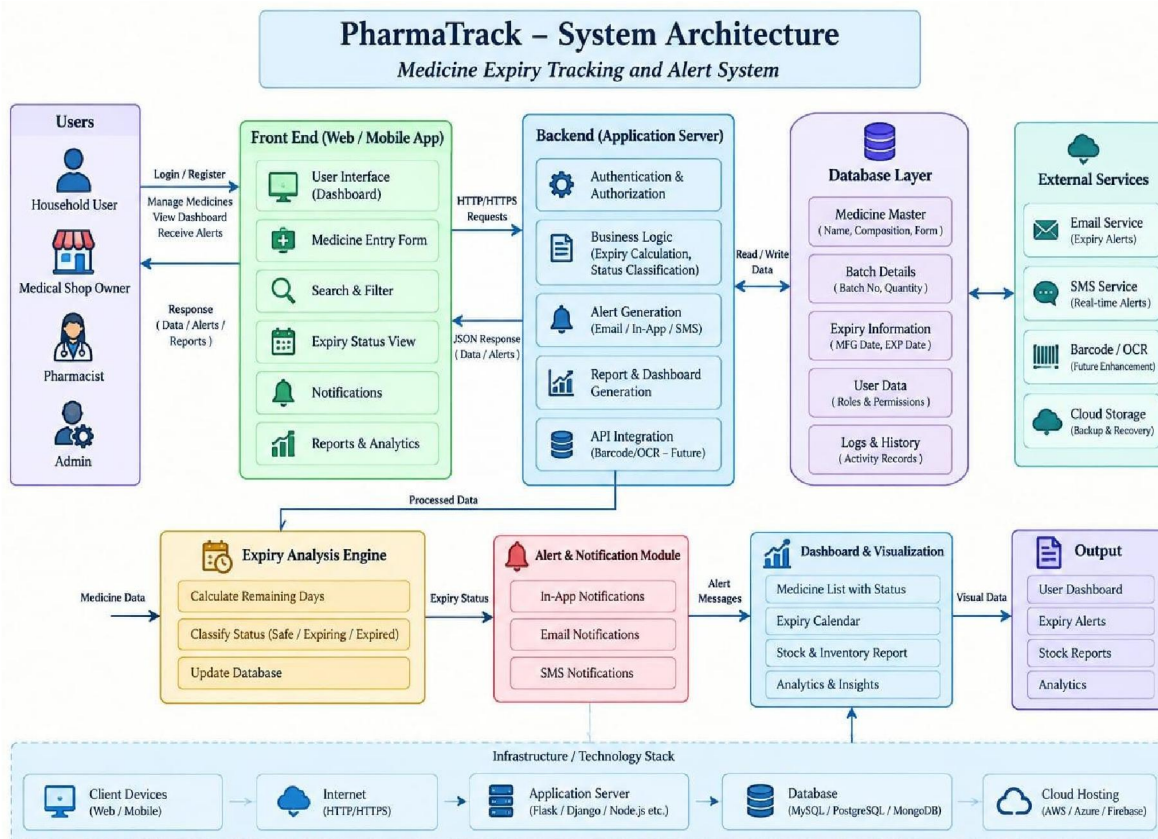


Fig. 1. Proposed PharmaTrack System Architecture

5.1.1 User Layer

The system supports different types of users, such as:

- Household User: Can add and manage medicines used at home and receive expiry notifications.
- Medical Shop Owner: Can maintain medicine inventory, batch information, quantities, and expiry dates.
- Pharmacist: Can manage medicine records and monitor medicines according to their expiry status.
- Administrator: Can manage users, system records, permissions, and overall system activities.

Users first log in or register in the system. After successful authentication, they can access the functions available according to their role.

5.1.2 Front-End Layer

The front-end provides the interaction between the user and the system. It contains a user-friendly dashboard through which users can perform different operations.

The major front-end components include:

User Interface/Dashboard – Provides an overview of medicine records and alerts. Medicine Entry Form – Allows users to enter new medicine information.



Search and Filter – Helps users find medicines based on name, category, batch, or status. Expiry Status View – Displays medicines as safe, expiring soon, or expired.

Notifications – Displays alerts generated by the system.

Reports and Analytics – Provides information about medicine stock and expiry trends. The front end sends requests to the backend through HTTP/HTTPS communication.

5.1.3 Security and Access Control

Security is an important part of the proposed methodology because the system stores user and medicine-related information. The system uses:

Authentication

Users must log in using valid credentials before accessing protected functions. Authorization

Different users can be provided with different permissions. For example, an administrator may have more privileges than a household user. Secure Communication

Communication between the client and application server can use HTTPS to protect information transmitted over the network. Database Security

Access to the database should be restricted to authorized application components and users. Activity Logging

Important actions can be recorded in logs so that system activities can be monitored and reviewed.

5.1.4 Complete System Workflow

The complete methodology of the proposed PharmaTrack system can be explained through the following sequence:

Step 1: User Registration/Login

The user registers or logs into the PharmaTrack system.

Step 2: Medicine Entry

The user enters medicine details such as medicine name, batch number, manufacturing date, expiry date, quantity, and category.

Step 3: Input Validation

The backend checks the entered information for completeness, correct format, and logical consistency.

Step 4: Database Storage

After successful validation, the medicine information is stored in the database.

Step 5: Expiry Calculation

The expiry-analysis engine compares the current date with the medicine's expiry date.

Step 6: Status Classification

The medicine is classified as:

Safe / Expiring Soon / Expired according to the configured expiry rules.

Step 7: Database Update

The latest expiry status is associated with the medicine record.

Step 8: Alert Generation

If a medicine is approaching its expiry date or has already expired, the system generates an appropriate alert.

Step 9: Notification

The alert can be displayed through the application and, where configured, sent through email or SMS.

Step 10: Dashboard Visualization

The updated medicine status is displayed on the dashboard through lists, expiry calendars, reports, and analytics.

Step 11: User Action

The user can then review the medicine record and take the appropriate operational action, such as checking stock or removing an expired item according to applicable pharmacy procedures.



VI. ALERT GENERATION AND STATUS CLASSIFICATION

The alert module converts the calculated remaining days into a user-readable status. A medicine that is comfortably within its valid period is marked as active/safe. A medicine that falls within the configured warning period is marked as expiring soon. A medicine whose expiry date has passed is marked as expired.

Example warning: "Paracetamol will expire on 15 October 2026. Please check the medicine before its expiry date."

Example expired status: "Paracetamol expired on 15 October 2026."

The initial prototype can use in-application notifications. Email or other notification channels can be considered as future extensions. Alerts should communicate the date and medicine name clearly rather than relying only on color.

Status	Condition	System Response
Green / Safe	Expiry is beyond the warning threshold	Show active medicine status
Yellow / Warning	Expiry is within the configured warning period	Generate expiry warning
Red / Expired	Expiry date has passed	Mark as expired and display alert

VII. USER INTERFACE DESIGN

The interface is planned to be simple and task-oriented. The dashboard will provide a summary of total medicines, active medicines, medicines expiring soon, expired medicines, and low-stock medicines where stock tracking is enabled.

The proposed screens are:

Login/Registration: provides controlled access to the user's records. Dashboard: summarizes inventory and expiry status.

Add Medicine: collects medicine and batch details.

Medicine List: shows stored medicines with expiry dates, quantity, and status.

Search and Filter: supports searching by medicine name, batch number, category, or status. Medicine Details: displays the complete record of a selected medicine.

Notifications: lists medicines requiring attention.

VIII. OPTIONAL EXTENSIONS

Barcode or QR-code scanning can reduce manual entry where suitable product information is available. OCR can also be investigated for reading printed expiry information from packaging. However, the extracted information should be verified against the physical package because a barcode or OCR result may not always provide a batch-specific expiry date accurately.

Future versions can add stock-level alerts, batch-wise inventory, expiry reports, disposal records, user roles, cloud synchronization, and analytics. More advanced forecasting or optimization models can be incorporated later if sufficient historical inventory data are available.

IX. SYSTEM TESTING AND EVALUATION

Testing will be performed using controlled medicine records representing different expiry conditions. The purpose is to verify that date calculations, status changes, validation rules, and notifications operate as intended.

X. EXPECTED OUTCOME

The expected outcome is a functional prototype that maintains medicine records and automatically identifies medicines based on their expiry dates. The system is expected to reduce the effort required for manual expiry checking by presenting relevant information through a centralized dashboard and timely alerts. For medical shops, the same mechanism can support batch-wise inventory review; for households, it can provide a simple reminder-oriented view.



The project will be evaluated primarily on functional correctness: whether records are stored accurately, dates are calculated correctly, status transitions occur at the intended threshold, and notifications correspond to the stored data. Usability can be assessed through user feedback after the prototype is demonstrated.

XI. DISCUSSION

The reviewed literature supports the use of automation for pharmaceutical inventory activities. Intelligent inventory research emphasizes the challenge of managing products that have limited shelf lives, while practical medical-store studies demonstrate the usefulness of simple computerized monitoring. PharmaTrack combines these observations into a focused application that does not require a complex optimization model for its core function. Instead, its primary contribution is transparent date tracking and user-oriented alerts.

A key design consideration is data accuracy. An alert system can only be as reliable as the medicine information entered into it. Therefore, validation, clear data-entry fields, and future support for barcode/OCR assistance are important areas for improving the system. The project can also be expanded later if reliable historical inventory data become available.

XII. CONCLUSION

This literature survey examined research related to pharmaceutical inventory management and automated medical-store management and used those findings to define the methodology for PharmaTrack. The proposed system focuses on storing medicine information, automatically calculating expiry status, generating timely alerts, and presenting the results through a simple interface. A configurable warning period, such as four days before expiry, provides an easily understandable mechanism for identifying medicines that need attention.

The proposed architecture is suitable for a major-project prototype and can support both household and medical-shop use cases. Future development can extend the core system with barcode/OCR-based data entry, richer inventory reports, cloud services, and advanced analytics. The main objective remains reliable and understandable medicine-expiry monitoring.

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