

# AI-Based Expiry-Aware Dynamic Discount System

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**Abstract:** Smart Discount is an AI-powered dynamic discount system designed to reduce product waste and improve inventory management in e-commerce platforms. The system automatically adjusts product prices by analyzing important factors such as product expiry dates, sales trends, and inventory levels. By applying intelligent discount strategies, SmartDiscount ensures that products nearing their expiry are sold in time, preventing unnecessary waste while providing customers with attractive price reductions. The platform includes a dynamic product catalog, smart shopping cart, expiry alerts, and a savings tracker for customers, while administrators can manage inventory, monitor sales, and analyze customer activity through an interactive dashboard. Built using Python Flask, SQLite, HTML, CSS, and Bootstrap, the system provides a user-friendly and efficient solution for retailers. By combining automation with real-time analytics, SmartDiscount helps businesses optimize revenue, improve customer satisfaction, and promote sustainable retail practices.

*Index Terms - AI-Based Discount System, Dynamic Pricing, Inventory Control, Product Expiry Management, E-Commerce Analytics, Smart Retail*

*Solutions, Automated Discount Generation, Sales Forecasting, Customer Engagement, Sustainable Business Practices, Flask, SQLite.*

### 1. INTRODUCTION

In modern e-commerce and retail industries, managing product inventory efficiently is a major challenge, especially for items with limited shelf life. Many businesses face significant losses due to unsold products reaching their expiry date, leading to unnecessary waste and reduced profitability. To address this issue, intelligent pricing strategies are required that can dynamically adjust product prices based on real-time conditions. SmartDiscount is an AI-powered dynamic discount system designed to solve this problem by automatically applying discounts to products based on factors such as expiry date proximity, sales performance, and inventory levels. By offering timely discounts on products that are nearing expiration, the system encourages customers to purchase these items while helping businesses clear their inventory efficiently. The platform provides a user-friendly interface for customers to browse products, view special deals, and track their savings, while administrators can

manage inventory and monitor sales through an analytics dashboard. Built using technologies such as Python Flask, SQLite, HTML, CSS, and Bootstrap, SmartDiscount aims to create a sustainable and efficient e-commerce environment that benefits both retailers and consumers..

## 2. LITERATURE SURVEY

### 1. PhilipKotler(2016)

Philip Kotler discussed the concept of dynamic pricing and customer-oriented marketing strategies in modern retail systems. His work explains how businesses can adjust product prices based on demand, market trends, and consumer behavior. Dynamic pricing helps organizations maximize revenue and improve customer satisfaction. This concept forms the foundation for systems like SmartDiscount, where product prices change automatically depending on various factors.

### 2. VijayV.Vazirani(2018)

Vijay V. Vazirani researched algorithmic pricing and optimization techniques used in e-commerce platforms. His studies highlight how intelligent algorithms can determine optimal prices by analyzing product demand, supply conditions, and sales patterns. These methods help businesses automate pricing decisions and reduce manual errors.

### 3. HalR.Varian(2019)

Hal R. Varian studied the role of data analytics and machine learning in dynamic pricing strategies. His research shows how businesses can use data-driven techniques to adjust prices in real time based on customer demand and market conditions. This

approach is widely used in modern online platforms such as travel booking and e-commerce websites.

### 4. AndrewNg(2020)

Andrew Ng explored the application of artificial intelligence and machine learning in business decision-making systems. His work demonstrates how AI models can analyze large datasets to predict demand, optimize pricing, and improve operational efficiency. AI-based pricing systems can significantly reduce product wastage and increase profitability.

### 5. JeffreyHeer(2021)

Jeffrey Heer focused on the importance of data visualization and analytics in business intelligence systems. His research highlights how graphical dashboards and analytics tools help administrators monitor sales trends, customer behavior, and inventory levels. Such analytical insights support better decision-making in e-commerce platforms like SmartDiscount.

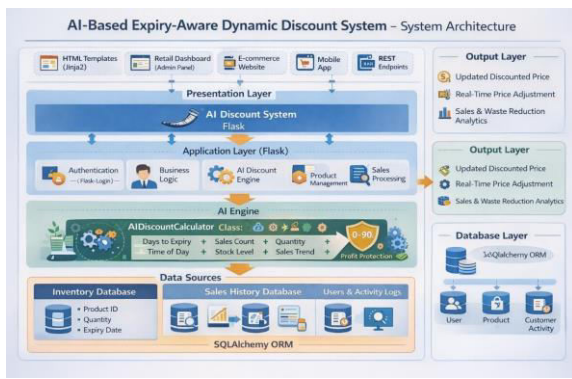
## 3. METHODOLOGY

### i) Proposed Work:

The proposed system, SmartDiscount, is an AI-powered dynamic discount platform designed to improve inventory management and reduce product waste in e-commerce environments. Unlike traditional systems with fixed pricing, this system automatically adjusts product prices based on factors such as expiry date, sales performance, and inventory levels. As products approach their expiration date or remain unsold for longer periods, the system intelligently increases discounts to encourage quicker sales. The platform provides a user-friendly interface where customers can easily browse products, view

real-time discounts, identify items that are expiring soon, and track their savings. Administrators can efficiently manage product details, monitor inventory status, and analyze sales data through a centralized dashboard with graphical reports. By integrating automation and data analysis, the proposed system helps businesses optimize pricing strategies, reduce inventory losses, and improve customer satisfaction

**ii) System Architecture:**



**Fig 1 System Architecture**

**iii) Modules**

**1. Environment Setup**

Install Python and required libraries such as Flask, Flask-SQLAlchemy, Flask-Login, and Werkzeug using pip.

**2. Project Structure Creation**

Create the project folders and files including app.py, templates folder (HTML files), static folder (CSS, JS, images), and database file.

**3. Database Design**

Design the SQLite database to store user details, product information, inventory data, and purchase history.

**4. User Authentication Module**

Implement user registration, login, and logout functionality using Flask-Login for secure authentication.

**5. Product Management Module**

Develop features for administrators to add, update, delete, and view products along with their expiry dates and stock details.

**6. AI Discount Calculation Module**

Implement the dynamic pricing logic that calculates discounts based on expiry date, sales rate, and inventory levels.

**7. Frontend Development**

Design responsive web pages using HTML, CSS, JavaScript, and Bootstrap for product display, shopping cart, and checkout.

**8. Shopping Cart and Purchase Module**

Allow customers to add products to the cart, view total price, and complete the purchase process.

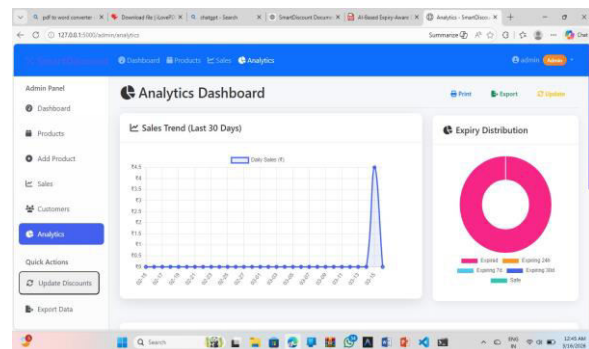
**9. Admin Dashboard and Analytics**

Create an admin panel to monitor inventory, track sales data, and display analytics using charts.

**10. Testing and Deployment**

Test all modules to ensure proper functionality and deploy the system for user access through a web browser

**4. EXPERIMENTAL RESULTS**



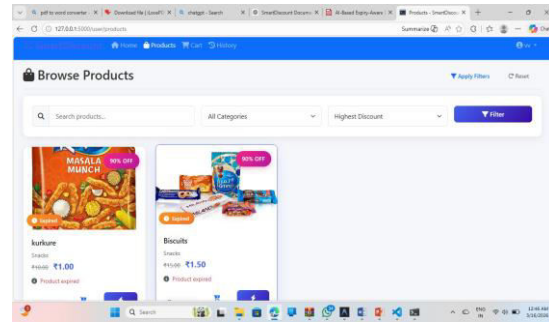
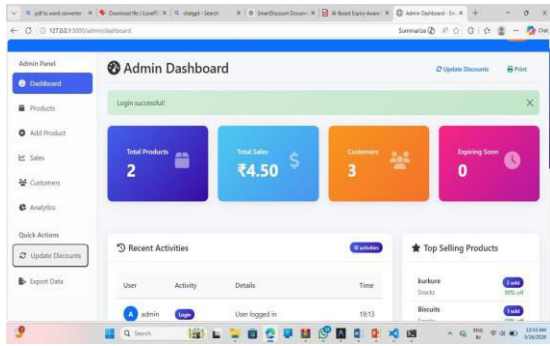


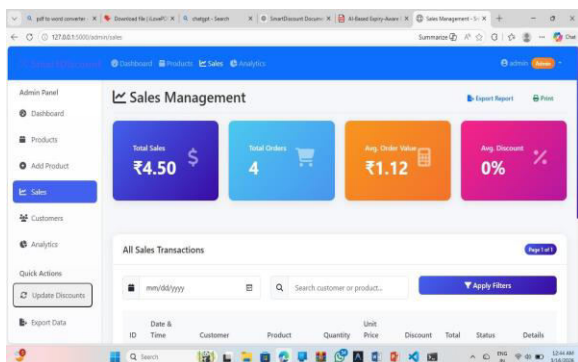
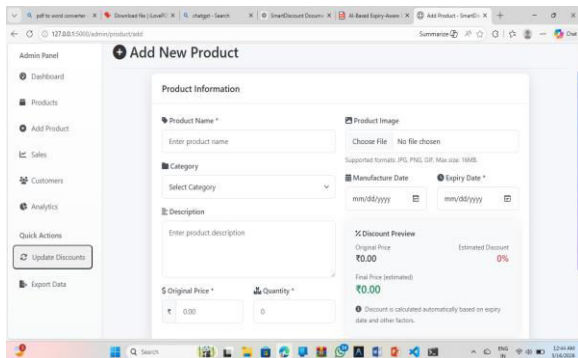
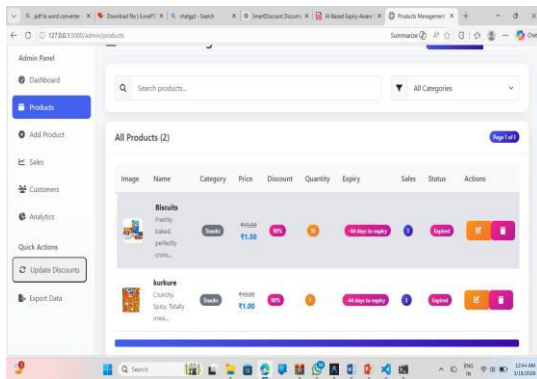
Fig 2: Results

5. CONCLUSION

The SmartDiscount system provides an effective solution for managing product inventory and reducing waste in e-commerce platforms. By implementing an AI-powered dynamic discount mechanism, the system automatically adjusts product prices based on important factors such as expiry date, inventory levels, and sales performance. This intelligent pricing strategy helps businesses sell products before they expire while offering attractive discounts to customers. The platform also provides useful features such as a dynamic product catalog, shopping cart, expiry alerts, and an analytics dashboard for administrators. Overall, SmartDiscount improves inventory management, increases sales opportunities, enhances customer satisfaction, and promotes sustainable retail practices by minimizing product wastage.

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