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Design and Implementation of an E-Commerce System for Babcock University Supermarket

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Abstract

Today's buying and selling can be seamless only with the involvement of e-commerce systems. At Babcock University, Ilisan-Remo, Ogun State, Nigeria, students and member of staff often face challenges such as standing in long queues to make payments, price discrepancies, and limited product availability while shopping at the university supermarket. This study seeks to tackle these issues by building an e-commerce system for Babcock University Supermarket. The incremental process model was adopted during the system development. The implementation tools include HTML, CSS, JavaScript (for the interactive/friendly interface), PHP and MySQL (for the backend and data management). The system also includes a chatbot integrated via FastBots API, which helps users with common queries and navigation. Another key feature is the content-based filtering recommendation system**,** which suggests products to users based on their browsing history. In conclusion, this AI-powered e-commerce system provides an efficient solution for improving supermarket operations in a university setting. This helps make shopping easier, faster, and more efficient by providing an online platform where one can browse and purchase products without hassle. The result shows how AI and e-commerce can be used to enhance retail efficiency and customer satisfaction. Future direction could incorporate integrating mobile payment options**,** enhancing the AI features for better product recommendations, and introducing delivery tracking to further improve shopping experience.

Keywords: E-commerce; Chatbot Integration; Content Filtering; Personalized Recommendations; Recommender System.

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1. Introduction

E-commerce has developed the retail industry, giving opportunities for business owners to improve their businesses by using e-commerce to expand their reach, improve customers' convenience, and operational efficiency [1]. The benefits of e-commerce in businesses cannot be overemphasized as e-commerce allows organizations to explore global markets and reach customers around the world in new ways [2]. E-commerce brings businesses to the spotlight globally, which allows them to break down geographical barriers and provides access to markets that were previously unreachable [3]. E-commerce provides consumers with the ability to shop at any time and from anywhere, and this enhances convenience and accessibility. In this age of technological advancement, retail stores have come to rely on their ability to adapt to the constantly changing needs of their customers, who expect premium shopping experiences.

Babcock University Supermarket, popularly called Babrite, exhibits some of the characteristics and functions aforementioned. Babrite is located within Ilisan Main campus of Babcock University and serves the university community, which includes the ever-growing population of students, staff, and faculty members.

2. Problem Statement

In Babcock University community, students and staff often encounter a range of challenges while shopping at the Supermarket, and this usually impacts their overall satisfaction with the services provided. The most significant challenges they face are: poor customer service, discrepancies between price tags on the shelves and actual amount of the goods, long waiting time in the queues and limited stock of products available. This necessitates the need to design and implement an e-commerce system.

3. Aim and Objectives

The main aim of this study is to design and implement an AI-powered e-commerce system for Babcock University Supermarket, with the goal of improving customer experience and operational efficiency. The specific objectives are to:

i. design a model for an AI-powered e-commerce system for Babcock University Supermarket.
ii. implement an AI-powered e-commerce system based on the designed model.
iii. evaluate the developed AI-powered e-commerce system.

4. Methodology Overview

i. For the design of the model, the UML (Unified Modelling Language) diagrams were applied to construct the user-system interactions and the major system design.
ii. For the implementation of the AI-enhanced e-commerce system, HTML, CSS and Javascript were used for the frontend for a user-friendly website and maintainable code and PHP for the backend for easier data handling. The AI layer adopted FastBots API for chatbot functionality to provide automated responses while the recommendation system applied a rule-based algorithm for easy management.

5. Literature Review

E-commerce systems are essentially a collection of processes that manage online retain operations such as: showcasing product catalogues, administering shopping carts, and facilitating secure payment transactions [5]. These systems provide significant convenience for people by allowing them to access goods and services that may otherwise be limited by physical constraints. Globally, the growth in digital literacy and the increasing demand for campus services have been driving the university-based e-commerce market. This trend is particularly evident in universities in the developed countries where digital commerce platforms are being integrated with existing campus services to enhance community experiences [6].

The application of e-commerce systems in Nigeria universities is still in its early stages. While institutions like Covenant University have established e-commerce platforms to improve service delivery in campus settings [7], the full integration of modern technologies, including machine learning, has not yet been fully realized. Machine learning offers great potential in enhancing e-commerce systems by creating personalized user experiences, efficiently managing inventory, and maintaining high standards of financial reporting [8].

5.1 Overview of Existing Systems

Since the late 20th century, the internet has produced many platforms that focus on convenience and efficiency. A related work is a chatbot created by Covenant University students in Nigeria that helps the customers by answering questions and assisting with placing order using natural language processing, allowing users to talk to it like they would with a real person [9]. However, most existing systems are generic and are not customized to cater to local university environments.

Jumia and Amazon use artificial intelligence (AI) in their e-commerce systems to make online shopping experience better for users. Jumia recommends products to customers based on what they have earlier bought or checked [10]. This helps people find things they might like without strenuous search. Amazon also uses AI by having chatbots that can help customers with their questions. These chatbots can answer common questions, help track orders, and provide quick support without needing human intervention which implies that users can get help right when they need it [11].

Platforms like Jumia, Konga and AliExpress have been evaluated on usability factors such as: navigation, search relevance, product information and customer service and evidence shows that these factors contribute significantly to customer satisfaction [12]. Additionally, incorporating AI-driven features like smart recommendations and automated customer support can enhance usability and engagement [13].

5.2 Review of Closely Related Works

The following table summarises the review of some closely related works highlighting the work done and gaps identified in each of the studies. The review is limited to the most recently done studies in relation e-commerce applications.

Table 1: Summary of Review of Closely Related Works

S/N	Author(s)	Title	Year	Summary of works	Gaps Identified
1.	Univio Editorial Team [14]	E-Commerce Trends 2025: A Year of Challenges, Opportunities, and Optimization	2025	Analyzes key e-commerce trends for 2025, including operational efficiency, scalability, and the role of advanced analytics.	Broad analysis without specific focus on smaller supermarkets.
2.	Santoshi Deshkmukh, Swapnil Gundewar [15]	A Comparative Analysis of Rule-Based and AI-Driven Systems for Improving Customer Satisfaction and Engagement in E-Commerce Using Chatbots Powered by Artificial Intelligence	2025	This research focuses on the use of chatbots and natural language processing (NLP) in banking support, with banks increasingly utilizing AI-driven chatbots to enhance customer support and communication.	There is no specificity in explaining chatbot implementation in banking. The report overgeneralizes AI's impact without concrete examples and ignores challenges like security risks or handling complex inquiries.
3.	Nitin Rane, Saurabh Choudhary, Jayesh Rane[16]	Acceptance of artificial intelligence technologies in business management, finance, and e-commerce: factors, challenges, and strategies	2024	This study looks into the acceptance of artificial intelligence (AI) in business management, finance, and e-commerce, highlighting factors driving adoption, obstacles, and strategies for integration.	There is no consideration for how perceptions of AI might change over time or how different types of organizations (like small vs. large businesses) face unique challenges.

4.	Saarah Hendricks, Samwel Dick Mwapwele [17]	A systematic literature review on the factors influencing e-commerce adoption in developing countries	2024	This study explores the factors influencing e-commerce adoption in developing countries, focusing on technology, environment, and customer trust. It found that these factors are interconnected and can be addressed collectively to boost adoption.	The findings rely heavily on qualitative analysis through thematic assessment but do not present quantitative data that could strengthen the conclusions, such as statistics on e-commerce growth rates or user engagement.
5.	Ransome Epie Bawack, Samuel Fosso Wamba, Kevin Daniel Andre Carillo, Shahriar Akter [18]	Artifcial intelligence in ECommerce: a bibliometric study and literature review	2022	This paper synthesizes AI research in e-commerce using bibliometric analysis and literature review. It identifies core research themes like sentiment analysis, trust, personalization, and optimization in AI in e-commerce.	The paper does not explore the application of AI in smaller or more specific settings like university e-commerce platforms. There is also limited research on the practical challenges of integrating AI in regions with less developed infrastructure, like Nigeria.

5.3 Gap Analysis

1. Unexplored Areas in University E-commerce Research: Although e-commerce research in academic environments is plentiful, few studies focus on integrating machine learning into university settings in Nigeria. Most existing research examines basic e-commerce functionalities without exploring how AI-driven personalization and predictive analytics could transform small-scale retail environments [19]. This presents an opportunity to explore these advanced features further.

2. Unique Needs of Babcock University and Babcock Super store: Babcock University's Supermarket requires a customized e-commerce solution that integrates advanced machine learning capabilities. The platform should include AI-powered product recommendations, optimize inventory using predictive analytics, and ensure secure payment processing through partnerships with local fintech companies like Flutterwave and Paystack. These could address unique operational needs and enhance overall user experience.

3. Analysis of Existing Solutions and Their Shortcomings: Local e-commerce platforms in Nigeria scarcely offer advanced machine learning features necessary for personalized user experiences and predictive inventory management [7]. By incorporating AI into campus e-commerce solutions, user engagement would be significantly improved, and stock levels could be optimized based on real-time demand. This would address the shortcomings of existing solutions and provide a tailored, efficient platform for the university system.

6. Methodology

6.1 System Architecture

The system architecture for the Babcock University Supermarket e-commerce platform follows a three-tier architecture. It is a common client-server architecture in web applications which separates an application into three logical layers:

1. Presentation Layer (Client-Side): In the Presentation Layer, users interact with a website built with HTML, CSS and Javascript. The content-based recommendation system then suggests products to users based on predefined conditions, which are frequently bought-together items and their favorite categories.
2. Application Layer (Server-Side): The Application Layer handles all the underlying functions process requests from the frontend. The backend uses PHP and MySQL to make sure everything runs smoothly by pulling user information, sending it to the recommendation system to get personalized recommendations, and then displaying these recommendations in the frontend. The backend also manages inventory, tracks stock levels and allows admins to update, add, or remove products.
3. Data Layer (Database and AI Services): The Data Layer handles the intelligent functionalities of the system including the chatbot and the recommendation engine.

Figure 6.1 illustrates the system architecture.

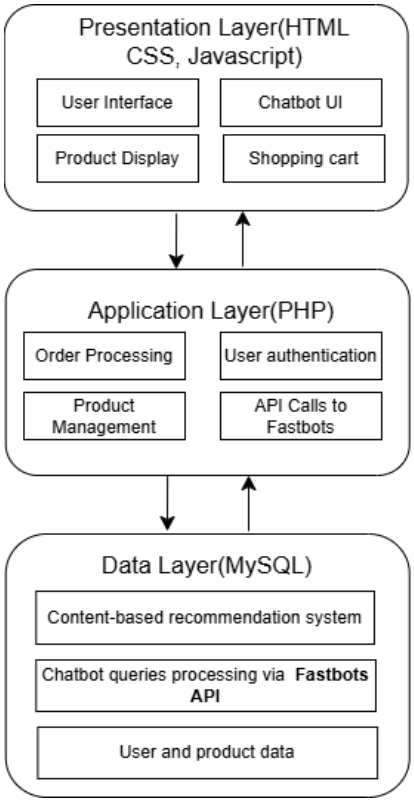

Figure 6.1: System Architecture of the E-Commerce System

6.2 Flowchart for User Interaction

The flowchart in figure 6.2 shows the interactions between users and the admin and provides a clear view of the system's workflow within the e-commerce system.

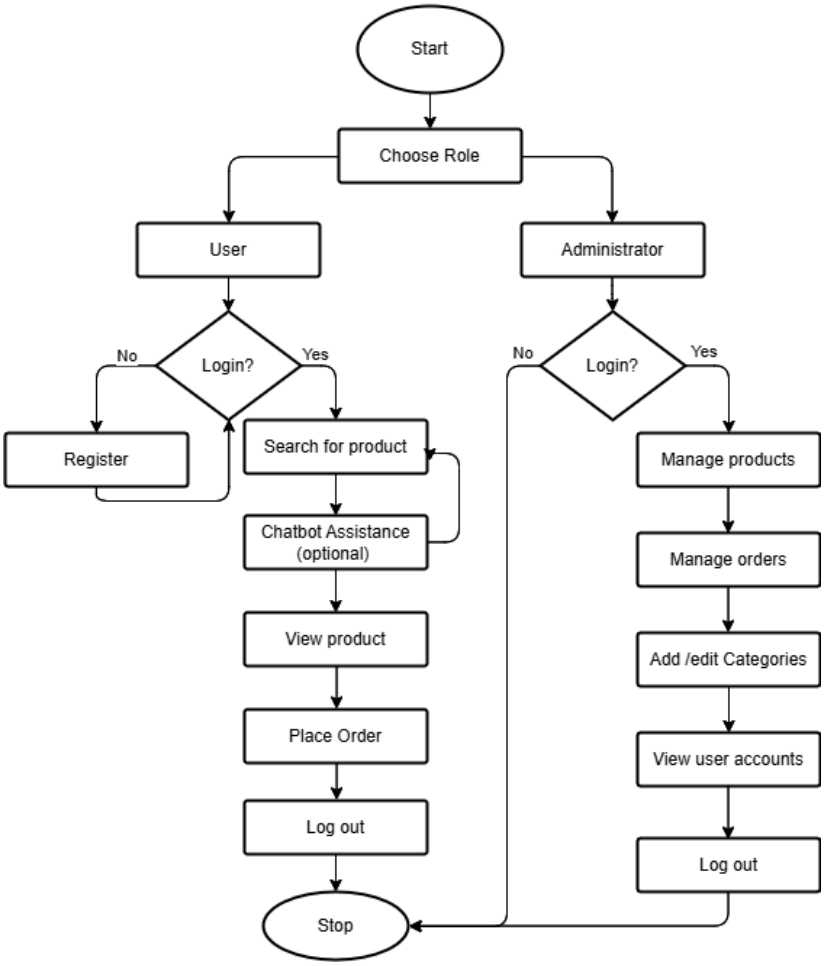

Figure 6.2: Flowchart showing the Interaction between the User, Administrator and the System

6.3 Use Case Diagram for the E-Commerce System

The use case diagram shows how various users interact with the system. The main actors are the Customer and Admin.

For Students (Customers)

1. The system allows the student to log in**.**
2. The system allows the student to view products.
3. The system displays product recommendations.
4. The system enables the student to add items to the cart**.**
5. The system allows the student to checkout items**.**
6. The system offers chatbot interaction to assist students.
7. The system provides order confirmation after checkout.

For Administrators

1. The system allows the admin to add products to the inventory.
2. The system enables the admin to edit products in the inventory.
3. The system allows the admin to validate order status.
4. The system enables the admin to view user accounts.

Figure 6.3 represents the use case diagram which shows the various interactions between users and E-commerce system. It displays the central actions that the actors: student and Administrator can perform.

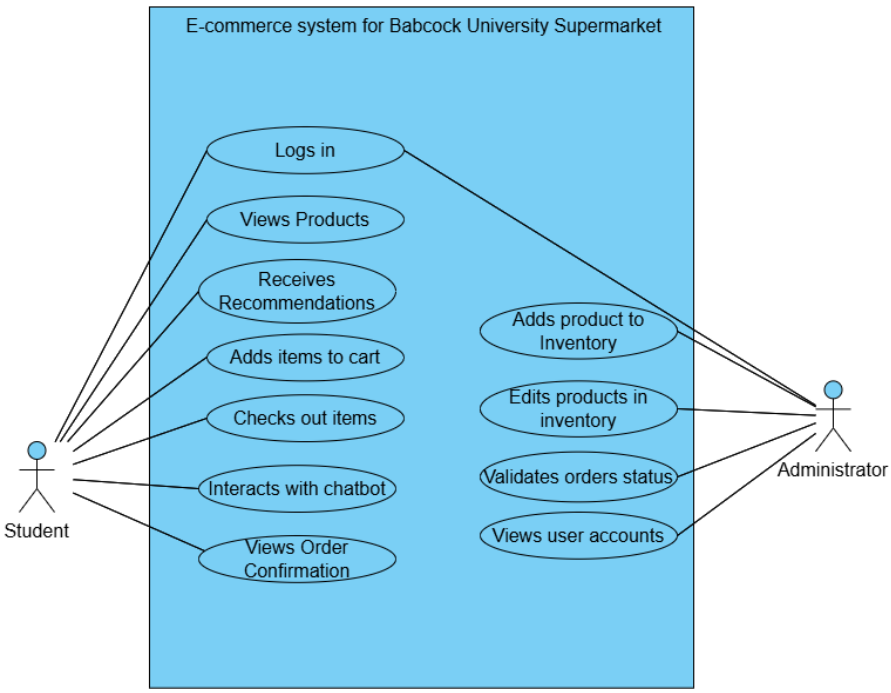

Figure 6.3: Use case Diagram showing User Interaction with System

6.4 Sequence Diagrams for the E-Commerce System

6.4.1 Sequence Diagram for the Product Recommendation System

Figure 6.4 shows how the system generates product recommendations. When a student visits the Products Page (UI), a request is sent to the Recommendation Engine (Backend - PHP), which retrieves the student's browsing history from the Database (MySQL). The backend identifies the top two most-viewed product categories and selects four random products from those categories. The results are returned to the UI and displayed as recommendations.

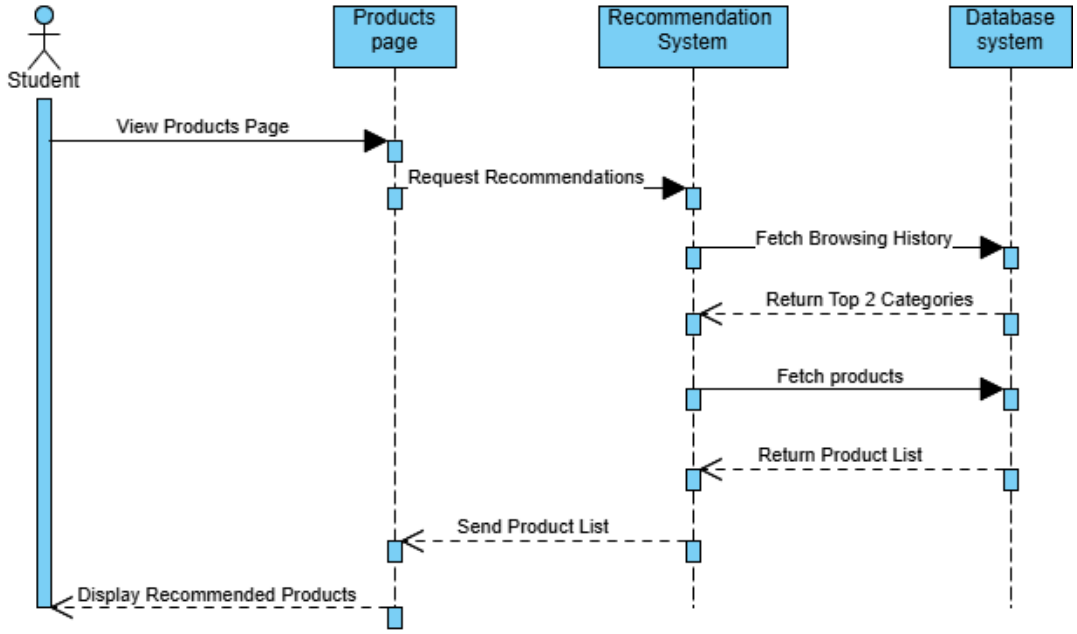

Figure 6.4: Sequence Diagram for the Product Recommendation System

6.4.2 Sequence Diagram for adding an Item to Cart

Figure 6.5 explains the process of adding a product to cart. When a student selects an item and clicks "Add to Cart," the Products Page (UI) sends a request to the Cart Service (Backend - PHP), which checks the Database (MySQL) to verify if the product already exists in the cart. If not, it inserts the product and confirms the addition. The UI then updates the cart and displays a confirmation message.

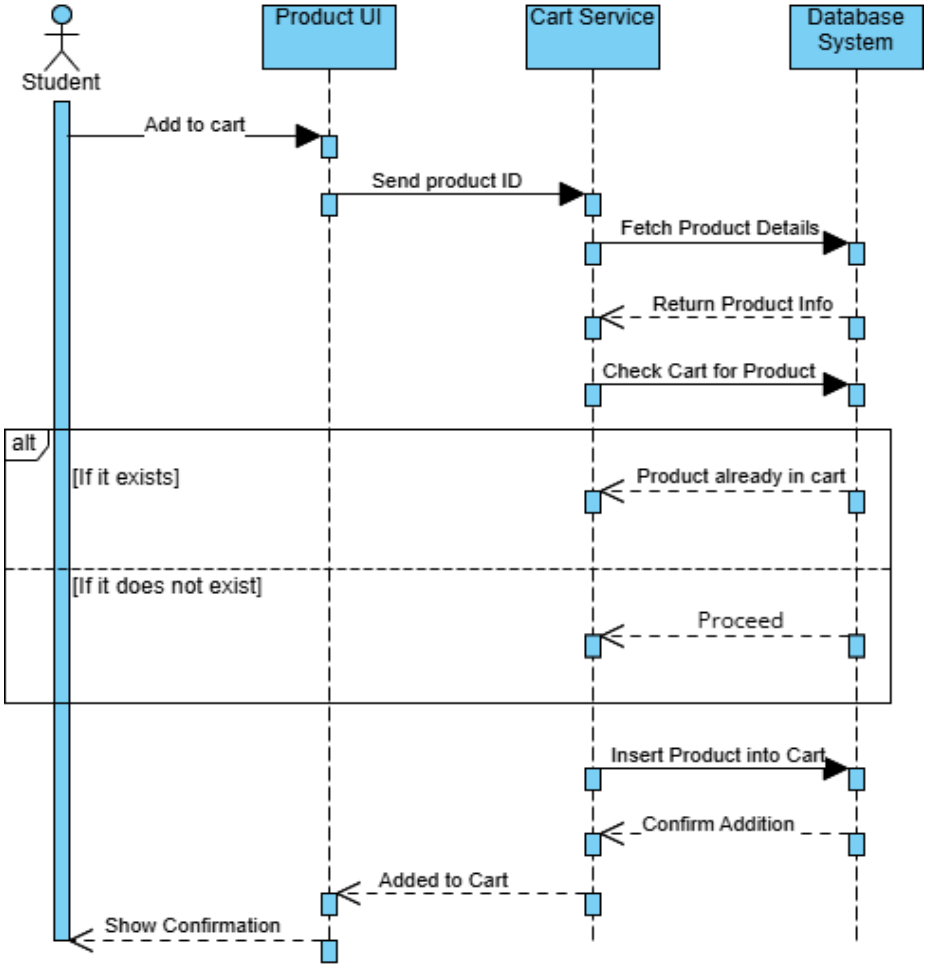

Figure 6.6: Sequence Diagram for adding an Item to Cart

6.4.3 Sequence Diagram for Cart Checkout

Figure 6.7 details the sequence of events during checkout. When a student initiates checkout from the Cart Page (UI), a request is sent to the Checkout Service (Backend - PHP). The backend retrieves the cart items from the Database (MySQL), converts them into an order, and updates the order status.

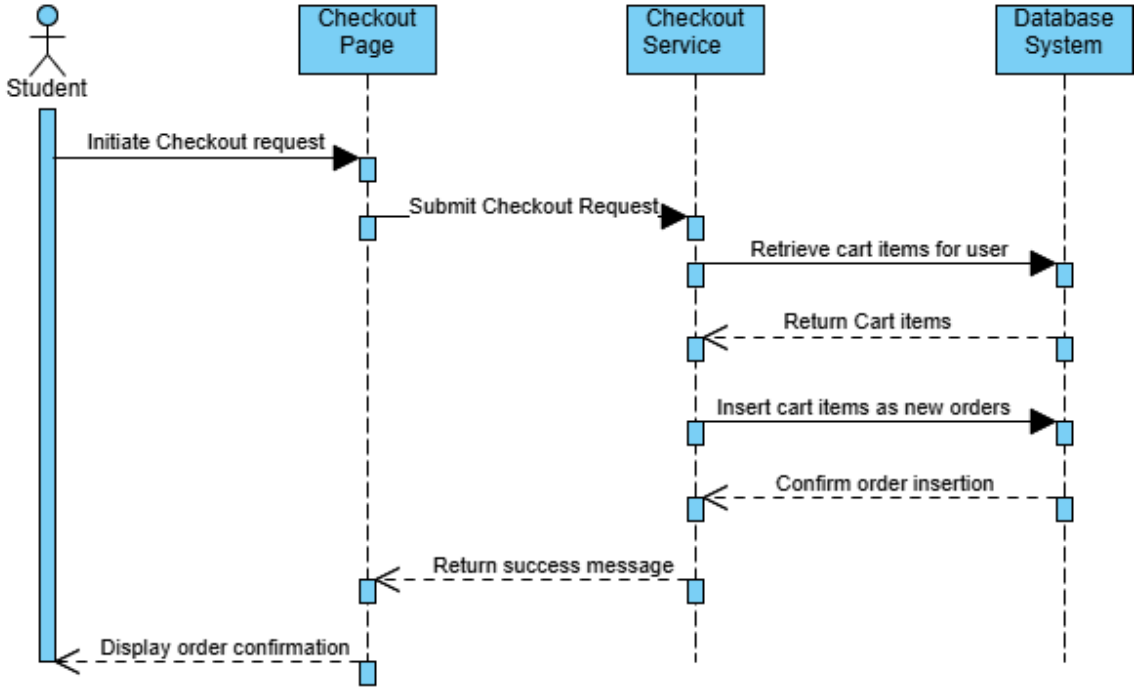

Figure 6.7: Sequence Diagram for Cart Checkout

6.4.4 Sequence Diagram for Chatbot Interaction

Figure 6.8 demonstrates the chatbot interaction process. When a student sends a message in the Chatbot UI (Chat Window), the request is forwarded to the FastBots API (External Service), which processes the message and returns a response. The UI then displays the chatbot's reply to the student.

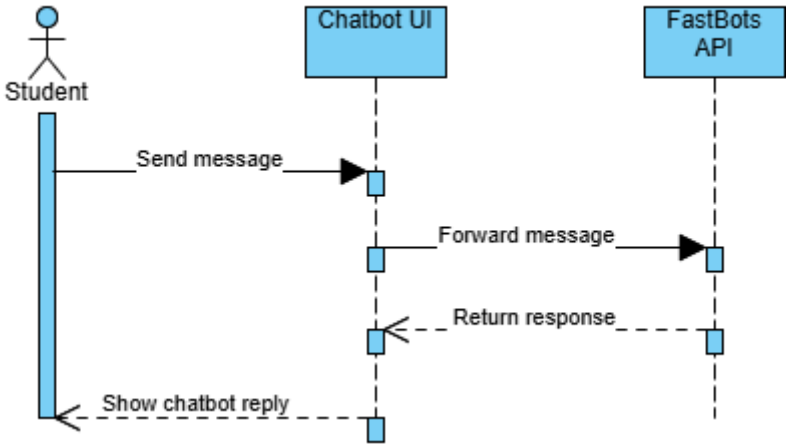

Figure 6.8: Sequence Diagram for Chatbot Interaction

6.4.5 Sequence Diagram for Admin adding a New Product

Figure 6.9 depicts how an administrator adds a new product. The admin enters the product details in the Admin

Dashboard (UI), which sends the data to the Product Service (Backend - PHP). The backend stores the new product in the Database (MySQL) and confirms the addition. The UI then displays a confirmation message to the admin.

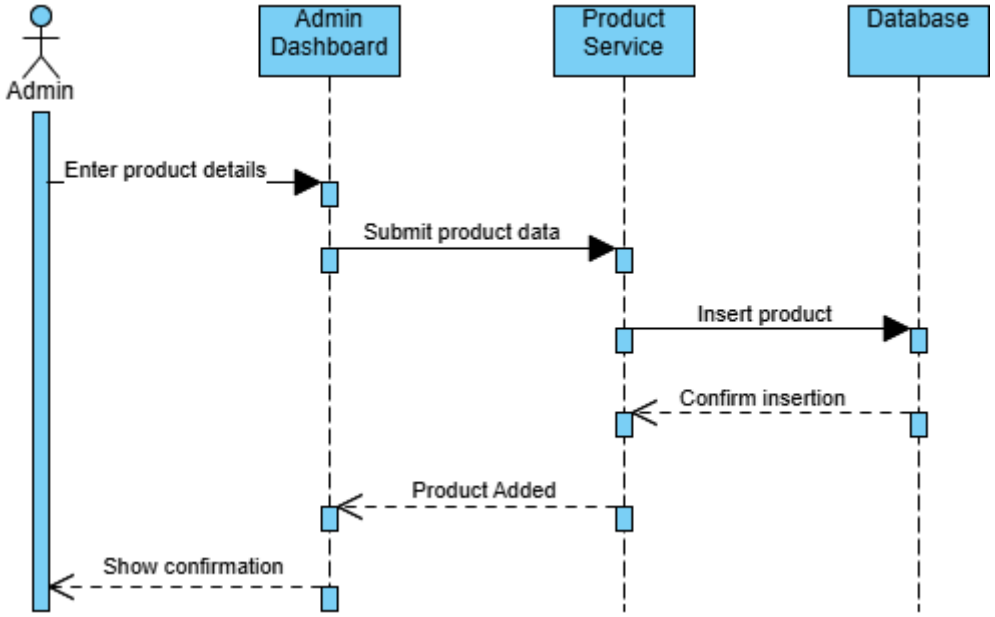

Figure 6.9: Sequence Diagram for Admin adding a New Product

6.4.6 Sequence Diagram for Admin Updating a Product

Figure 6.10 represents the sequence for updating product details. The admin modifies the product information on the Admin Dashboard (UI) and submits the changes. The Product Service (Backend - PHP) updates the corresponding record in the Database (MySQL) and confirms the update.

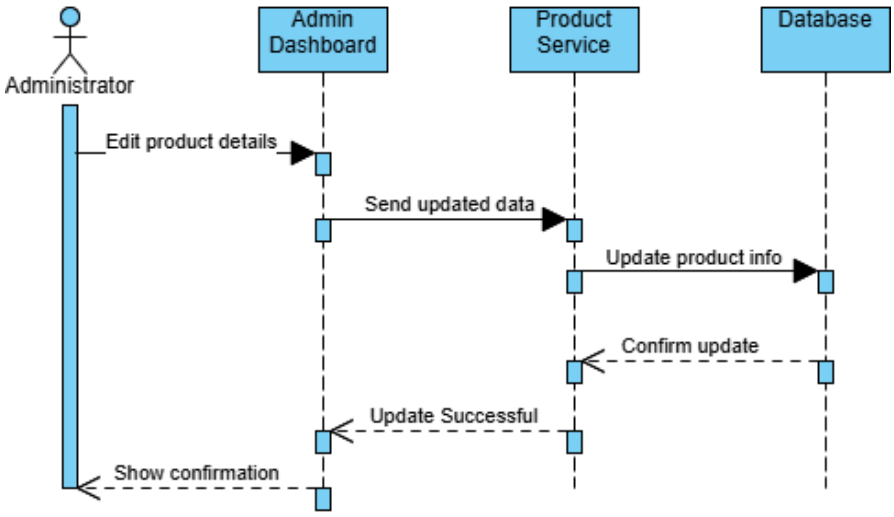

Figure 6.10: Sequence Diagram for Admin Updating a Product

6.4.7 Sequence Diagram for Admin Confirming Product Delivery

Figure 6.11 describes how an admin marks an order as delivered. The admin selects an order on the Admin Dashboard (UI) and confirms delivery. The Order Service (Backend - PHP) updates the Orders Table in the Database (MySQL), changing the status to "Delivered." A confirmation message is then sent back to the UI.

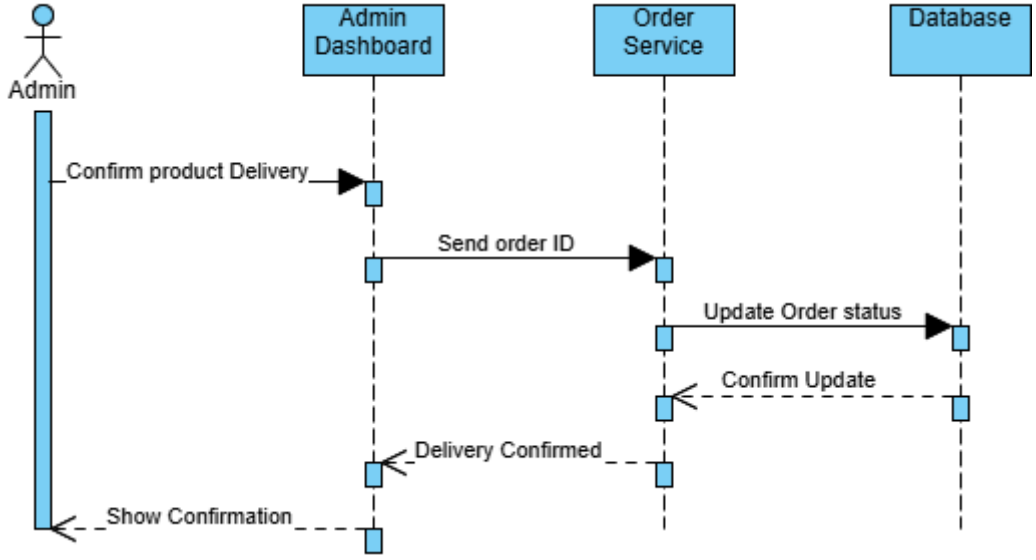

Figure 6.11: Sequence Diagram for Admin Confirming Product Delivery

6.5 Class Diagram for the E-Commerce System

The class diagram represents the structural design of the Babcock University Supermarket e-commerce system; it provides an object-oriented view of how students, admins, products, orders, and other system components interact. The diagram also defines relationships between the core entities of the system.

Figure 6.12 presents the detailed class diagram for the system.

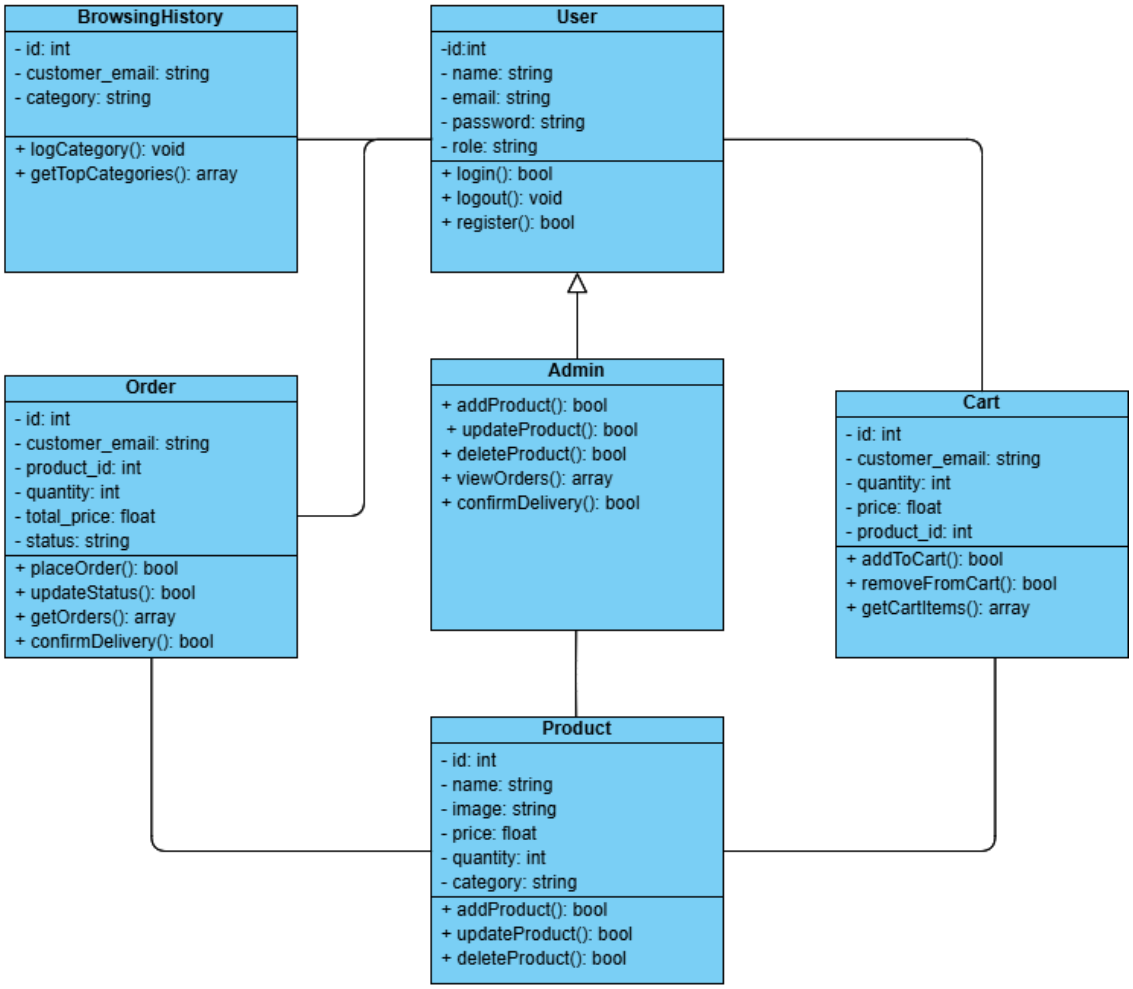

Figure 6.12: Class Diagram of the E-Commerce System

7 . Results and Implementation

7.1 User Homepage (Before Order)

Once the user logs in to the system, the next is homepage, where one can browse products. At this stage the recommendation system does not have any records of user's browsing or order history so it does not display recommended products as shown in figure 7.1. When the cursor hovers over a product, it displays icons to add products to cart, favorites or view the product description.

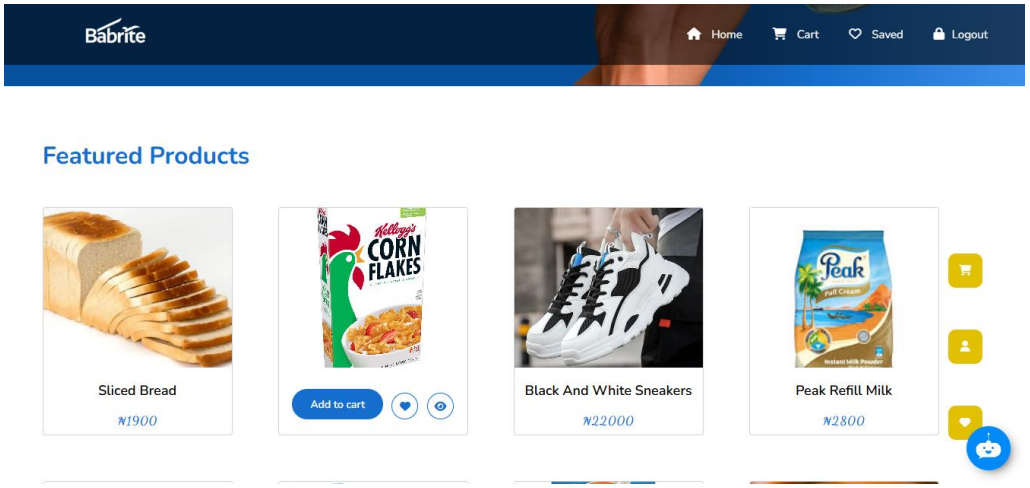

Figure 7.1: User Homepage before Ordering any Product

7.2 Chatbot Window

This window is displayed from the icon at the bottom right corner as shown in figure 7.2.

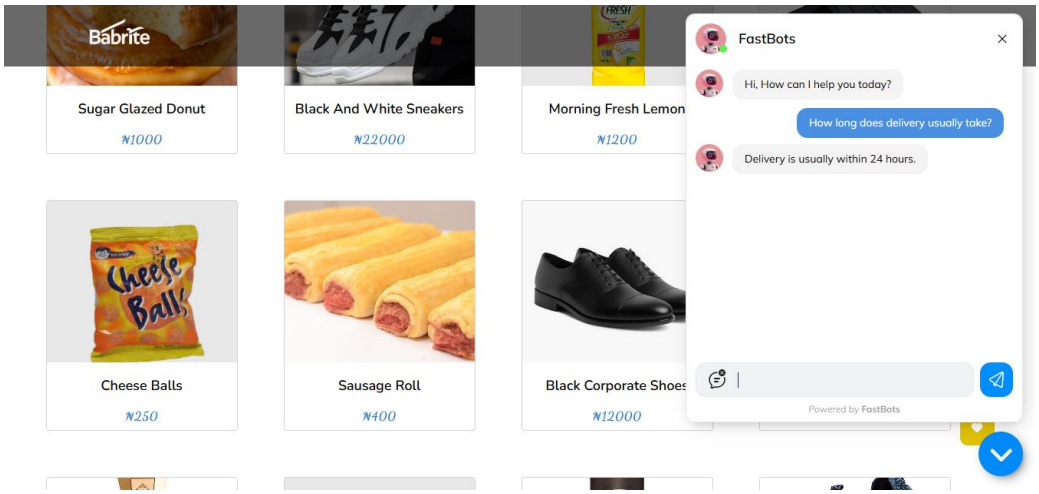

Figure 7.2: Chatbot Window

7.3 Checkout Page

After selecting items, students go to the Checkout page to complete their order, the cart updates in real time and shows the selected items and the total price as shown in figure 7.3.

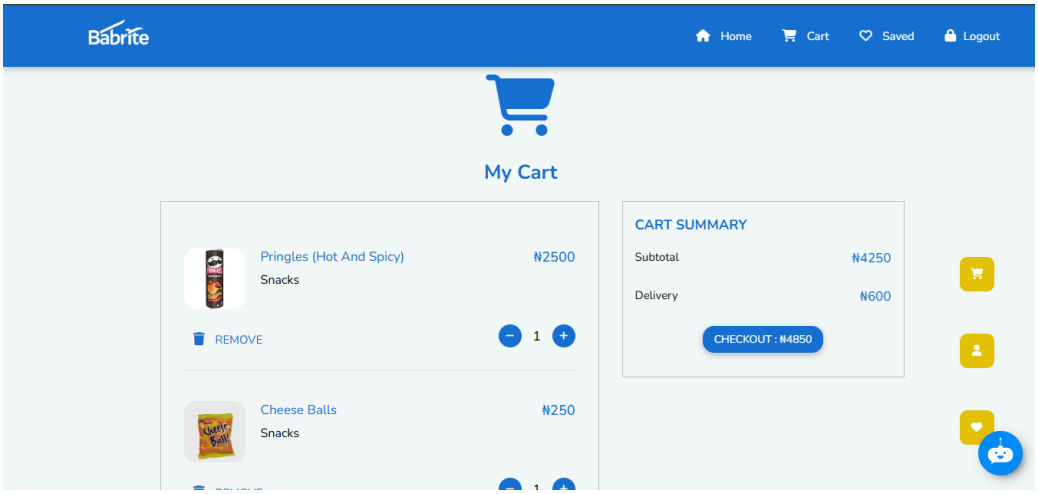

Figure 7.3: Checkout page

7.4 Order Status Page

In this page, the user can view the status of everything they have ordered, whether it is confirmed or it has been delivered as shown in figure 7.4.

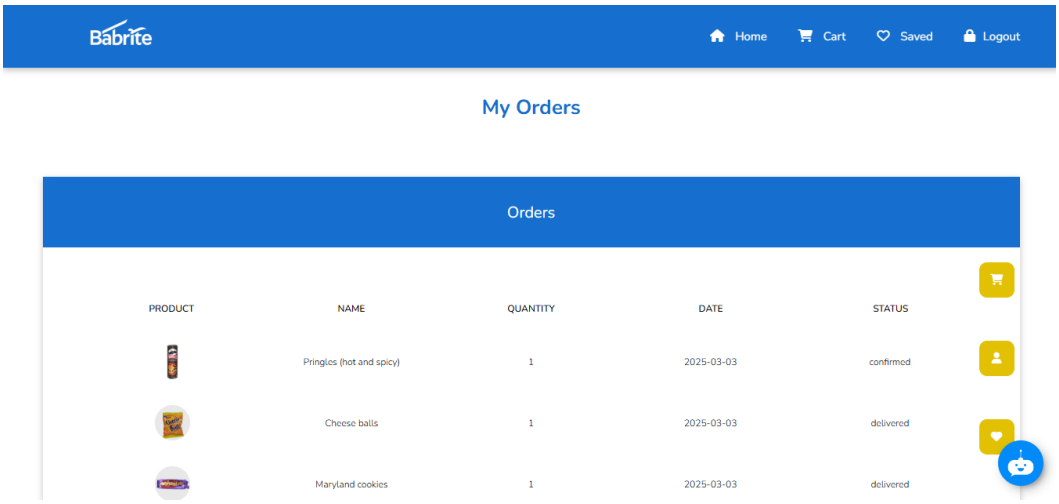

Figure 7.4: Orders page

7.5 Homepage (After Order – Personalized Recommendations)

After an order has been successfully made, the database now has some information on the user's preferences and updates the homepage with personalized recommendations as shown in figure 7.5.

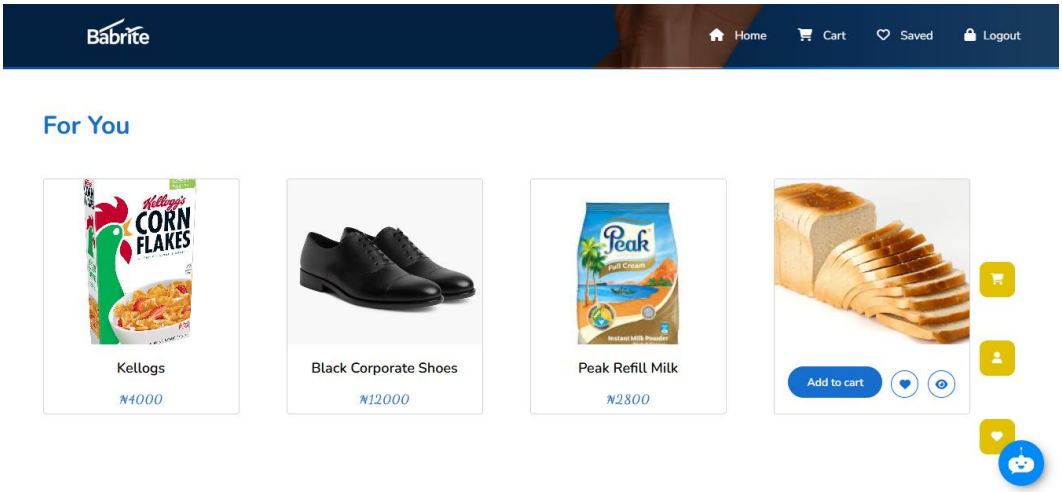

Figure 7.5: User's Homepage After Order

7.6 Inventory Management

Upon logging in, admins immediately see a list of products in the inventory and each product entry display the following details: name, price, stock quantity and an option to update or delete the item. This allows the admins to keep track of stock levels and make changes when necessary as shown in figure 7.6. Figure 7.7 depicts an admin updating a product's information. Figure 7.8 shows the screen to add a new product to the site.

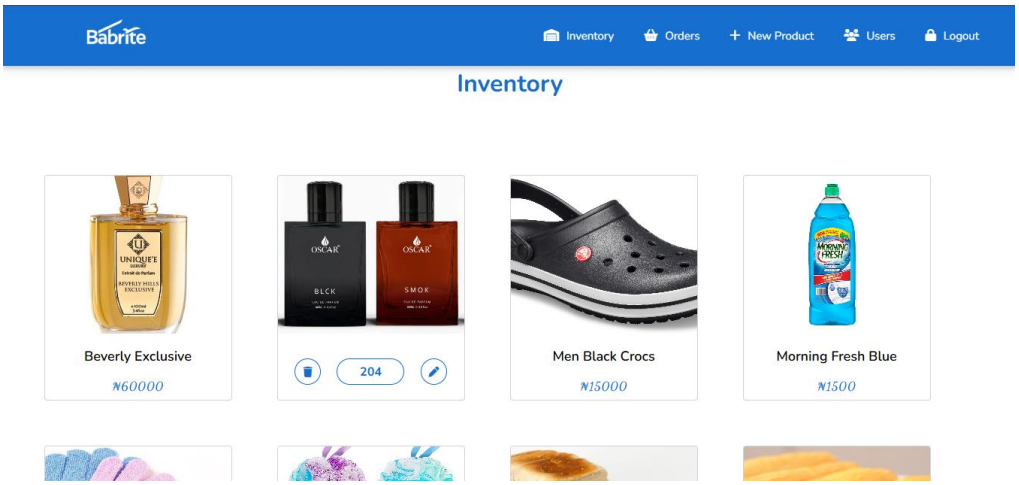

Figure 7.6: Inventory Page

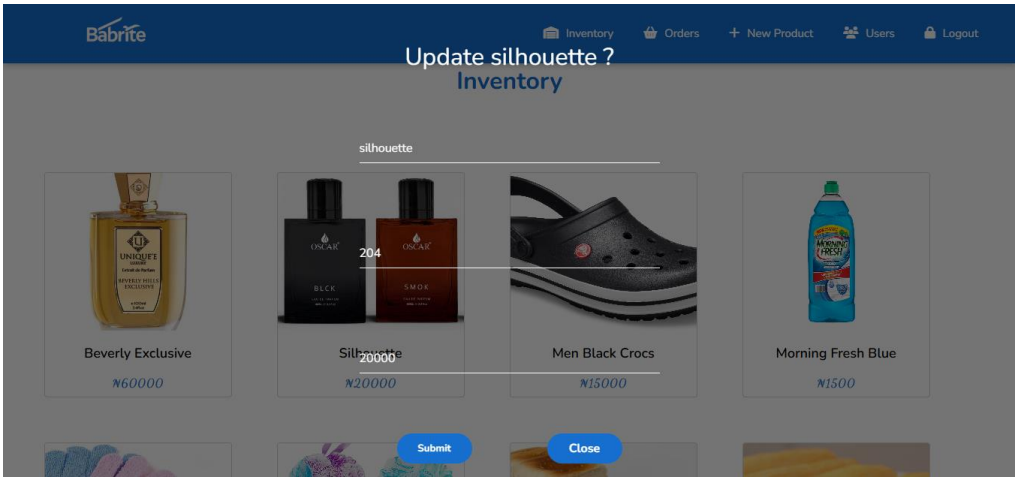

Figure 7.7: Product Details Update

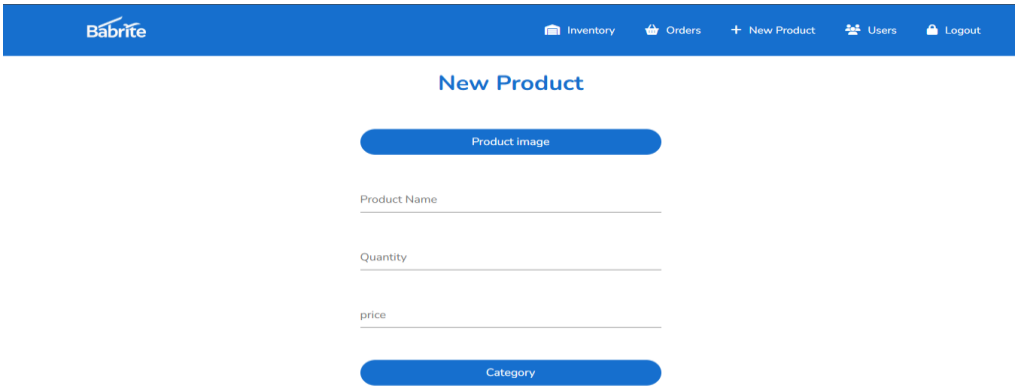

Figure 7.8: New Product Page

7.7 Order Management

Admins can navigate to the order management screen, where they see a list of all pending and completed orders. Each order includes details such as the student's name, ordered items, and the status of the order. Admins can either confirm or reject orders as shown in Figure 7.9.

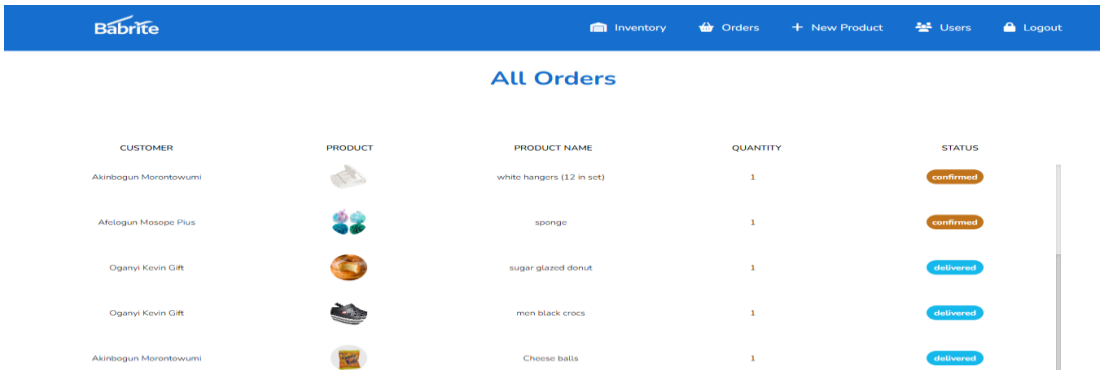

Figure 7.9: Order Tracking Screen

8 . Conclusion and Recommendations

This study aimed at designing and implementing an AI-enhanced e-commerce system for Babcock University supermarket incorporating intelligent recommendations so as to improve the shopping experience and reduce time spent waiting in queues. The scope and limitation of this design is a campus system network where the system can successfully support university community. This improves the efficiency of campus-based retail operations. The work has a recommendation system built specifically for a university supermarket, which is not common in campus retail stores. The system provides simple product recommendations based on user interactions. It also provides a chatbot to assist users in navigating the system. This could serve as a foundation for future studies on improving e-commerce in the university campuses and similar niche markets. Further recommendations could include the incorporation of machine learning techniques to refine suggestions based on seasonal trends and school activities, addition of online payment options, addition of a panel for deliverymen for easier order tracking and a mobile friendly version of the system.

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