IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, April 2026
Impact Factor: 8.2

PharmaSignal: Smart Drug Expiry Alert and Monitoring Platform

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Abstract: *The PharmaSignal Platform is a web-based application developed to make pharmacy inventory management easier and more organized. It helps pharmacists and medical store staff efficiently manage medicines, track stock levels, and monitor expiry dates in a single digital platform. The application is built using modern technologies like Angular for the frontend and ASP.NET for the backend, supported by a secure database to ensure data safety and reliability.Users can add, update, and manage medicine records, check stock availability, and monitor expiry status at any time. The platform includes smart features that automatically identify expired and near-expiry medicines, helping reduce wastage and financial loss. It also provides low-stock alerts, allowing users to restock medicines on time and avoid shortages. The system supports stock-in and stock-out operations, making it easy to track medicine movement and maintain accurate inventory records. An interactive dashboard displays important information such as total medicines, expired items, near-expiry medicines, and low-stock products for quick decision-making*

Keywords: *PharmaSignal*

I. INTRODUCTION

A digital platform can simplify and improve pharmacy operations by organizing all inventory-related data in one place. PharmaPredict is designed as a web-based application that enables pharmacists to efficiently manage medicine stock, monitor expiry dates, and handle daily operations with greater accuracy. By using modern technologies, the platform ensures that data is updated instantly and can be accessed easily whenever needed.The application provides features for adding and managing medicine records, tracking stock levels, and identifying expired or near-expiry medicines. It automatically highlights medicines that are close to expiry, helping reduce wastage and ensure patient safety. The system also detects low-stock items and provides alerts, allowing timely restocking and preventing shortages.PharmaPredict supports stock-in and stock-out operations, making it easier to track the movement of medicines and maintain accurate inventory records. A user-friendly dashboard displays key information such as total medicines, expired items, near-expiry medicines, and low-stock products, enabling quick decision-making.

II. RELATED WORK

Pharmacy inventory management is an essential part of healthcare systems, ensuring the availability of medicines and reducing risks associated with expired or insufficient stock. Various organizations and medical stores use different methods to manage inventory, ranging from manual record-keeping to digital solutions. Traditional approaches often rely on paper registers, spreadsheets, or basic software, which can lead to errors, data redundancy, and difficulty in tracking real-time stock information. These limitations can affect efficiency and

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increase the chances of medicine wastage or stock shortages.Several studies and existing solutions have proposed web-based pharmacy management platforms developed using technologies such as ASP.NET, and MySQL. These systems typically include features like medicine record management, stock tracking, billing, and administrative control. Web-based platforms help centralize data and improve accessibility for pharmacy staff. However, many of these systems lack advanced features such as real-time alerts for expiry and low stock, predictive analysis, and intelligent decision support. They also depend heavily on manual monitoring, which can reduce overall efficiency.

III. LITERATURE REVIEW

1. Pharmacy Inventory Management System
Authors: A. Sharma, R. Gupta, P. Mehta, S. Verma, K. Patil
Explanation:
A web-based application designed to manage pharmacy operations such as medicine records, stock levels, and billing. The system helps maintain centralized data and improves accuracy compared to manual record-keeping. It allows users to update stock and monitor medicine availability efficiently. Additional Issues: Does not provide automated expiry alerts or intelligent monitoring features for reducing medicine wastage.

2. Medical Store Inventory Management Application
Authors: M. Patil, S. Kulkarni, R. Jadhav, P. Desai, A. More
Explanation:
This application focuses on managing medicine inventory by tracking stock levels and updating records in real time. It simplifies daily operations in medical stores and improves data organization.
Users can add, edit, and view medicine details easily.
Additional Issues: Lacks expiry tracking features and real-time alert mechanisms for low stock and expired medicines.

3. Web-Based Drug Inventory and Expiry Alert System
Authors: S. Sharma, M. Gupta, A. Verma
Explanation:
A web-based system that manages drug inventory and provides automated alerts for expired and near-expiry medicines. It uses a structured database and includes a dashboard for monitoring stock status and generating reports.
Additional Issues:
Limited real-time notification support and lacks advanced analytics for better decision-making.

4. Smart Pharmaceutical Inventory with Predictive Analysis
Authors: R. Patel, K. Shah, D. Mehta
Explanation:
This system uses predictive analytics to monitor medicine lifecycle and forecast expiry trends. It helps in optimizing stock usage and reducing wastage by analyzing historical data. The system improves planning and inventory control. Additional Issues: Requires integration with real-time systems and user-friendly interfaces for practical implementation.

IV. PROBLEM STATEMENT

The proposed PharmaPredict platform addresses these challenges by providing a user-friendly web-based application that centralizes all inventory data. It enables efficient tracking of medicine stock, automatic

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identification of expired and near-expiry medicines, and real-time alerts for low stock. By improving accuracy, reducing manual effort, and ensuring timely updates, the platform enhances overall pharmacy management and supports better healthcare services.

V. PROPOSED SYSTEM OVERVIEW

Ensures real-time monitoring, secure data management, and simplified processes to improve pharmacy inventory control and reduce medicine wastage.The proposed PharmaPredict platform connects pharmacists, administrators, and inventory data on a single web-based platform. It aims to improve stock management, enhance expiry tracking, and increase efficiency in pharmacy operations. The system includes a user-friendly frontend developed using Angular and a secure backend built with ASP.NET, supported by a centralized database for storing all medicine-related information.Users can add, update, and manage medicine records, perform stock-in and stock-out operations, and monitor inventory status in real time.

VI. SYSTEM ARCHITECTURE

The PharmaPredict platform is a web-based application that connects pharmacists and administrators within a single integrated system. Its main objective is to streamline pharmacy inventory management, ensure accuracy in tracking medicine stock and expiry dates, and securely manage data using a centralized database.

1. Modules

1.1 Pharmacist Module

In this module, the pharmacist can securely log into the system and manage medicine inventory. The pharmacist can add new medicines, update existing records, and perform stock-in and stock-out operations. They can also monitor expiry dates, check stock levels, and receive alerts for low stock and near-expiry medicines.

1.2 Inventory Module

This module handles all medicine-related data such as name, batch number, quantity, manufacture date, and expiry date. It maintains accurate records of stock and ensures real-time updates whenever changes occur. The system automatically tracks expiry timelines and identifies expired or near-expiry medicines.

1.3 Dashboard Module

The dashboard provides a visual overview of important information such as total medicines, expired items, near-expiry medicines, and low-stock products. It helps users quickly analyze inventory status and make informed decisions. All data is updated in real time for better monitoring.

1.4 Admin Module

The administrator manages user access and controls the overall system. Admin can monitor all records, ensure data accuracy, and maintain system security. They are responsible for smooth operation, managing permissions, and handling any system-level updates.

2. Backend Architecture (ASP.NET Integration)

The system uses ASP.NET Core and a centralized database to manage authentication, data storage, and business logic:

• Authentication & Authorization: Ensures secure login and role-based access for users such as pharmacists and administrators.

• Database (SQL Server): Stores structured data related to medicines, stock levels, expiry dates, and transaction records in a secure and organized manner.

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• API Services: Handles communication between the frontend (Angular) and backend, enabling operations like adding medicines, updating stock, and retrieving dashboard data in real time.

3. Inventory and Alert Workflow

• The pharmacist adds new medicines and updates stock details in the system.
• The system continuously monitors stock levels and expiry dates of medicines.
• If a medicine is near expiry, the system generates an alert notification.
• If stock levels fall below the minimum limit, a low-stock alert is triggered.
• The system updates all changes in the database and displays real-time status on the dashboard for users.

VII. IMPLEMENTATION DETAILS

The implementation of the PharmaPredict platform consists of four main steps: User Input and Medicine Management, Inventory Monitoring, Dashboard and Alerts, and Notifications and Updates.

User Input and Medicine Management

Users (pharmacists and administrators) log into the application securely. Pharmacists add medicine details such as name, batch number, quantity, manufacture date, expiry date, and price. They can also update and delete records as needed. All input data is validated and stored securely in the centralized database to ensure accuracy and data integrity.

Inventory Monitoring

When medicines are added or updated, the system continuously monitors stock levels and expiry dates. It identifies expired and near-expiry medicines based on current date comparisons.
Stock movement is tracked through stock-in and stock-out operations, ensuring accurate inventory records at all times.

Dashboard and Alerts

The system provides a dashboard that displays important information such as total medicines, expired items, near-expiry medicines, and low-stock products. It automatically generates alerts when medicines are about to expire or when stock levels fall below the minimum threshold. These insights help users make quick and informed decisions.

Notifications and Updates

The system provides real-time updates on inventory status. Users are notified about low stock, expired medicines, and near-expiry items. All changes are instantly reflected in the dashboard, ensuring that users always have access to the latest information.

History and Reusability

The system maintains records of all medicine transactions, including stock-in and stock-out history. Users can review past data to analyze trends, manage inventory more effectively, and make better decisions. This feature helps in improving long-term planning and ensures efficient pharmacy operations.

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SYSTEM AECHITECTURE

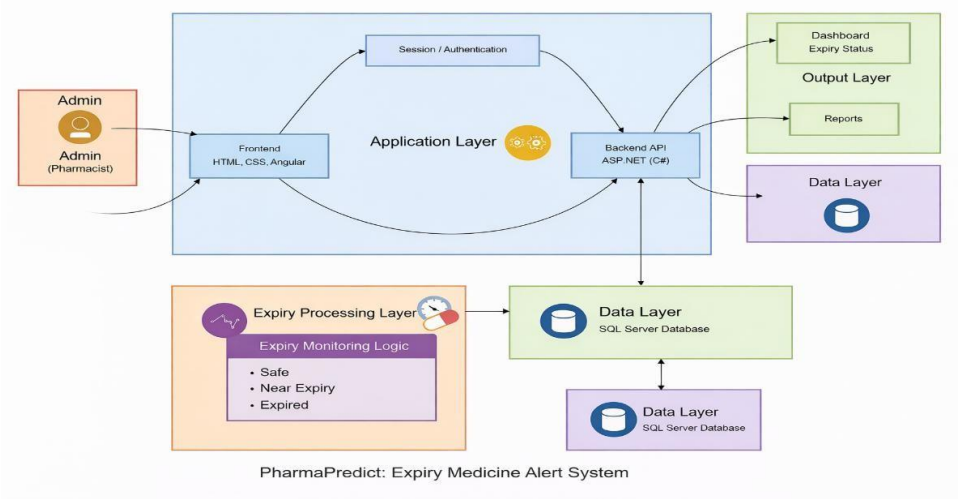

Figure 1: System architecture

VIII. PROPOSED SYSTEM

System Architecture :
System Architecture is shown in Figure 1.
Our proposed system will function in following steps:

Step 1: User Registration
Pharmacists and administrators register in the web application with their details.

Step 2: Login & Authentication
The system verifies users through secure login and role-based authentication.

Step 3: Medicine Entry
Users add medicine details such as name, batch number, quantity, manufacture date, and expiry date into the system.

Step 4: Inventory Monitoring
The system continuously tracks stock levels and expiry dates of medicines in real time.

Step 5: Alert Generation
The system automatically identifies near-expiry and low-stock medicines and generates alerts.

Step 6: Dashboard & Notifications
Users receive real-time updates and can view inventory status through an interactive dashboard.

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IX. ANALYSIS OF PROPOSED SYSTEM

1. Enhanced Efficiency and Real-Time Monitoring:

The proposed PharmaPredict platform improves the efficiency, accuracy, and reliability of pharmacy inventory management. By integrating a web-based interface with a centralized database, the system provides real-time updates on medicine stock, expiry dates, and inventory status, reducing manual effort and delays.

2. Intelligent Monitoring and Alert System:

The system automatically tracks medicine expiry dates and stock levels, generating alerts for near-expiry and low-stock items. This ensures timely action, reduces medicine wastage, and prevents the use of expired drugs, improving patient safety.

3. Secure Role-Based Access:

The platform implements role-based access control, allowing pharmacists and administrators to interact with the system according to their responsibilities. This ensures data security, controlled access, and proper management of sensitive inventory information.

4. Improved Coordination and System Reliability:

Compared to traditional manual or basic digital systems, PharmaPredict centralizes all inventory data and provides a structured workflow. It reduces errors, improves coordination within pharmacy operations, and ensures reliable data management for better decision-making.

5. MODULES

The proposed PharmaPredict platform is divided into four main modules: Pharmacist, Inventory, Admin, and Dashboard & Notification. Each module is designed to handle specific functionalities and ensure smooth system operation.

1. Pharmacist Module

This module allows pharmacists to manage medicine records and inventory operations. Users can add, update, and delete medicine details, as well as perform stock-in and stock-out activities. It ensures accurate tracking of inventory and provides alerts for expiry and low stock.

2. Inventory Module

The Inventory Module maintains detailed information about medicines, including batch number, quantity, and expiry dates. It continuously monitors stock levels and identifies expired or near-expiry items. This module ensures real-time data updates and proper inventory control.

3. Admin Module

The Admin Module manages the entire system and controls user access. It ensures data security, monitors all records, and maintains system functionality. The admin can also generate reports and oversee overall system performance.

4. Dashboard & Notification Module

This module provides a visual representation of inventory data, including total medicines, expired items, near-expiry medicines, and low-stock products. It also sends alerts and notifications to users, ensuring real-time communication and quick response to inventory changes.

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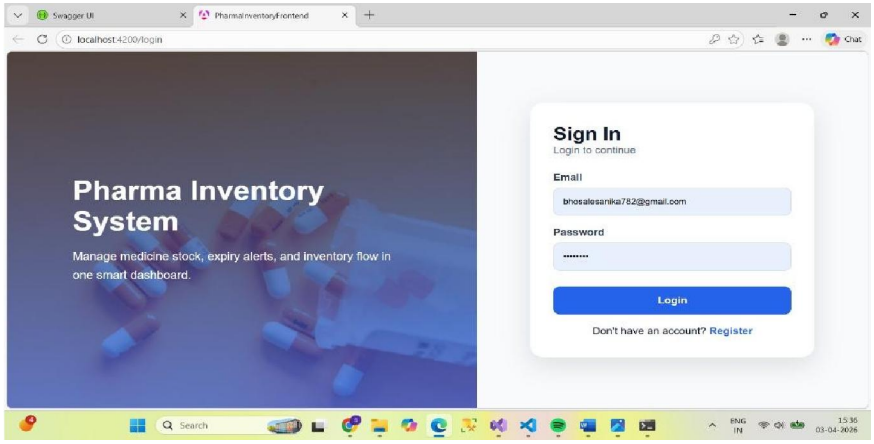
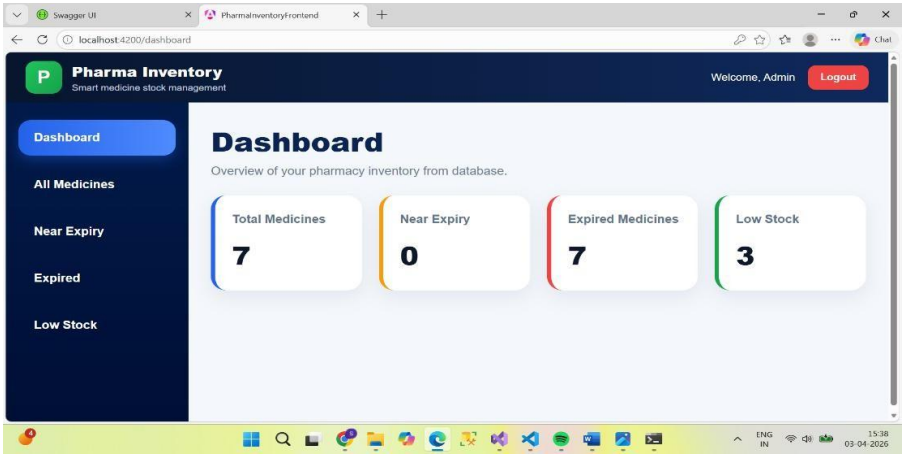
RESULTS

Login Page:



Dashboard:



X. CONCLUSION

The PharmaPredict platform provides a reliable and efficient solution for managing pharmacy inventory. By maintaining accurate medicine records and monitoring stock levels and expiry dates, the system reduces errors and prevents medicine wastage. Real-time alerts and a user-friendly dashboard improve decision-making and ensure timely actions for low stock and near-expiry medicines. Secure data management enhances reliability and transparency within pharmacy operations. Overall, the platform improves efficiency, supports better inventory control, and contributes to safer and more effective healthcare services.

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