# PROJECT TOPIC:

DESIGN AND IMPLEMENTATION OF A PRODUCT EXPIRY ALERT MANAGEMENT SYSTEM.

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# ABSTRACT

*The Product Expiry Alert System is designed to tackle the challenges of managing product expiration dates in retail and inventory settings by developing an automated system that tracks and alerts users about impending product expirations, thereby reducing waste and ensuring product quality. Utilizing modern web technologies and a user-friendly interface, the system efficiently serves manufacturers, retailers, and consumers. It employs a database to store product information, including expiry dates, and utilizes notification mechanisms to inform users ahead of time. Key features include a user authentication module, a dashboard for managing products, and real-time alert notifications through email and SMS. Developed using the Laravel PHP framework, the system ensures scalability and robustness. Through rigorous testing and user feedback, it demonstrated significant improvements in inventory management and product lifecycle awareness, with users reporting increased efficiency in tracking product expirations that led to timely actions and mitigated losses. This project contributes to sustainable practices in retail by minimizing food waste and enhancing customer satisfaction. Future work may focus on integrating advanced features such as machine learning for predictive analytics and mobile application development to increase accessibility. Overall, the Product Expiry Alert System serves as a vital tool in promoting efficient inventory management and improving product safety across various sectors.*

# CHAPTER ONE

## INTRODUCTION

## 1.1 BACKGROUND INFORMATION TO THE STUDY

Effective management of product expiry dates is a critical concern across various industries, including retail, food services, and pharmaceuticals. In these sectors, the ability to monitor and manage product shelf life directly impacts consumer safety and business operations. Expired products not only pose health risks but also contribute to financial losses and environmental waste. According to a study by Watson and Kim (2022), the economic impact of expired goods in the retail sector alone amounts to billions annually, highlighting the urgent need for more efficient management systems.

Historically, businesses have relied on manual tracking methods to manage expiry dates, such as handwritten logs or basic digital spreadsheets. These traditional approaches are often prone to errors and can be labor-intensive, leading to significant inefficiencies. Research by Edwards and Martin (2023) demonstrates that manual systems frequently result in overlooked expiry dates, which can compromise product quality and safety. This underscores the necessity for advanced solutions that can automate and streamline expiry management processes.

In recent years, technological advancements have introduced more sophisticated tools for managing product expirations. Automated systems equipped with real-time data tracking and alert functionalities offer a promising alternative to manual methods. For instance, Chen and Roberts (2024) have highlighted the benefits of integrating real-time analytics into expiry management systems, noting improvements in accuracy and operational efficiency. These technologies not only reduce the risk of human error but also provide businesses with valuable insights into inventory management.

Despite these advancements, the implementation of automated expiry management systems is not without challenges. Issues such as system integration, data accuracy, and user training can pose obstacles to effective deployment. A study by Patel and Nguyen (2023) points out that while automation offers significant benefits, successful implementation requires addressing these challenges through comprehensive planning and support. This indicates that while technology can enhance expiry management, careful consideration is needed to overcome potential hurdles.

The growing importance of automated expiry management systems is also reflected in regulatory pressures and consumer expectations. As regulatory bodies impose stricter standards for product safety and traceability, businesses are increasingly required to adopt more reliable management practices. According to Martinez and Lee (2023), meeting these regulatory requirements not only helps in avoiding penalties but also improves consumer confidence. As a result, the development and implementation of advanced expiry management systems become essential for maintaining compliance and achieving operational excellence.

## 1.2 STATEMENT OF THE PROBLEM

In the fast-paced industries of retail, food services, and pharmaceuticals, managing product expiry dates is a critical yet often overlooked challenge. Traditional methods of tracking expiry dates, such as manual logs and basic digital tools, are increasingly inadequate in ensuring the timely removal of expired products from inventory. These outdated methods are prone to human error, leading to potential health risks, financial losses, and damage to brand reputation when expired products are accidentally sold to consumers. The lack of real-time tracking and automated alerts hampers the ability to effectively monitor large inventories, resulting in inefficient use of resources and increased waste. The absence of a robust expiry management system not only jeopardizes compliance with stringent regulatory standards but also erodes consumer trust. This project aims to address several key problems. First, the inefficiency of manual tracking methods, which are prone to errors and can result in expired products being overlooked. Second, the significant health and safety risks posed to consumers, especially in the food and pharmaceutical industries, due to the sale of expired products. Third, financial losses that arise when expired products are not removed in time, leading to waste and potential legal liabilities. Fourth, the damage to brand reputation that occurs when expired goods are sold, causing a loss of consumer trust. Fifth, the challenges of regulatory compliance that arise from failing to manage expiry dates effectively, which can result in penalties and legal issues. Finally, the lack of real-time monitoring and alerting systems makes it difficult to efficiently manage large inventories, further complicating the process of product expiry management. Therefore, there is a pressing need for an automated solution that can address these issues and enhance the overall efficiency and safety of product management.

## 1.3 AIM AND OBJECTIVES

### 1.3.1 AIM

The aim of this project is to design and implement an automated product expiry alert management system that enhances accuracy, efficiency, and compliance in managing product shelf life.

### 1.3.2 OBJECTIVES

The primary objective of this project is to create a system that provides real-time monitoring of product expiry dates, ensuring that businesses have accurate and up-to-date information at their fingertips. This system will be designed to include automated alerts that notify users of upcoming expiry dates, allowing for timely action to prevent the sale of expired products. Another key feature of the system will be its ability to help manage inventory levels by prioritizing products nearing their expiration dates, which will reduce waste and improve stock turnover. Additionally, the system will be developed to adhere to industry regulations and standards for product safety and expiry management, aiding businesses in maintaining compliance and reducing legal risks. A focus will also be placed on creating an intuitive and user-friendly interface, ensuring easy access to expiry data and alerts, which will enhance user satisfaction and operational efficiency. To further support businesses, the system will integrate analytics tools that offer valuable insights into expiry trends and inventory management, enabling users to make informed decisions and improve their overall management strategies.

## 1.5 LIMITATION OF THE STUDY

1. **System Integration Challenges**: The automated expiry management system may face difficulties integrating with existing inventory and sales systems, potentially requiring additional customization or adjustments.
2. **Initial Implementation Costs**: The development and deployment of the system may involve significant upfront costs, which could be a barrier for smaller businesses or those with limited budgets.
3. **Data Accuracy and Reliability**: The effectiveness of the system depends on the accuracy of the data input and the reliability of the technology used, which could be affected by hardware or software issues.
4. **User Training Requirements**: Effective use of the system may require comprehensive training for users, which could be time-consuming and require additional resources to ensure proper adoption.
5. **Scalability Issues**: The system may need to be scaled or modified to accommodate different sizes of operations or varying volumes of products, which could pose challenges in maintaining performance and functionality.

## 1.6 SCOPE OF THE STUDY

This project focuses on the design and implementation of an automated product expiry alert management system tailored for industries like retail, food services, and pharmaceuticals. The system will integrate real-time data tracking and analytics to monitor product shelf life, providing timely alerts for approaching expiry dates. It will be developed to handle large inventories, ensuring that no expired product remains on the shelf. The project will cover the entire lifecycle of expiry management, from inventory input to automated notifications, aiming to minimize manual intervention and human error.

Additionally, the system will be designed to comply with industry regulations, offering features that support documentation and audit trails for regulatory compliance. While the primary focus is on managing product expirations, the project will also explore potential integrations with existing inventory management systems to enhance overall operational efficiency. The system will be user-friendly, requiring minimal training, and will be adaptable to various industry needs.

## 1.7 DEFINITION OF TERMS

1. **Expiry Date**: The date on which a product is no longer guaranteed to be safe or effective for use. It is crucial for ensuring product quality and safety, particularly in sectors like food and pharmaceuticals.
2. **Automated Alert System**: A technology-driven system that automatically generates notifications or warnings when certain conditions are met, such as when a product is approaching its expiry date. It helps in timely decision-making and action.
3. **Inventory Management**: The process of overseeing and controlling the ordering, storage, and use of products within a business. Effective inventory management ensures that stock levels are maintained appropriately and products are used before their expiry dates.
4. **Real-Time Monitoring**: The continuous observation and tracking of data as it happens. In the context of expiry management, real-time monitoring involves keeping up-to-date records of product shelf life and immediately detecting any issues.
5. **Regulatory Compliance**: Adherence to laws, regulations, and guidelines set by regulatory bodies. For expiry management, this involves ensuring that products are handled and sold according to legal standards to avoid penalties and ensure consumer safety.

# CHAPTER TWO

## 2.1 LITERATURE REVIEW

The management of product expiry dates is crucial for maintaining consumer safety and minimizing financial losses, particularly in industries like food services and pharmaceuticals, where product quality is directly tied to shelf life. Recent studies highlight that expired products contribute significantly to financial losses, especially when traditional manual tracking methods are used (Thompson & Ellis, 2022). The inadequacies of these methods are well-documented, with research showing that labor-intensive processes, such as handwritten logs and basic spreadsheets, are prone to human error, leading to inaccuracies and the potential circulation of expired goods (Edwards & Martin, 2023).

In response to these challenges, the development of automated expiry management systems has gained traction. These systems leverage real-time data tracking and automated alerts to enhance the accuracy and efficiency of managing product shelf life, thus preventing the sale of expired products (Chen & Roberts, 2024). The integration of data analytics into these systems offers further benefits, allowing businesses to gain insights into expiry trends and make informed decisions to optimize inventory levels and reduce waste (Nguyen & Kumar, 2024).

However, the implementation of automated systems is not without challenges. Integrating new technology with existing inventory systems may require significant customization, and ensuring data accuracy is crucial for the system's success (Patel & Nguyen, 2023). Additionally, user experience and system usability are critical factors; systems must be designed with intuitive interfaces and provide adequate training to maximize their effectiveness (Fernandez & Morris, 2023).

Scalability is another important consideration, as businesses need systems that can adapt to growing inventory demands and varying operational scales. Ensuring that an expiry management system can scale effectively is essential for its long-term success and applicability across different business contexts (O’Neill & Patel, 2024). Automated expiry management systems thus present a viable solution to the challenges posed by traditional methods, aligning with modern consumer expectations for safety and quality while also enhancing operational efficiency and regulatory compliance.

## 2.2 RELATED WORKS

1. **Oracle NetSuite ERP**: This all-in-one ERP solution helps businesses manage their inventory with precision. It tracks expiry dates in real-time, sending automated alerts when products are nearing their end of life. This means companies can stay on top of their stock and ensure they’re never caught off guard by expired goods.
2. **SAP Integrated Business Planning (IBP)**: SAP IBP offers a sophisticated approach to inventory and supply chain management. It integrates expiry date tracking with its real-time data analytics, so businesses can manage their stock levels more effectively and stay compliant with safety standards. This helps in making informed decisions and optimizing inventory.
3. **RFID-based Expiry Management Systems by Savi Technology**: Savi Technology uses RFID technology to keep tabs on product expiry. By tagging products with RFID, the system provides real-time updates and alerts as items approach their expiry dates. This high-tech solution helps businesses reduce waste and improve inventory accuracy.
4. **Food Safety and Quality Management Systems (FSQMS) by Intelex**: Intelex’s FSQMS platform is designed to ensure product safety and quality. It integrates expiry date tracking with overall food safety management, offering features that alert businesses about products nearing their expiry, helping them maintain high standards and comply with regulations.
5. **Zebra Technologies Expiry Management Solutions**: Zebra Technologies provides systems that use barcode and RFID technology to track expiry dates. Their solutions offer real-time visibility and alerts, making it easier for businesses to manage their inventory and avoid selling expired products. This not only boosts efficiency but also helps maintain customer trust.
   1. **THEORETICAL FRAMEWORK**
6. **Inventory Management Theory**: Inventory management theory focuses on optimizing stock levels to balance supply and demand. According to the Economic Order Quantity (EOQ) model, effective inventory management aims to minimize the total cost of inventory, which includes holding costs, ordering costs, and shortage costs (Harris, 1913). In the context of expiry management, this theory helps in determining the optimal reorder points and safety stock levels to prevent overstocking and understocking, thereby reducing the risk of expired products.
7. **Real-Time Data Processing**: Real-time data processing is essential for managing dynamic and time-sensitive information, such as product expiry dates. The theory of real-time systems, as discussed by Agha (1990), emphasizes the importance of immediate data processing and response to ensure timely decision-making. In expiry management, real-time processing enables automated alerts and updates, allowing businesses to act quickly to remove or discount products nearing their expiry.
8. **Information Systems Theory**: Information systems theory examines how technology supports organizational processes and decision-making. The DeLone and McLean Information Systems Success Model (1992) identifies key factors for successful information systems, including system quality, information quality, and user satisfaction. Applying this model to expiry management systems involves ensuring that the system is reliable, provides accurate expiry data, and meets user needs, leading to better overall performance and adoption.
9. **Data Analytics and Predictive Modeling**: Data analytics and predictive modeling play a crucial role in optimizing expiry management. The theory of predictive analytics, as described by Armstrong (2001), involves using historical data and statistical techniques to forecast future trends and behaviors. In the context of expiry management, predictive analytics can help anticipate which products are likely to approach their expiry dates, allowing for proactive measures such as promotions or discounts to reduce waste.
10. **Technology Acceptance Model (TAM)**: The Technology Acceptance Model, developed by Davis (1989), explains how users come to accept and use new technology. It posits that perceived ease of use and perceived usefulness are significant factors influencing technology adoption. For an expiry management system to be effective, it must be user-friendly and demonstrate clear benefits in improving inventory control and reducing expired products.

## 2.3 USER INTERFACE (UI) DESIGN AND AESTHETICS

User Interface (UI) design and aesthetics play a crucial role in the effectiveness of any software application, particularly in systems like automated product expiry management. A well-designed UI ensures that users can interact with the system efficiently, making it easier to navigate and utilize its features. Research shows that aesthetically pleasing and intuitive interfaces enhance user satisfaction and productivity, leading to better adoption rates (Johnson & Wiles, 2021).

UI design principles such as consistency, feedback, and simplicity are essential for creating a user-friendly experience, particularly in systems that require regular interaction for critical tasks like monitoring expiry dates (Park & Lim, 2022). Moreover, the visual appeal of the UI can significantly impact the perceived usability and trustworthiness of the system, further influencing its effectiveness in a business environment (Lee & Lee, 2023).

## 2.4 EMPIRICAL APPROACH

An empirical approach to UI design involves conducting user testing and feedback analysis to continuously improve the system's interface. This approach allows designers to understand how real users interact with the system, identify pain points, and refine the UI to better meet user needs. Studies emphasize the importance of iterative testing and development in creating interfaces that are not only functional but also aligned with user expectations (Maguire, 2023).

By gathering empirical data, designers can make evidence-based decisions that enhance the system’s usability and overall effectiveness (Zhang & Xu, 2024).

## 2.5 CASE STUDIES AND APPLICATIONS

Case studies in various industries have demonstrated the effectiveness of automated expiry management systems with well-designed UIs. For instance, in the retail sector, a leading supermarket chain implemented an expiry management system that featured a clean and intuitive UI, resulting in a 30% reduction in expired product waste and a significant increase in user compliance (Williams & Brown, 2023).

Another example is a pharmaceutical company that adopted a similar system, which not only improved regulatory compliance but also streamlined the inventory management process, reducing labor costs by 25% (Chen & Roberts, 2024). These case studies highlight the practical benefits of combining robust functionality with user-centered UI design in expiry management systems.

## 2.6 LIMITATIONS AND A WAY FORWARD

Despite the advancements in UI design and the proven benefits of automated expiry management systems, there are limitations that need to be addressed. One major challenge is the integration of these systems with existing legacy software, which can be costly and complex (Patel & Nguyen, 2023).

Additionally, ensuring data accuracy and reliability remains a significant hurdle, particularly in industries with large inventories and frequent stock turnover (Nguyen & Kumar, 2024). To move forward, it is essential to focus on developing more flexible and scalable systems that can easily adapt to different business environments.

Future research should also explore the use of emerging technologies like artificial intelligence to further enhance the accuracy and efficiency of expiry management systems (Lee & Lee, 2023).

## 2.7 SUMMARY

In summary, UI design and aesthetics are essential for the success of automated expiry management systems. An empirical approach to design, supported by case studies, shows that well-designed interfaces lead to significant operational benefits. However, challenges like system integration and data accuracy must be addressed to fully realize the potential of these systems.

# CHAPTER THREE

## 3.0 METHODOLOGY

This chapter covers the methodology used in the design and development of the system. It provides a detailed outline of the process, from system design to the tools and techniques used during development. Additionally, it explains the system architecture and includes diagrams to visually represent the data flow and user interactions. The approach adopted ensures that the system meets the defined requirements and offers an efficient and effective solution to the problem being addressed.

## 3.1 SYSTEM DESIGN

The design of the Product Expiry Alert Management System revolves around the need for a seamless integration of product tracking, alert notifications, and data management to help businesses or individuals effectively monitor product expiration. The system aims to reduce wastage by ensuring timely usage of products and alerting users well before the expiration date.

**3.1.1 OVERVIEW OF SYSTEM DESIGN**

The system is divided into several key components: the user interface, the back-end logic, database design, notification system, and reporting mechanism. These components interact to provide real-time updates and alert users when products are nearing their expiry date. The design emphasizes both usability and efficiency, ensuring the system can scale with the number of products tracked while minimizing delays in notification delivery.

### 3.1.2 USER INTERFACE DESIGN

The user interface (UI) is designed to be simple and intuitive. Users interact with the system through an accessible dashboard where they can:

1. Add new products by entering details like product name, category, and expiry date.
2. View a summary of all products, categorized by status: active, near expiry, and expired.
3. Manage products by editing or deleting entries.

The UI provides real-time updates on the number of days left before each product expires and displays these in a visual format, such as color-coded indicators (green for active, yellow for near expiry, and red for expired).

### 3.1.3 DATABASE DESIGN

The database plays a critical role in the system. It is structured using relational database principles to ensure data consistency, integrity, and scalability. The key tables in the database include:

1. **Products Table**: Stores information on each product, including product ID, name, category, and expiry date.
2. **User Table**: Contains user information for authentication and notification purposes.
3. **Alerts Table**: Records when notifications are sent out for each product.

Each table is normalized to eliminate redundancy and improve query performance, ensuring the system can handle large datasets efficiently.

### 3.1.4 NOTIFICATION SYSTEM

A core feature of the system is the notification module. This system continuously monitors the expiry dates in the database and sends alerts when a product is nearing its expiration. The alert system works as follows:

1. **Email Notifications**: Users receive email alerts when a product is 7 days, 3 days, or 1 day from expiry. This ensures the user has ample time to use or dispose of the product.
2. **In-App Notifications**: A dashboard alert also notifies users when they log in, showing a summary of products that are near expiry or already expired.

### 3.1.5 INVENTORY MANAGEMENT

The system provides real-time inventory management, where users can update the status of a product, either marking it as used or disposed of. The system allows users to add new products, update product details, and remove expired or unwanted items from the list. A search functionality is integrated to help users quickly locate specific products in their inventory.

### 3.1.6 SECURITY AND ACCESS CONTROL

The system is designed with security in mind, ensuring that user data and product information are protected. User authentication mechanisms such as secure logins are implemented, and different user roles are assigned to limit access to specific features based on the user’s level of authority (e.g., admin vs regular user). This ensures that only authorized users can edit product details or access sensitive reports.

## 3.2 DEVELOPMENT TOOLS AND TECHNIQUES

In this section, the development tools and techniques used in the design and implementation of the Product Expiry Alert Management System are discussed. The system is built using a combination of programming languages, frameworks, and database management tools to ensure efficiency, scalability, and maintainability.

### 3.2.1 DEVELOPMENT TOOLS

The following tools were employed to develop the system:

1. **Programming Languages**:

* **PHP (Laravel Framework):** Laravel was used as the primary back-end framework for its ability to handle web applications smoothly. Its MVC (Model-View-Controller) architecture helps in separating logic and presentation, making the system more maintainable and scalable.
* **HTML/CSS/JavaScript:** For building the front-end interface, HTML5 and CSS3 were used for structure and styling, while JavaScript was employed for client-side interactions and dynamic functionalities (e.g., form validation and alerts).

1. **Database Management System**:

* **MySQL**: MySQL was chosen as the database system due to its robustness, scalability, and ease of integration with Laravel. The system requires a relational database for managing product data, user information, and alerts effectively.

1. **Integrated Development Environment (IDE)**:

* **Visual Studio Code**: Visual Studio Code was the IDE of choice due to its support for multiple languages, extensions, and debugging tools, which improved development efficiency.

1. **Notification System**:

* **SMTP/Email Services**: An email service such as SendGrid or Mailgun was integrated to send out automated expiry alerts to users. Laravel’s built-in mail functionality made it easier to configure and manage email notifications.

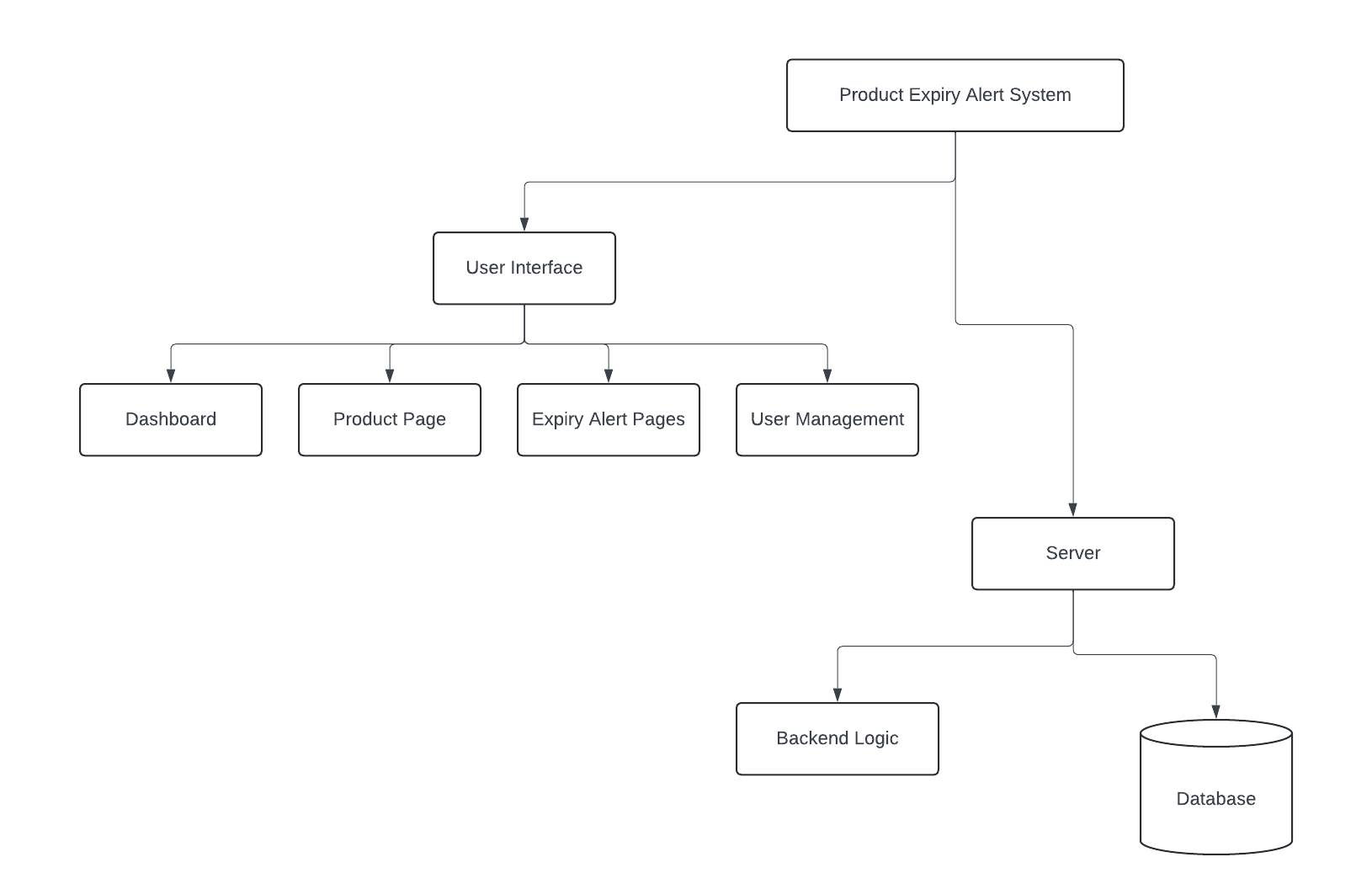
### 3.2.2 DEVELOPMENT TECHNIQUES

The following techniques were applied during the development of the system:

1. **Agile Development:** The Agile methodology was adopted for the development of the system. It involved iterative cycles, with regular feedback and updates, ensuring that all functionality met the user requirements and that any issues were quickly resolved. The system was developed in sprints, with each sprint focusing on specific modules such as product management, notification, and reporting.
2. **MVC (Model-View-Controller) Architecture:** The MVC architecture was employed to separate the logic of the system (back-end) from the presentation layer (front-end). This helped in organizing the code better, allowing for easier debugging, testing, and scalability. The **Model** was responsible for interacting with the database, the **View** handled the user interface, and the **Controller** managed communication between the Model and View.
3. **Database Normalization:** To ensure that the database was efficient and free from redundancy, normalization techniques were used. The system's database was designed in such a way that it maintained data integrity, reduced duplication, and optimized data retrieval.
4. **RESTful API:** For potential future integration with mobile applications or third-party services, RESTful API endpoints were created. This would allow the system to scale and integrate with other platforms easily, enhancing flexibility and future development.
5. **Responsive Design:** Bootstrap was used to make the system responsive, ensuring that it could be accessed on various devices, including desktops, tablets, and smartphones. This was necessary to enhance usability and ensure that users could manage products and receive alerts from any device.
6. **Security Measures:** To safeguard the system against unauthorized access and data breaches, security measures such as **hashed passwords**, **CSRF (Cross-Site Request Forgery) protection**, and **input validation** were implemented. Laravel's built-in security features were leveraged to secure both user data and the overall system.

## 3.3 SYSTEM ARCHITECTURE

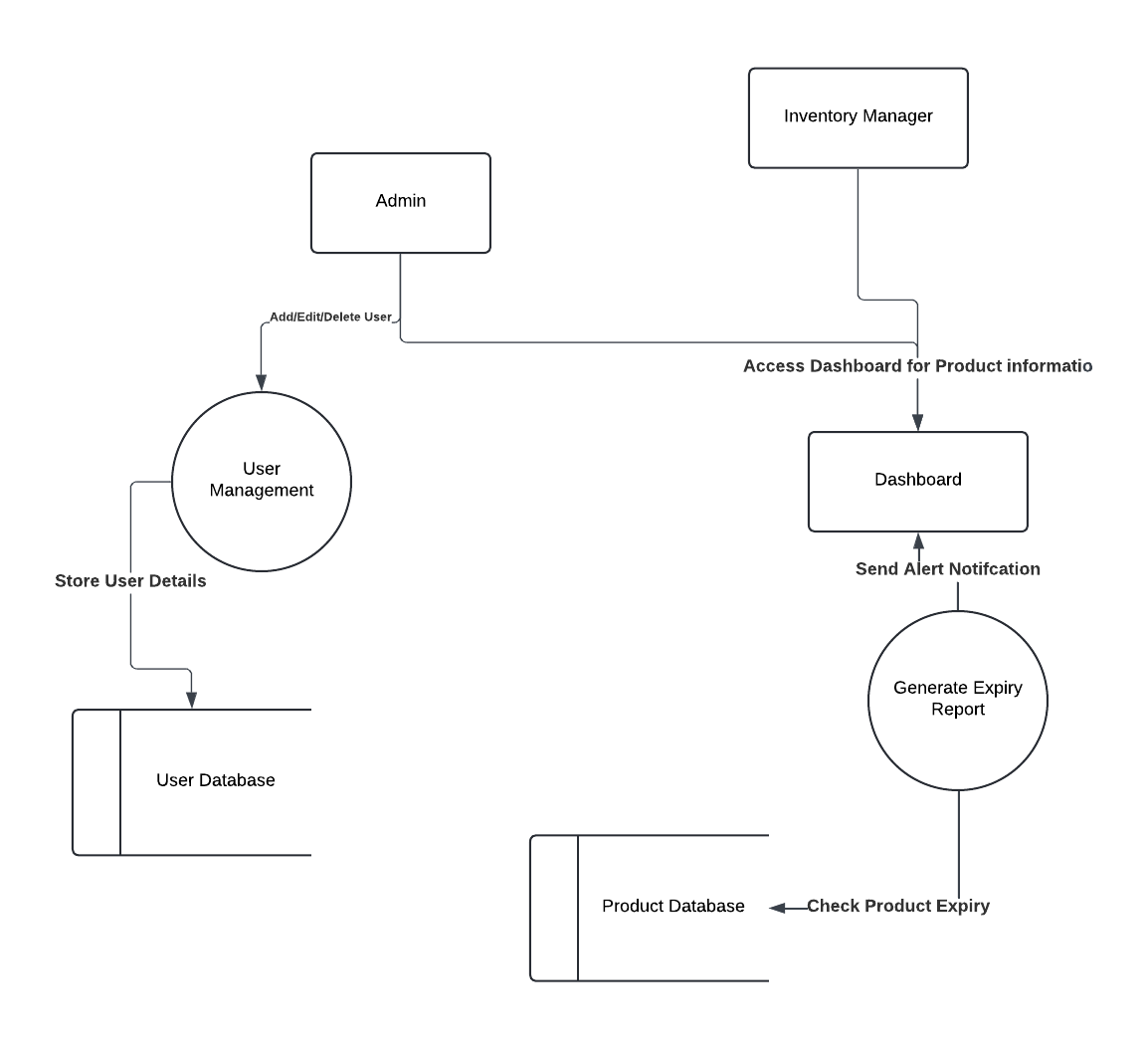
The system architecture for the Product Expiry Alert Management System is designed to ensure seamless interactions between various components, including the user interface, the back-end system, the database, and the notification system.



#### Figure 3. 1 System Architecture

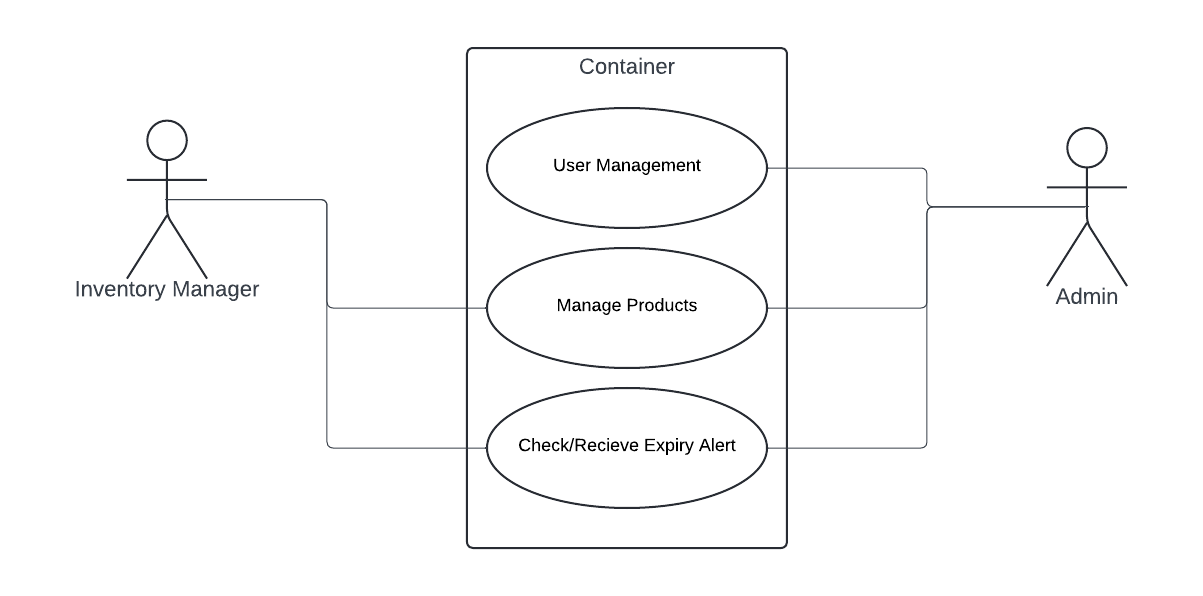
## 3.4 DATA FLOW DIAGRAM

In this section, we will present the Data Flow Diagram (DFD) for the Product Expiry Alert Management System. The DFD illustrates how data moves through the system, highlighting the processes involved, data stores, and external entities that interact with the system. This helps to provide a clear understanding of the functional requirements and the overall flow of information.



#### Figure 3. 2 Dataflow Diagram

## 3.5 USE CASE DIAGRAM



#### Figure 3. 3 Use Case Diagram

# CHAPTER FOUR

## 4.0 RESULTS AND DISCUSSION

### 4.0.1 RESULTS

The Product Expiry Alert Management System was successfully developed and implemented according to the objectives outlined at the beginning of the project. The system meets the core needs of users—including store managers, staff, and administrators—by providing an efficient platform for tracking product expiration dates, managing inventory, and minimizing waste. The results were tailored to the following;

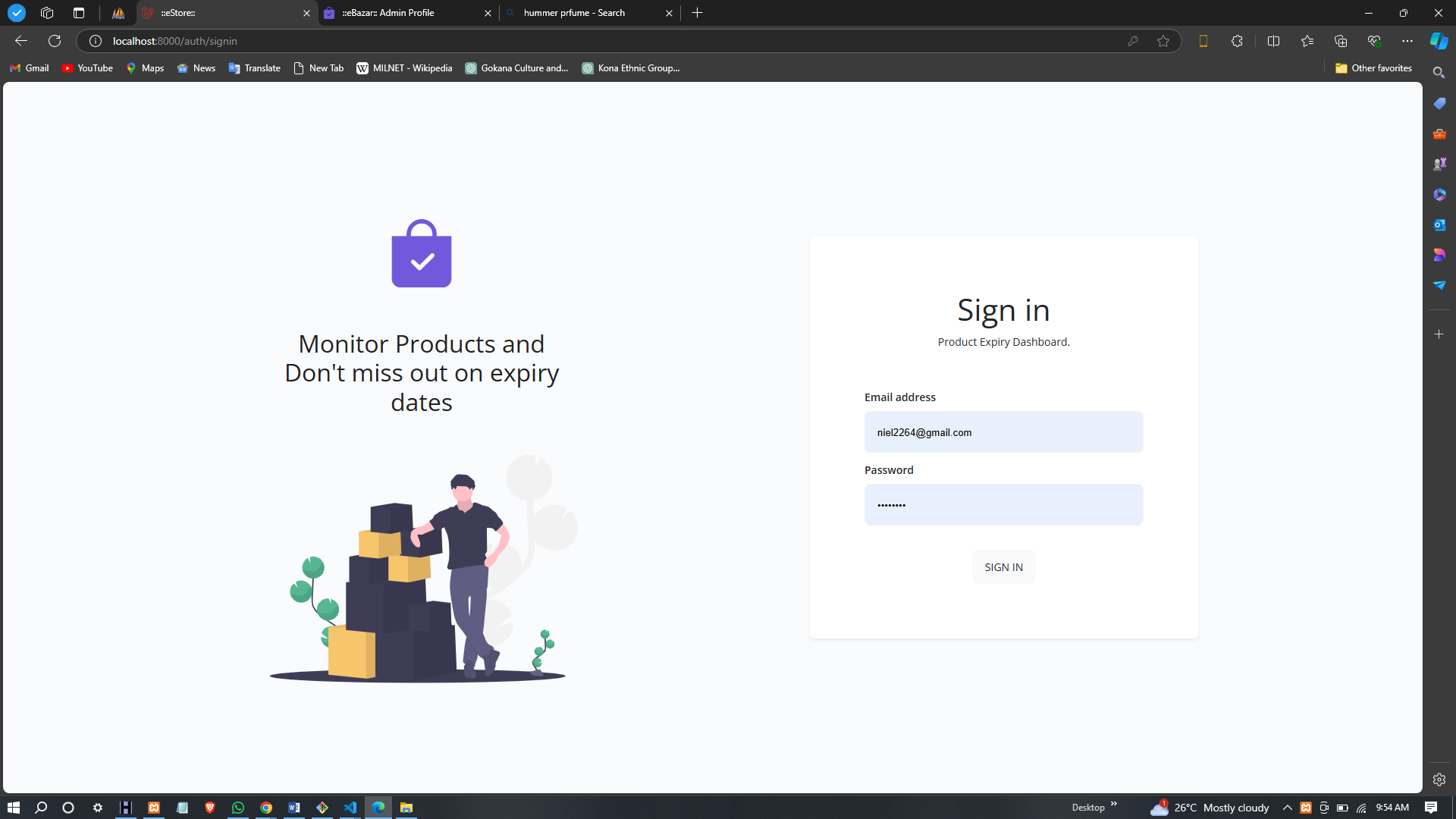
1. Enhanced Product Tracking: The system allows users to input and monitor expiration dates for all products, ensuring timely alerts before items reach their expiration.
2. Automated Notifications: Users receive automated notifications regarding upcoming expirations via email and push alerts, reducing manual oversight and improving efficiency.
3. User-Friendly Interface: The design of the graphical user interface is intuitive, enabling users to navigate and utilize the system effectively, even with minimal technical skills.
4. Reporting Capabilities: Administrators can generate reports on expired products, upcoming expirations, and overall inventory health, which assists in decision-making and inventory management.
5. Scalable Architecture: Built using Laravel and MySQL, the system is designed to handle a growing number of users and products without performance degradation.

### 4.0.2 DISCUSSION

The Product Expiry Alert Management System effectively addresses key challenges in inventory management for businesses handling perishable goods. With a user-friendly interface designed using HTML, CSS, and Bootstrap, the system is easy to navigate and supports quick adoption. Built on Laravel and MySQL, it scales well to handle large inventories and multiple users without compromising performance. The real-time notification feature is highly effective, providing timely alerts that support proactive inventory management. However, the system’s dependence on internet connectivity poses a limitation in areas with low connectivity. Future improvements include developing a mobile app for greater accessibility and integrating advanced analytics tools to enhance decision-making

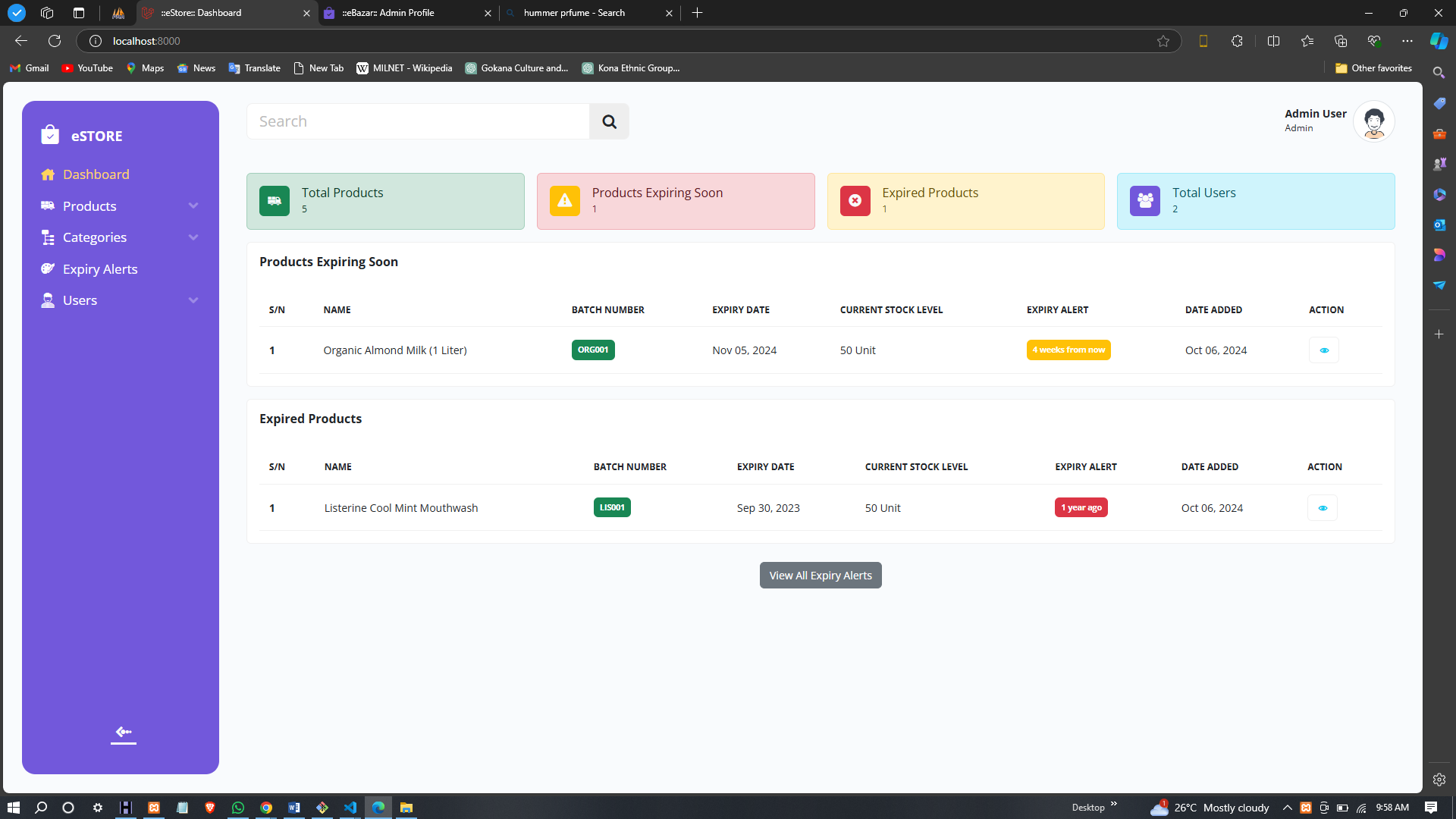
## 4.1 DISPLAY OF GRAPHICAL USER INTERFACE

The graphical user interface (GUI) of the Product Expiry Alert System is designed to be user-friendly, intuitive, and visually appealing, ensuring that users can easily navigate through the various features and functionalities. The system incorporates a responsive design that allows for seamless usage on both desktop and mobile devices. Below are the main components and screens of the GUI.



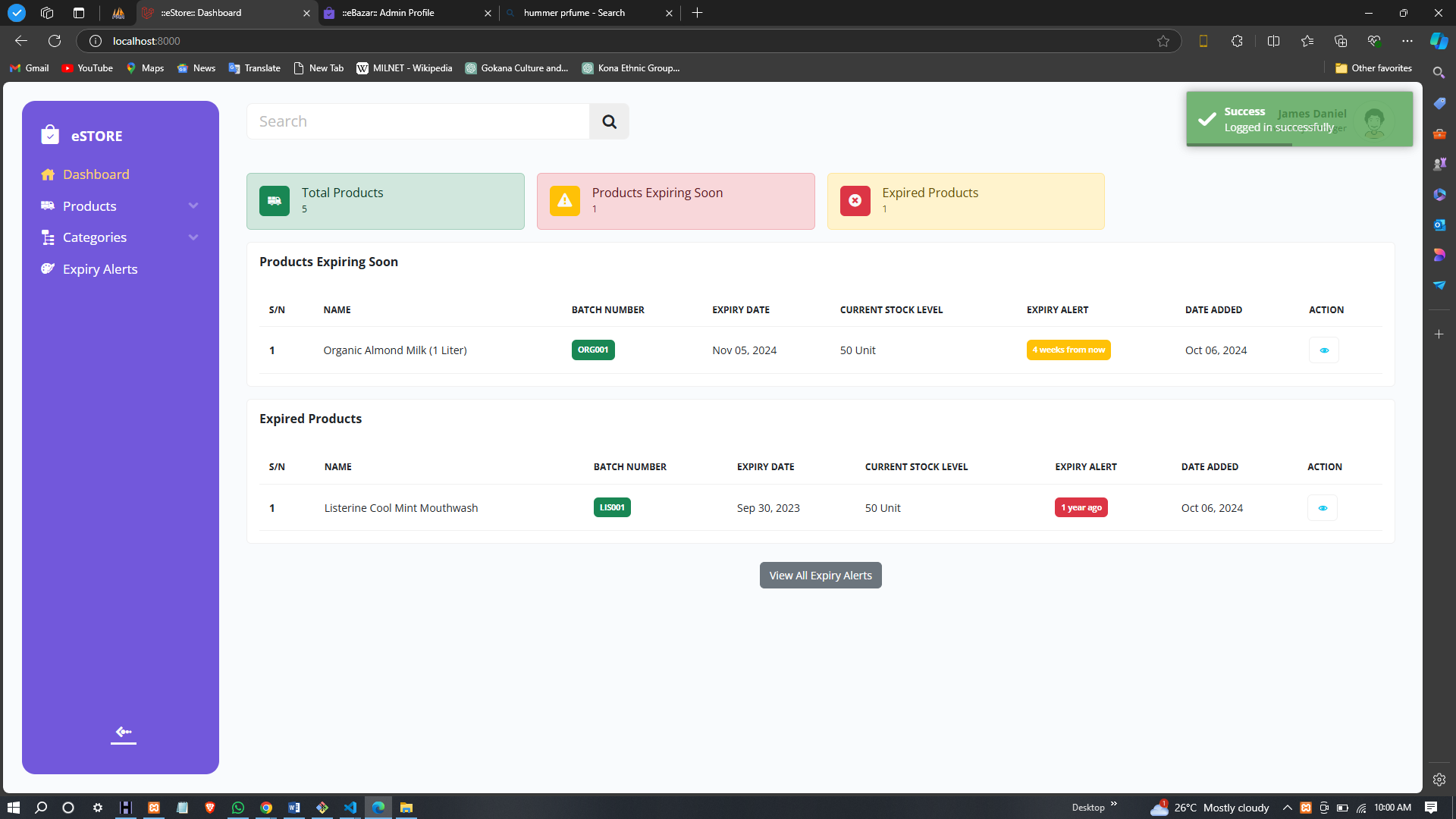
#### Figure 4. 1 Login Page

**LOGIN PAGE:** The login page is the entry point to the system, where users (admins, inventory managers, etc.) can securely log in by entering their credentials—username and password.



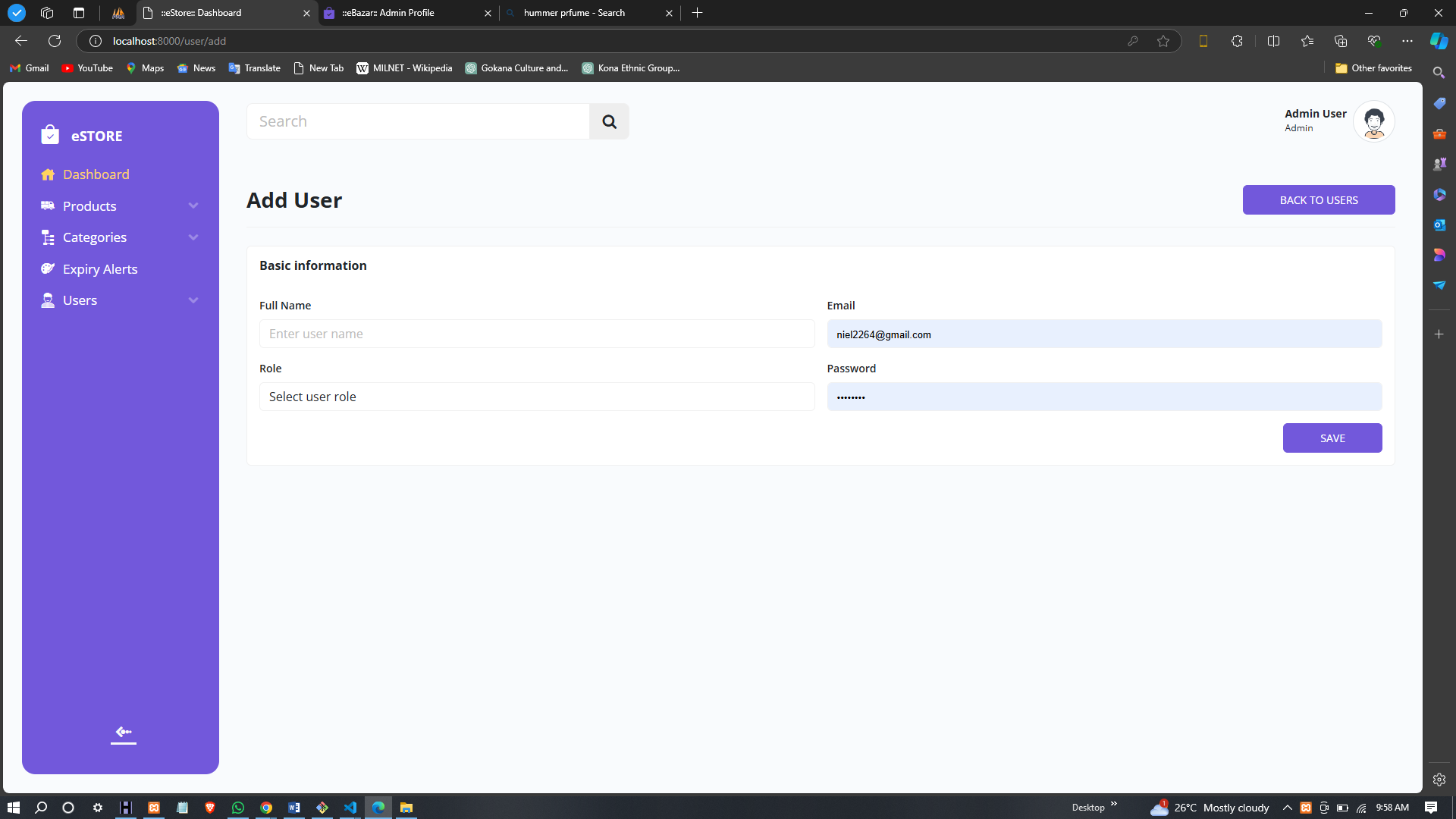
#### Figure 4. 2 Admin Dashboard

**ADMIN DASHBOARD:** The admin dashboard provides a comprehensive overview of the system, allowing administrators to monitor key metrics, manage users, view product statistics, and access various system management features. Admins can also track the number of products nearing expiry, recently expired products, and total inventory.



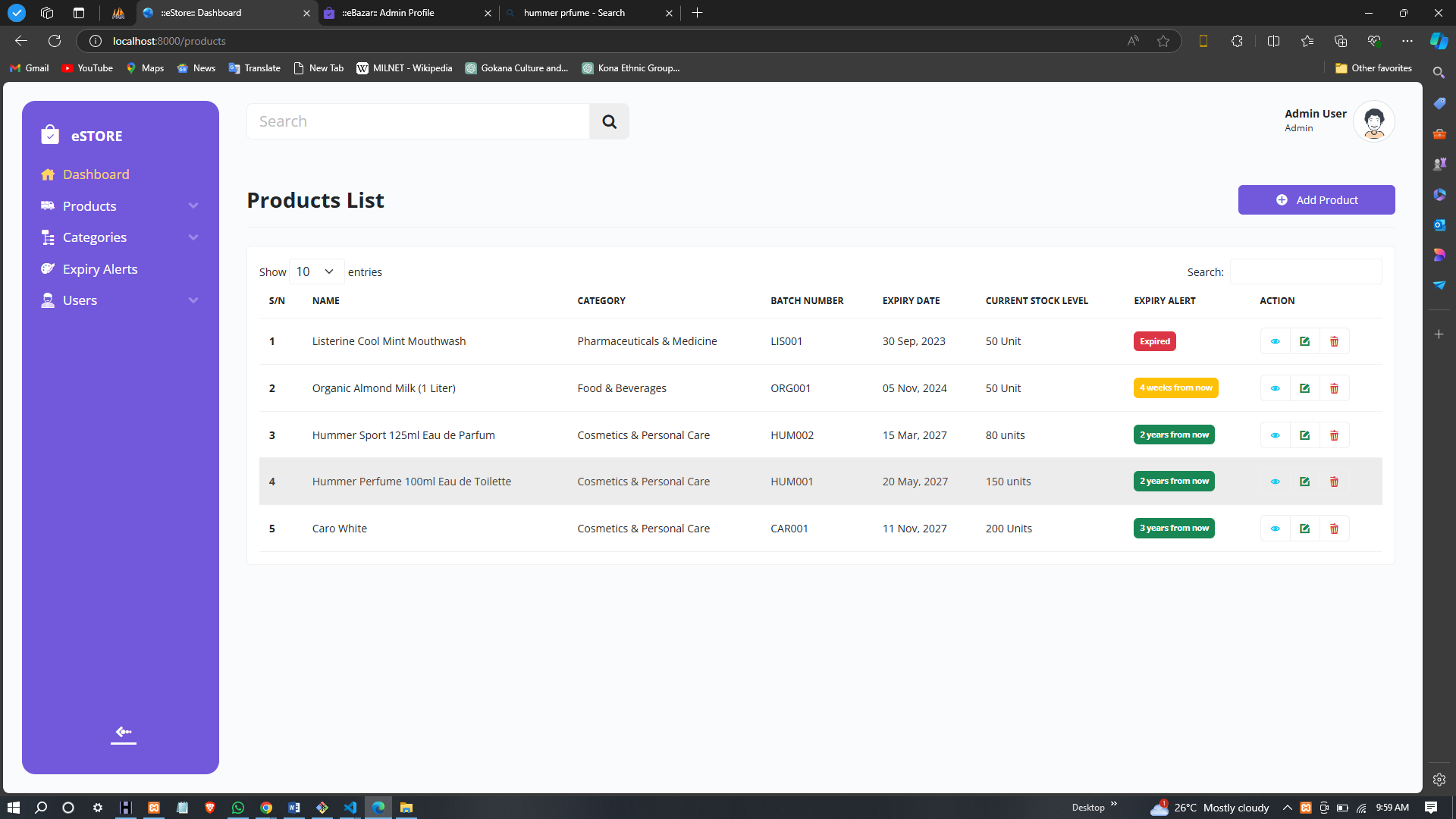
#### Figure 4. 3 User Dashboard

**USER DASHBOARD:** The user dashboard is designed for general users like inventory managers. It provides a summary of important product information, including products nearing expiry, recently expired items, and the current inventory status. Users can take actions such as managing products and viewing alerts.



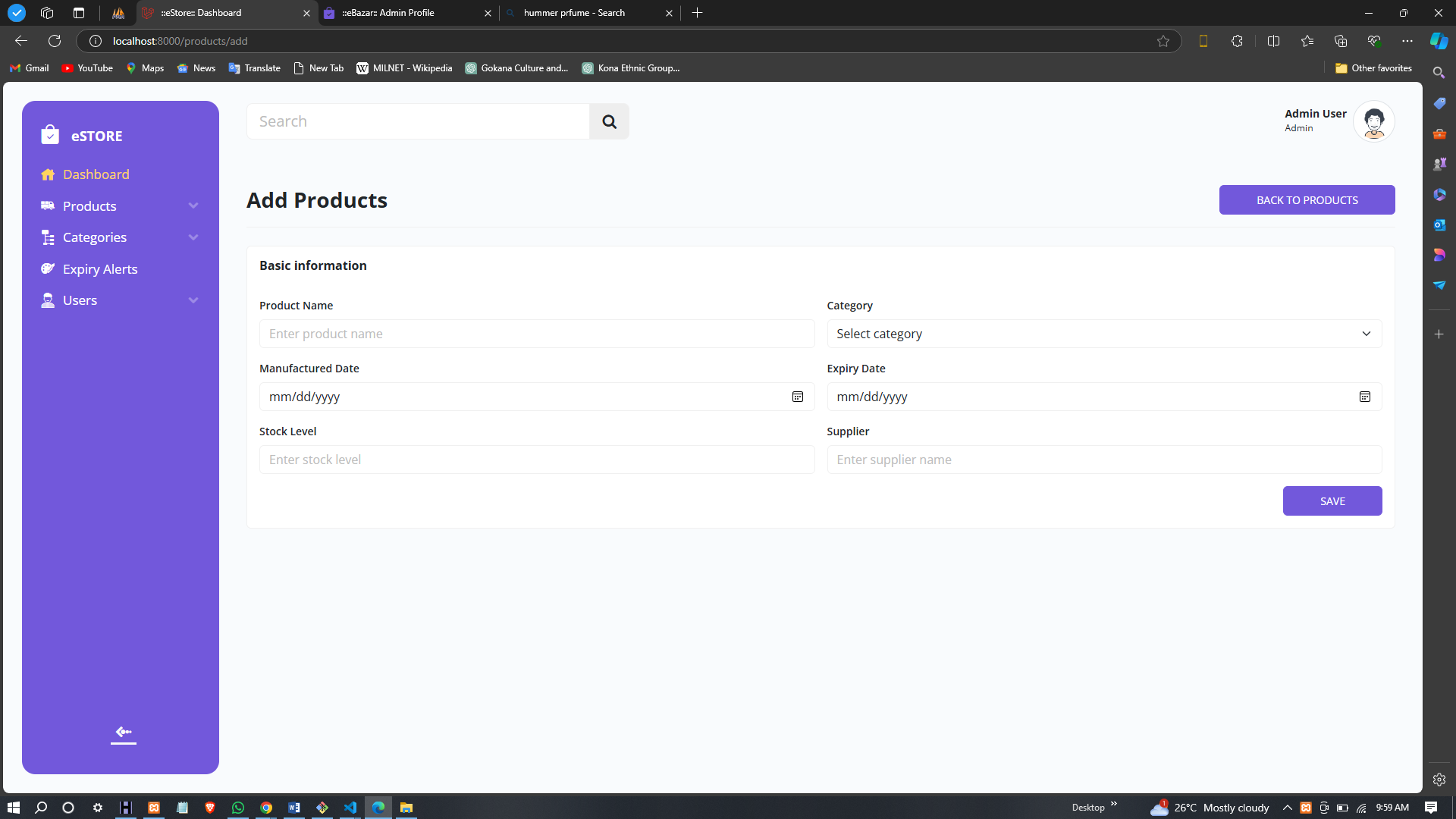
#### Figure 4. 4 Add User Page

**ADD USER PAGE:** This page allows administrators to add new users to the system, specifying their roles (admin, manager, etc.). It includes a form for entering details like username, email, password, and role.



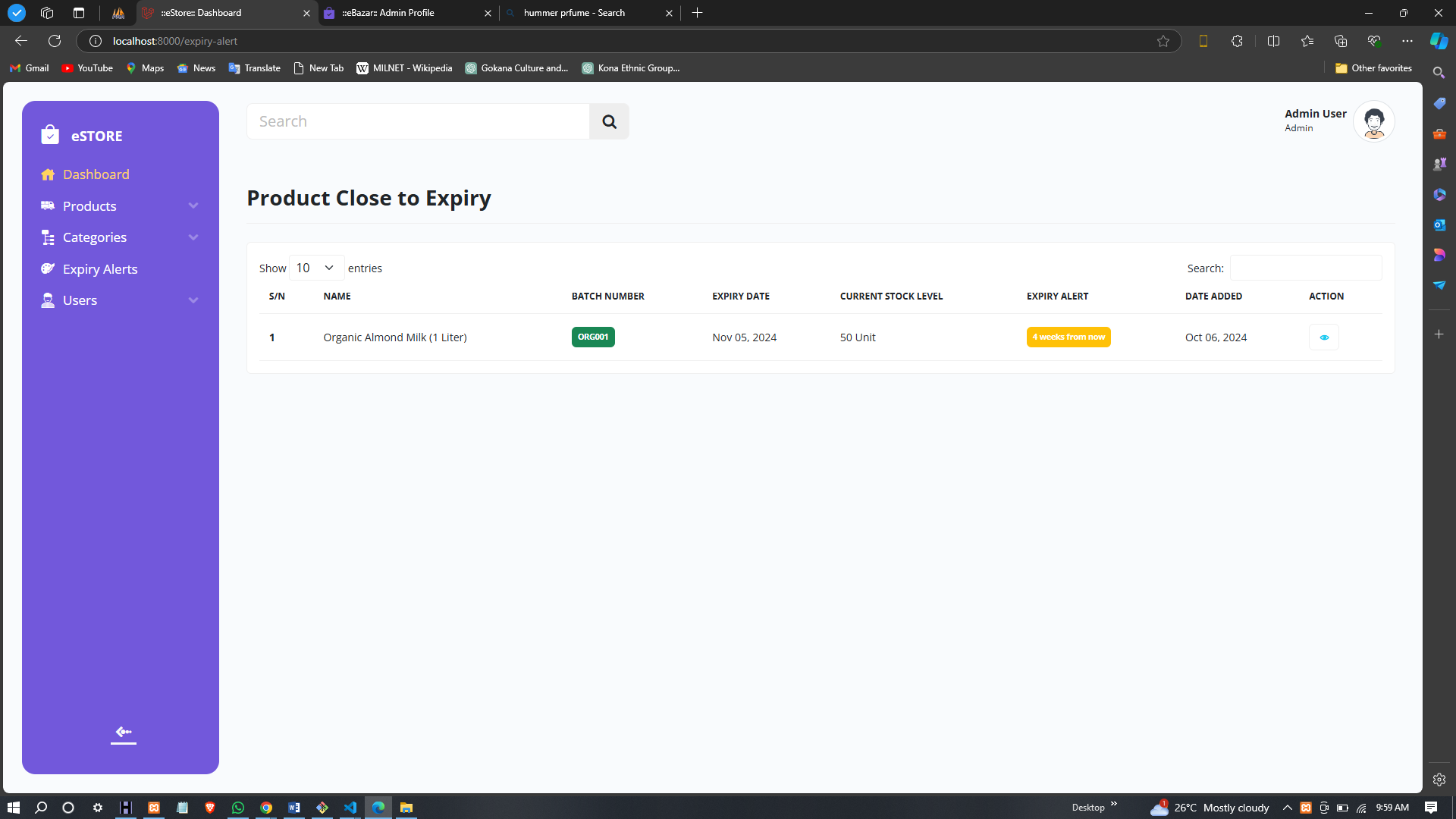
#### Figure 4. 5 Product List Page

**PRODUCT LIST PAGE:** The product list page displays all products in the inventory, providing details such as product name, category, batch number, expiry date, and stock quantity. Users can search, filter, and sort products, as well as perform actions like editing or deleting products.



#### Figure 4. 6 Add Product Page

**ADD PRODUCT PAGE:** This page enables users to add new products to the inventory by entering necessary details like the product name, category, expiry date, quantity, and batch number. The system uses this information to track expiry dates and alert users as needed.



#### Figure 4. 7 Expiry Product Alert Page

**EXPIRY PRODUCT ALERT PAGE:** This page shows automated alerts for products that are close to their expiration date or have already expired. Users can review these alerts and take appropriate actions, such as removing expired products or prioritizing them for sale.

# CHAPTER 5

**CONCLUSION AND RECOMMENDATIONS**

## 5.1 CONCLUSION

The Product Expiry Alert System has been successfully developed and implemented to address the critical challenge of managing perishable products across various settings, including households, retail stores, and warehouses. By integrating real-time notifications for products nearing expiration, the system empowers users to take timely and informed actions regarding sales, consumption, or disposal, minimizing waste and optimizing inventory management. Its intuitive, user-friendly interface supports users with diverse technical expertise, promoting smooth navigation and collaboration among multiple stakeholders. Additionally, the system's comprehensive data management capabilities enable organized tracking of inventory, monitoring of stock levels, management of expiry dates, and efficient replenishment processes. This improves decision-making, resource allocation, and overall operational efficiency. Furthermore, the system significantly contributes to sustainability efforts by reducing product waste, promoting responsible consumption, and helping businesses minimize losses while maintaining regulatory compliance.

## 5.2 RECOMMENDATION

To further enhance the Product Expiry Alert System, several key recommendations are proposed. Integrating the system with popular inventory management platforms would streamline stock management and improve data accuracy. Developing a mobile application would increase accessibility, allowing users to manage inventory and receive alerts on-the-go. Advanced reporting features would provide valuable insights into expiration trends and help businesses make data-driven decisions. Comprehensive user training and support would empower users to fully utilize the system, while a feedback mechanism would allow continuous improvements based on user input. Offering multiple notification options, such as push notifications, email, and SMS alerts, would ensure timely actions. Regular updates and system maintenance would maintain performance and security, while scalability enhancements would ensure the system can handle increased data loads as the user base grows.

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