

Design and Development Web-Based E-commerce Website with AI Integration

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FINAL YEAR DESIGN PROJECT REPORT

**This Report Presented in Partial Fulfillment of the
Requirements for the Degree of Bachelor of Science in
Computer Science and Engineering**

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APPROVAL

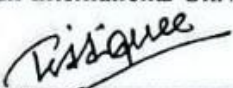
This Project titled “**Design and Development Web-Based E-commerce Website with AI Integration**”, submitted by Md. Ashikur Rahman Shovo, ID No: **203-15-3925** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on **17 September, 2025**.

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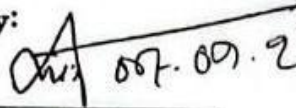
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We hereby declare that this project has been done by us under the supervision of **Dr. Md. Ali Hossain**, Associate Professor, Department of Computer Science and Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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ABSTRACT

Online shopping has become an essential aspect of daily life in the current digital era, especially in quickly emerging economies like Bangladesh where technological breakthroughs are changing corporate methods and customer behavior. In order to give customers a smooth, safe, and incredibly responsive buying experience, this project focuses on designing and developing a full e-commerce platform for electronics and smart devices. To create a dynamic and interface that is easy to use and functions well on both desktop and mobile devices, the system makes use of the Django framework for dependable back-end operations, SQLite3 for dependable database administration, and contemporary front-end technologies like HTML, CSS, Tailwind CSS, and JavaScript. Product classification, sophisticated search and filtering capabilities, a shopping cart, safe checkout, and an administrator panel for effective administration of users, orders, and items are among the essential features. Apart from these fundamental features, the project incorporates an AI-driven assistant intended to improve user engagement and streamline platform navigation. Through conversational contact, users can track orders, find goods, get personalized suggestions, and solve common problems thanks to the AI assistant's capability for natural language questions. Through real-time assistance and a more interesting, human-like shopping experience, this clever integration not only increases accessibility but also boosts customer pleasure. To increase consumer engagement and retention, the platform also includes order monitoring, real-time notifications, responsive design principles, and personalized suggestions. All things considered, this project shows how modern web technology and artificial intelligence can be used practically to produce a creative and expandable e-commerce solution. The platform demonstrates how technology-driven solutions can make online shopping smarter, more efficient, and customer-centric while addressing the changing needs of the contemporary electronics retail industry. It does this by combining a visually appealing, responsive front-end with a secure and well-structured back-end and enhancing it with AI-driven interaction.

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Chapter 1

Introduction

1.1 Introduction

E-commerce has transformed the way people purchase in today's digital world by providing the ease of accessing a large selection of things at any time and from any location. However, people frequently struggle to identify the things they need fast as online marketplaces get bigger and more complex. By creating a web-based e-commerce platform specifically for electronics and smart items, our initiative tackles these issues.

Modern web technologies such as Django for back-end development, SQLite3 for database administration, and HTML, CSS, Tailwind CSS, and JavaScript for the front-end are used in the platform's construction. To improve accessibility and usability, especially for users who prefer hands-free engagement, the voice search feature uses natural language processing. This allows users to find products using spoken instructions. Additionally, the platform focuses on personalization and inclusivity, ensuring that users with different tastes and digital skills can navigate and interact with the system effectively.

This project aims to build a highly effective e-commerce solution that meets the changing needs of online customers by combining strong web development frameworks, user-friendly design, and modern search capabilities.

1.2 Motivation

The rapid growth of e-commerce and the increasing demand for effective, user-friendly online shopping systems are the main reasons for this initiative. Although online shopping is now widely accessible, many platforms still use traditional, text-based search methods and basic interfaces. This can make it difficult for customers to find products quickly or navigate the system easily.

These restrictions are especially clear in Bangladesh. Users come from diverse language backgrounds and have different levels of digital skills. Because of this, a modern e-commerce platform must feature an engaging and easy-to-use interface. It should support various ways for users to interact, such as voice search and personalized recommendations.

Building a cutting-edge e-commerce platform specifically for the Bangladeshi market is another goal of this project. It offers a contemporary user experience and demonstrates how technology may enhance accessibility and personalization in online shopping by utilizing AI features like voice recognition. In the end, this initiative aims to introduce

fresh ideas to the e-commerce industry, facilitating faster, easier, and more pleasurable buying for all.

The platform is designed to provide a scalable foundation that can handle increasing traffic and user needs over time. It also supports smooth navigation and faster product discovery. This project aims to deliver an effective, reliable, and modern e-commerce system for electronics and smart products. It focuses on using the latest web technologies and a well-organized structure. In doing so, it aims to set a standard for user-focused online shopping experiences in Bangladesh.

1.3 Objective

The primary objective of this initiative is to design and Development a cutting-edge, web-based e-commerce platform that offers a smooth, user-focused shopping experience, with an emphasis on smart items and gadgets. The system seeks to provide a responsive, effective, and dynamic platform that satisfies the demands of a wide range of users by utilizing cutting-edge web technologies and frameworks.

Particular goals consist of:

1. **Putting Advanced Search Features in Place:** Include voice search capabilities driven by natural language processing (NLP) to help customers find products quickly with spoken instructions, decreasing the need for text input and improving accessibility.
2. **Personalized Recommendations:** To guarantee that every user gets a customized shopping experience, employ AI-driven algorithms to examine user behavior, browsing history, and purchase habits in order to make relevant product recommendations.
3. **Ensuring Inclusive and Accessibility:** utilize responsive web technologies, such as HTML, CSS, Tailwind, and JavaScript, while designing the interface to make it easier for users of all skill levels, devices, and language preferences to utilize the site.
4. **Building a Sturdy Back-end:** To ensure safe, scalable, and effective data handling—including product management, user authentication, and order processing—use Django as the back-end framework and SQLite3 for database administration.
5. **Modern Web Development Practices:** As a model for Bangladesh's next-generation e-commerce platforms, highlight the integration of front-end and back-end technology, AI-based personalization, and voice-enabled interaction.

By attaining these objectives, the project seeks to produce a fully functional, technologically advanced e-commerce website that combines intelligent features with a user-friendly design, delivering a modern shopping experience customized to the electronics and smart products market.

1.4 Methodology

This web-based e-commerce platform was developed using a methodical and structured approach to guarantee a dependable, expandable, and user-friendly

system. Requirement analysis, system design, deployment, testing, and continuous maintenance are all included in the methodology.

1.4.1 Requirement Analysis

The first stage is to collect and examine stakeholder and end-user demands. Advanced voice search, AI-powered product suggestions, trending product highlights, safe authentication, and effective cart and order management are among the key features that have been discovered. To make sure the platform takes into account the unique difficulties experienced by Bangladeshi users, such as linguistic variety and differing degrees of computer literacy, user surveys, interviews, and competitor analysis were carried out.

1.4.2 System Design

The system design phase establishes the platform's high-level and detailed structures based on the requirements. The selected technological stack consists of:

- Front-end: JavaScript, HTML, CSS, and Tailwind for interactive and responsive user interfaces.
- Backend: For reliable server-side operations, use the Django framework.
- Database: SQLite3 for effective and portable data administration.

The personalized recommendation engine is powered by AI algorithms, while voice search functionality is integrated using Natural Language Processing (NLP). To illustrate the system architecture and interactions, UML diagrams were developed, including use case, class, and sequence diagrams.

1.4.3 Implementation

Agile implementation practices enable frequent testing and incremental development. Django and Python handle the back-end logic, ensuring secure handling of user authentication, product management, and transactions. JavaScript, HTML, and Tailwind CSS are used on the front-end to create a responsive and user-friendly experience. Strict security procedures are followed during development to safeguard user information and stop illegal access.

1.4.4 Testing

The system's performance, security, and dependability are guaranteed by extensive testing. There are several types of testing, including unit, system, integration, and user acceptance testing (UAT). Security testing, which includes input validation, session management, and defense against typical web vulnerabilities, receives particular emphasis.

1.4.5 Deployment

Cloud services are used to deploy the platform in order to guarantee scalability and high availability. To guarantee smooth maintenance and upgrades, pipelines for continuous integration and deployment or CI/CD are utilized. Proactive management is made possible by system monitoring, which keeps track on user behavior, performance, and security problems.

1.4.6 Maintenance and Iteration

Post-deployment maintenance ensures that the platform remains up to date, secure, and functional. Regular updates fix problems, improve features, and maintain security standards. This creates a dependable and safe online shopping experience for

all users. By focusing on Django, Python, and security measures, this approach provides a stable and reliable e-commerce platform that meets modern online shopping needs.

1.5 Project Outcome

The project's end product is a scalable, reliable, and secure e-commerce platform designed for smart devices and gadgets. The platform, which was developed using contemporary web technology, offers a smooth and effective online purchasing experience. Important results include:

- **User-Friendly experience:** The platform guarantees a responsive, aesthetically pleasing, and user-friendly experience that is appropriate for desktop and mobile users by utilizing HTML, Tailwind CSS, and JavaScript.
- **Optimized Product Search:** Users may find desired items more quickly with a rapid and accurate product search tool, which also reduces search effort and improves overall usability.
- **Full Admin Panel:** Django-powered back-end enables administrators to effectively manage users, orders, items, and reviews, guaranteeing seamless operational control.
- **Secure Payment and Checkout:** Secure session handling, SSL encryption, and CSRF protection keep transactions safe and ensure dependable payment processing.
- **Real-Time Notifications:** To improve user engagement and retention, automated email alerts notify users of purchase updates, password resets, and special offers.
- **Scalable and Maintainable Architecture:** Built with Django and Python, the system is built to manage increased traffic and data growth, making future expansion seamless.
- **Security and Privacy of Data:** Web security best procedures like safe authentication, encrypted storage, restricted access controls, safeguard for consumer information.

In summary, the project combines cutting-edge web technologies, a scalable back-end, and strong security features to produce an e-commerce platform that is incredibly functional, safe, and effective. The platform guarantees dependable and secure operations for administrators and users alike, in addition to improving the user experience.

1.6 Organization of the Report

From project conception to implementation, testing, and evaluation, this report is organized to provide a coherent and understandable flow. The following is how the chapters are arranged:

- **Chapter 1: Overview**
Gives a summary of the primary objective motivation and the need of developing a safe and intuitive e-commerce platform.
- **Chapter 2: Context**
Explains the project's technological underpinnings, including database administration, security considerations, web development frameworks, and earlier studies on online retail systems
- **Chapter 3: Methods of Research**
Explains the technique, which includes the use of Django, Python, Tailwind CSS, and SQLite3, as well as requirement analysis, system design, functional and non-functional requirements, and user interface design.

- Chapter 4: System Design
Covers database structures, web interface design and system architecture. incorporates class and ER diagrams to show the components and how they interact.
- Chapter 5: Execution and Outcomes
Focuses on creating and integrating essential features, such as the admin panel, product search, secure payment options, and notifications.
- Chapter 6: Assessment and Testing
Explains testing methods with a focus on security, dependability, and user experience, such as unit testing, system testing, and performance evaluation.
- Chapter 7: Wrap-Up
Highlights the platform's usefulness while summarizing its major successes, difficulties, and lessons learned. It also makes recommendations for future development.

To give readers a thorough grasp of the project's technical design, development life-cycle, and operational outcomes, each chapter builds on the one before it.

This paper covers every phase of the creation of the e-commerce platform in an organized manner, from conception to completion. Goals, motivation, and the necessity of a safe, user-friendly system are described in Chapter 1. The technological foundation and relevant studies are reviewed in Chapter 2. The prerequisites, instruments, and research technique are described in Chapter 3. The system design, including the architecture and schematics, is described in detail in Chapter 4. Key features and implementation outcomes are presented in Chapter 5. Testing techniques with an emphasis on security, dependability, and performance are covered in Chapter 6. Chapter 7 offers a through synopsis of the initiative lifecycle and results, concluding with accomplishments, difficulties, lessons learned, and suggestions.

Chapter 2

Background

2.1 Introduction

Nowadays, In the current time Global retail has changed as a result of e-commerce, which allows customers to effortlessly purchase from home and access a large selection of goods. E-commerce is a crucial guideline for the worldwide market. Improved internet connectivity, reasonably priced cellphones, and shifting consumer preferences have all contributed to Bangladesh's e-commerce industry's impressive rise. Despite this expansion, there are still difficulties in offering a platform that is safe, responsive, and user-friendly, particularly for electronics and smart devices. Additionally, there is a need for numerous product-based secure platforms. Every ten years, we need to upgrade our security platform with new technology. Finding particular products might take a lot of time on traditional platforms because they rely on text-based search and simple filtering. Furthermore, a seamless user experience, security, and data privacy remain top priorities. This project intends to develop a web-based e-commerce platform that addresses these issues by combining Tailwind CSS and JavaScript for responsive front-end design, Django and Python for back end security and data administration, and SQLite3 for lightweight database management. With its safe, scalable, and maintainable design, the system provides users with a dependable and efficient online purchasing experience. These will be make the great experience with the platform of e-commerce.

2.2 Literature Review

The main literature on technology-driven e-commerce is compiled in this area, with a focus on platform design, security, and usability rather than AI-driven features. Also the technology of the web is more securing day by day. Thought out the every concern we have to need literature review.

Table 2.1: Summary of Literature Reviewed.

Aurthers	Year	Title	Methodology	Key Finding
Ahmed et al.	2019	Role of SQLite in Small-scale E-commerce Platforms	Quantitative	SQLite offers low-traffic e-commerce systems lightweight and effective database administration.

Karim & Hossain	2020	Implement Responsive E-commerce webside	Experiment	The responsiveness of the user interface on desktop and mobile devices was enhanced with Tailwind CSS and JS.
Islam & Sultana	2020	Enhancing Product Search in Online Stores	Experiment	Search filtering by department, brand, and category greatly enhances user navigation.
Patel & Singh	2022	The Role of Voice Search in Modern Retail	Case Study	Reviewed the rise of voice-based search and its impact on modern shopping behaviors, especially for mobile users.
Rahman et al.	2021	Web-based E-commerce Development using Django	Case Study	demonstrated that Django works well for developing e-commerce quickly while maintaining safe back-end management.
Choudhury	2022	Feature-based Comparison of Bangladeshi E-commerce Platforms	servey	found feature holes in regional platforms such as Pickaboo and Daraz.
Shafiq et al.	2018	Secure Online Payment Systems	Literature Review	highlighted the need of CSRF protection, SSL, and secure session management for e-commerce security.
Hasan et al.	2019	User-friendly Interfaces for Online Shopping	servey	Bounce rates are decreased and customer satisfaction is raised with responsive, simplified user interfaces.
Chowdhury	2022	Comparative Study of E-commerce Features	Literature Review	Wishlists, fast views, and trending goods are examples of features that have a big impact on user retention.

Alam & Biswas	2020	Integration of Voice Search in Web Platforms	Case Study	Although lightweight voice search improves accessibility, small-scale systems' performance must be balanced.
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2.2.1 Similar Applications

In this part, I examine pertinent e-commerce systems from Bangladesh and elsewhere that are functionally comparable to our suggested system. Our platform incorporates best practices from current solutions in terms of feature availability, safe transactions, and user interface design, even if it is not entirely AI-driven. The practical applications, strong points, and potential areas for development in the Bangladeshi e-commerce market are the main topics of this investigation.

Research Studies and Case Studies:

- **Bangladeshi Responsive E-Commerce Platforms**
Bangladeshi internet retailers improved their websites for cross-platform compatibility and mobile responsiveness, according to a research by Alam & Hossain (2021). The results demonstrated that local customers with slower internet speeds may greatly enhance website performance through the use of lightweight frameworks and effective database management (such as SQLite).
- **Gap in Local E-Commerce Features**
Rahman et al. (2020) examined typical features that are absent from local platforms, like guest checkout, sophisticated product filtering, and wishlist management. They concluded by emphasizing that without extensive AI integration, these features can improve customer happiness and retention.
- **Payment Security for Online Purchases in Bangladesh**
- **Karim & Sultana (2019)** investigated how SSL certificates, secure checkout processes, and OTP verification affect establishing consumer confidence in digital commerce in Bangladesh. These characteristics are in perfect harmony with our project's dedication to safe payment integration.

Mobile apps and web applications:

- **Amazon**
One of the biggest and most powerful e-commerce sites in the world, Amazon is well-known for utilizing artificial intelligence (AI) to improve the buying experience. To provide incredibly tailored product recommendations, This recommendation engine looks at the user browsing habits, purchases history and search history. Sales conversions and user engagement are greatly increased by this customization. Additionally, Amazon allows customers to search and shop hands-free by integrating voice search with Alexa, its virtual assistant. This feature promotes accessibility for people with different literacy or mobility levels in addition to increasing.

- **eBay**

Ebay: The world famous global online marketplace eBay implements AI and ML to refine its search accuracy as well as provide personalized product recommendations. Personalized product recommendations to maximize relevance and customer satisfaction by analyzing user actions such as search queries, browsing history and transactions. By continually learning from how users are interacting with it, eBay's search algorithm ensures that over time results better reflect personal tastes. This approach aligns with our ambition in the project to establish an intelligent recommendation engine that could adapt to a user's needs and deliver a better online shopping experience.

- **Daraz Bangladesh**

Our approach aims to address this using multi-parameter product filtering. Daraz is the biggest online marketplace in Bangladesh that provides access to a wide range of products with safe payment gateways & mobile apps. It offers browsing by product categories, flash sales and seller ratings, but its filtering of search results lacks depth and purchasing sometimes takes a while. By deploying multi-parameter product filtering, our platform attempts to solve this issue. Our approach addresses this by applying multi-parameter product filtering.

- **Pickaboo**

Pickaboo is renowned for its genuine branded goods and quick delivery services. It features mobile-first design, EMI facilities, and discount programs. However, users must register before making a purchase because guest checkout is not available. Guest checkout will be available on our platform to help new users make purchases more quickly.

- **Alibaba**

Among the biggest e-commerce sites in the world, Alibaba offers both B2B and B2C services. Through its online marketplace, it links millions of customers and providers worldwide. The platform ensures trust between customers and sellers by providing sophisticated product search, filtering choices, and secure payment processes. Additionally, Alibaba incorporates tools that improve user experience and credibility, such as supplier verification, customer ratings, and personalized product suggestions. To facilitate large-scale operations and guarantee scalability, its ecosystem also consists of cloud services and mobile applications. One may learn a lot about maintaining product catalogs, improving search efficiency, and putting robust security mechanisms in place by examining Alibaba's infrastructure. These elements are helpful guides for creating a dependable and successful e-commerce platform.

An overview of related applications

Although the majority of Bangladeshi platforms provide fundamental e-commerce features, it is evident from the analysis that some feature gaps still exist, such as low-bandwidth optimization, guest checkout, cross-category suggestions, and advanced filtering. In order to provide Bangladeshi consumers with a safe, intuitive, and feature-rich experience, our platform aims to integrate the best aspects of these current solutions while resolving their drawbacks.

2.3 Gap Analysis

The qualities of well-known e-commerce platforms are compiled in this table and contrasted with those of your suggested e-commerce system. The areas where your system plans to provide new or improved functions are the main focus.

Comparison chart for gap analysis

Table2.2 : Comparison between related work

Features	Amazon	eBay	Daraz (BD)	Pickaboo (BD)	Alibaba	Proposed system
AI-Powered Product Recommendations	Yes	Yes	No	No	Yes	No
Voice Search	Yes	No	No	No	No	Yes
Add to favorite or wishlist	Yes	Yes	Yes	No	Yes	Yes
Search option of products	Yes	Yes	Yes	Yes	Yes	Yes
Detailed descriptions of products	Yes	Yes	Yes	No	Yes	Yes
Offers collection	Yes	Yes	Yes	Yes	Yes	Yes
Customer reviews and ratings	Yes	Yes	Yes	Yes	Yes	Yes
Multiple payment options	Yes	Yes	Yes	Yes	Yes	Yes
FAQs option	No	Yes	Yes	No	Yes	Yes
Chatting option	Yes	Yes	No	No	Yes	Yes
Filtering liked and disliked products	Yes	Yes	Yes	Yes	Yes	Yes
Product add to cart	Yes	Yes	Yes	Yes	Yes	Yes
Secure Checkout & Payment Processing	Yes	Yes	Yes	No	Yes	Yes
Quick view	Yes	Yes	Yes	No	No	Yes
Easy Navigation & User-Friendly Interface	Yes	Yes	Yes	No	Yes	Yes

Advanced Filtering (Category / Brand / Dept)	Yes	Yes	No	No	Yes	Yes
Personalized User Dashboard	Yes	Yes	No	Yes	Yes	Yes
AI Assistant	NO	YES	NO	NO	NO	YES

2.4 Summary

The gap study reveals distinct features and functional differences between the top international e-commerce platforms and their Bangladeshi equivalents. A seamless, customized, and interesting shopping experience is ensured by platforms such as Amazon and eBay, which offer sophisticated features like voice search, customization dashboards, advanced filtering, rapid product view, AI-powered product suggestions, and secure checkout systems. By filling these gaps, the system hopes to provide a cutting-edge, effective, and user-friendly platform that satisfies the rising needs of Bangladeshi internet buyers while adhering to international best practices for e-commerce.

Chapter 3

Research Methodology

3.1 Methodology/Requirement Analysis & Design Specification

The concept generation is mainly for identifying the basic requirements of web-based e-commerce system and transforming them into an overall systems architecture. It ensures that user needs and project goals will be satisfied by the architecture, capabilities and workflows of the platform. Where the system design sets technology background for the application with a Django back-end, SQLite3 database and it's fronted part is made responsive with HTML, CSS and Tailwind; the requirement analysis takes care of all functional aspects such as registration or log in related aspects to user management, search and add-to-cart processes to check out sessions. This phase will create a solid foundation for an e-commerce platform which is scalable, maintainable and user-friendly – it does this by simply nailing down your requirements and designs

3.1.1 Overview

In this section, the system design and requirement analysis for e-commerce web based application is described. It is a Django-powered back-end managing server-side scripting and database operations, as well Table driven front-end implemented with HTML,CSS,and Tailwind, SQLite 3 to store data for this Python Data-driven web application. User registration, product search and filtering, cart management, secure checkout, and order tracking are the major features discovered by the analysis which ensures that all components work in conjunction with one another to make an efficient ecommerce system that is also reliable, maintainable as well easy for the user.

3.1.2 System Design

In order to guarantee effectiveness, scalability, and user-friendliness, the system design specifies the architecture and structure of the web-based e-commerce platform. The Django framework is used to create the back-end, which manages the database, server-side logic, and authentication. The front-end, which offers a responsive and aesthetically pleasing experience, is constructed using HTML, CSS, and Tailwind. The database utilized to efficiently maintain user profiles, transaction information, and product details is SQLite3. Because the architecture is modular, maintenance and updates will be simpler in the future. UML diagrams, such as use case, class, and sequence diagrams, are used to depict key capabilities, such as product search, cart management, secure checkout, and order tracking. These diagrams offer explicit direction for development and workflow visualization.

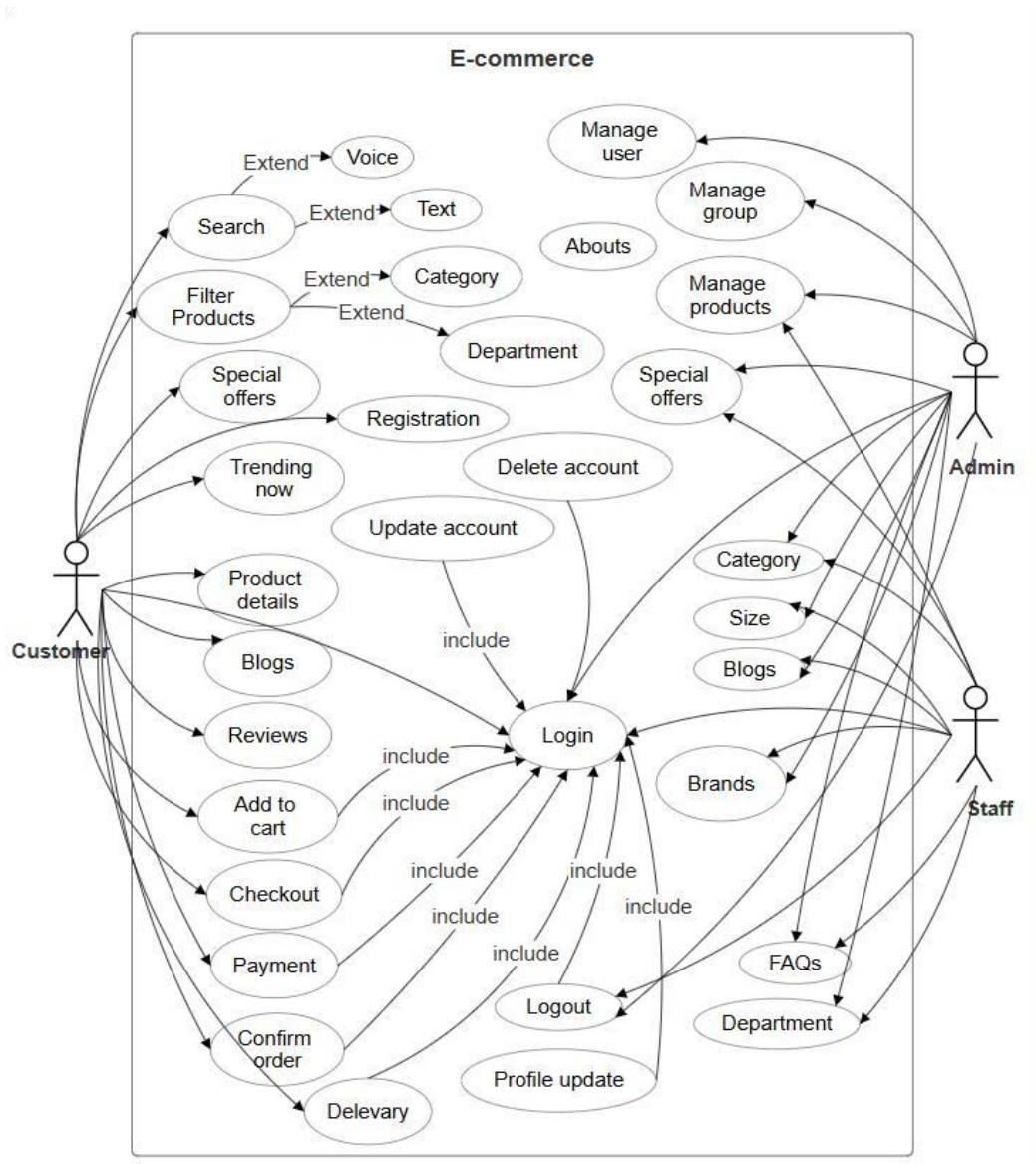


Figure 3.1.2.1: Use case

This Diagram for a web-based e-commerce platform is shown by the diagram, which shows how several user roles—Admin, Staff, and Customer—interact with system features. Consumers have the ability to sign up, log in, browse products, filter by department or category, search by voice or text, examine product information, read reviews and blogs, add items to their cart, check out, pay, confirm purchases, and follow delivery. Users, groups, items, categories, brands, departments, frequently asked questions, and special offers can all be managed by administrators and staff. Roles share common tasks, such as updating profiles and logging in and out. This use case guarantees that user interactions and system operation are clearly visualized..

3.1.3 Functional and Nonfunctional Requirements

Functional Requirements

These outline the precise attributes and functionalities that the system needs to offer:

- User Registration & Authentication: Safe login, password recovery, and customer and administrator sign-up.
- Product browsing and search: To assist consumers in finding products fast, advanced filtering, sorting, and voice-activated search are available.
- AI-powered recommendations based on past browsing and purchasing activity are known as personalized recommendations.
- Product management is an admin dashboard that allows you to add, amend, or remove goods along with their prices, descriptions, and photos.
- Order processing includes a tracking system, shopping cart, and secure checkout.
- Payment Integration: a variety of safe payment methods, such as digital wallets, mobile banking, and cards.
- Evaluate & Rating System: Consumers have the ability to evaluate and rate products.
- Display of Trending Products: Emphasize top-selling and popular products on the home page.
- A layout that is optimized for desktop, tablet, and mobile devices is known as a mobile responsive interface.
- Tools for administrative management: inventories, sales analytics.
- Admin administration tools include inventory control, user management, and sales analytics.

Nonfunctional Requirements

These specify the system's limitations and quality attributes:

- Performance: Under typical traffic circumstances, the page loads in less than three seconds.
- Security features include secure authentication, encrypted data transmission (HTTPS), and defense against XSS and SQL injection.
- Scalability: The capacity to accommodate growing numbers of users and products without experiencing significant performance deterioration.
- Usability: Easy navigation, a user-friendly interface, and WCAG 2.1 compliance.
- Availability and Reliability: Backup and recovery options and a minimum 99% uptime.
- Maintainability: Easy changes are made possible by a modular architecture with explicit code documentation.
- Compatibility: Support for a range of devices and popular browsers, including Chrome, Firefox, Safari, and Edge.
- Sustainability: Using resources as efficiently as possible to use less energy.

3.1.4 Data Flow Diagram

The central system is the e-commerce program, which receives data from administrators and customers and returns outputs that have been processed. While administrators and employees use the back-end to manage content, inventory, and orders, customers primarily use the front-end interface to browse, search, and make purchases.

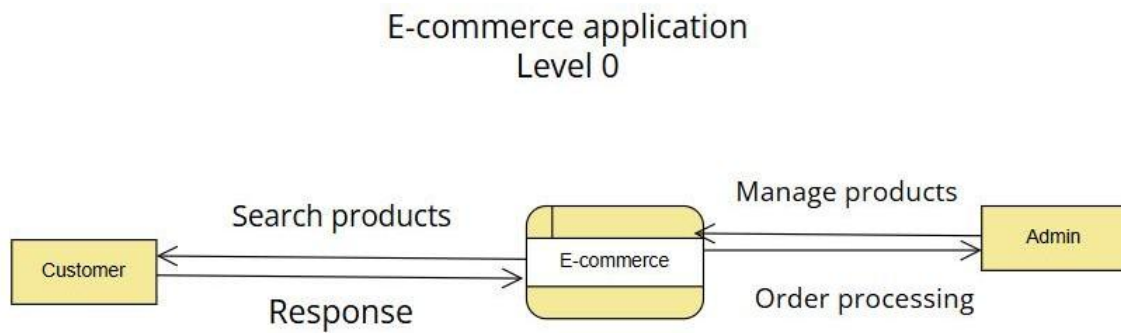


Figure 3.1.4.1: Level 0

Overview of Data Flow:

- From Customers: Payment information, cart actions, and search terms.
- From administrators/staff: order management information, category modifications, and product updates.
- From the system: Order confirmations, transaction statuses, search results, and suggestions

Data Flow Diagram – Level 1

A thorough analysis of the data flow within the e-commerce platform is given by the Level 1 DFD, which highlights important procedures, data repositories, and external parties. The Level 1 Data Flow Diagram (DFD) of the e-commerce application displays the data flow between its numerous components in addition to the primary functions of the system. On the other hand to register, log in, browse, filter, and search for products, customers use the platform, which retrieves all pertinent data from the User Database and Product Database. They can proceed to place orders, which are processed and kept in the Order Database, and add or remove goods from their cart, with the changes being recorded in the Cart Database. Customers can browse or post reviews, which are kept in the Review Database, and the system is coupled with a Payment Gateway to enable safe transactions. To maintain efficient operations, administrators update listings, keep an eye on order statuses, and manage product inventory. This diagram clearly demonstrates how external entities, processes, and data stores interact, providing a seamless and efficient user experience while maintaining data integrity and operational control.

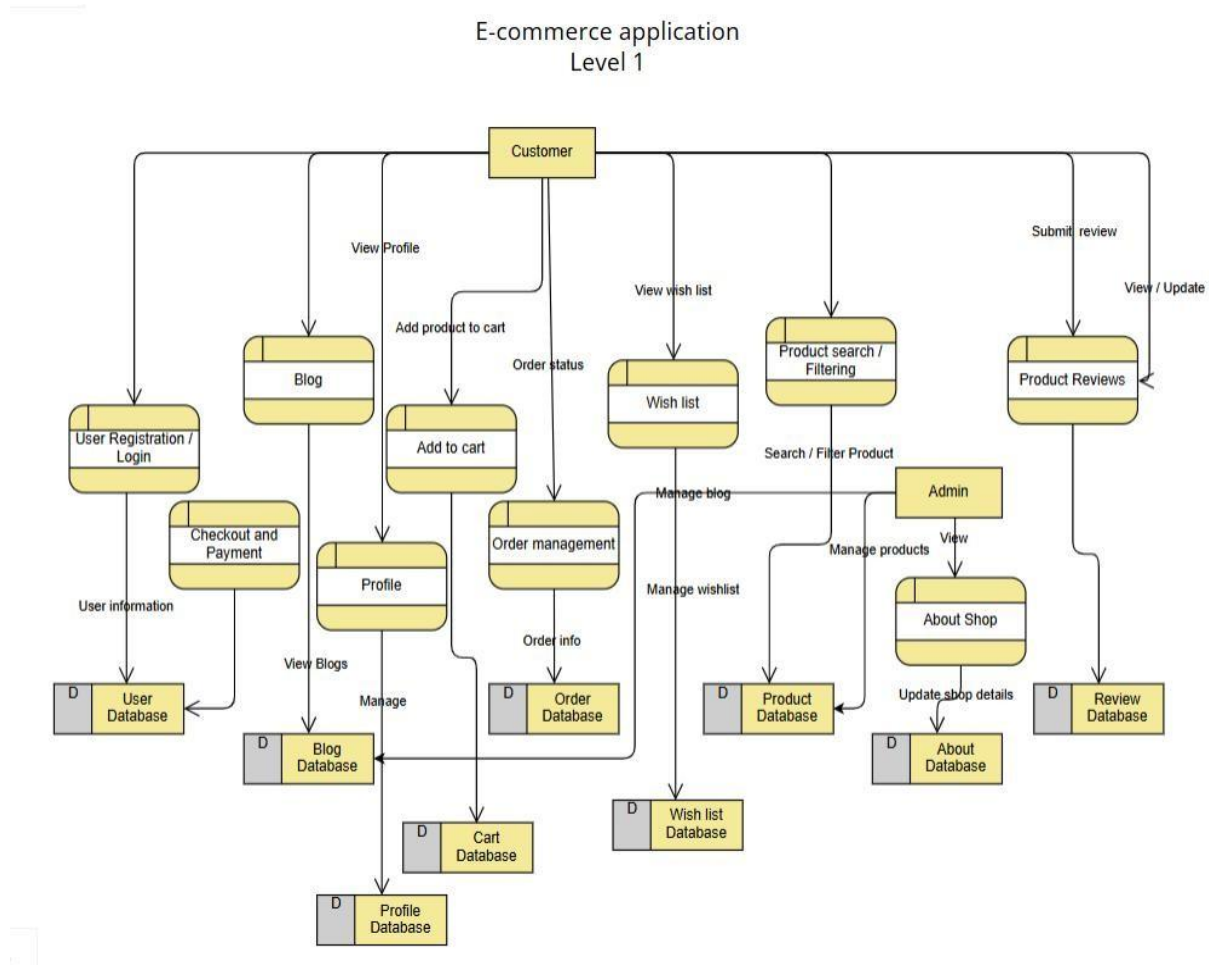


Figure 3.1.4.2: Data flow diagram level 1

3.1.5 UI Design

The e-commerce platform's user interface (UI) design prioritizes providing a seamless, intuitive, and aesthetically pleasing experience. It adheres to modern web design guidelines to guarantee that the user experience is responsive, accessible, and simple to use across a range of devices. The visual components and layout are organized to improve usability, which makes user interactions simple and interesting.

Home page Design:

In the screen shot we can see the home page and template. where We have a quick look of a navigation bar ,profile ,Banner, All department button, also filter an logo shop name . you can search with text or voice command.And profile option,sign in or login ,log out etc. In the All department also we can chose various section of filtered product.

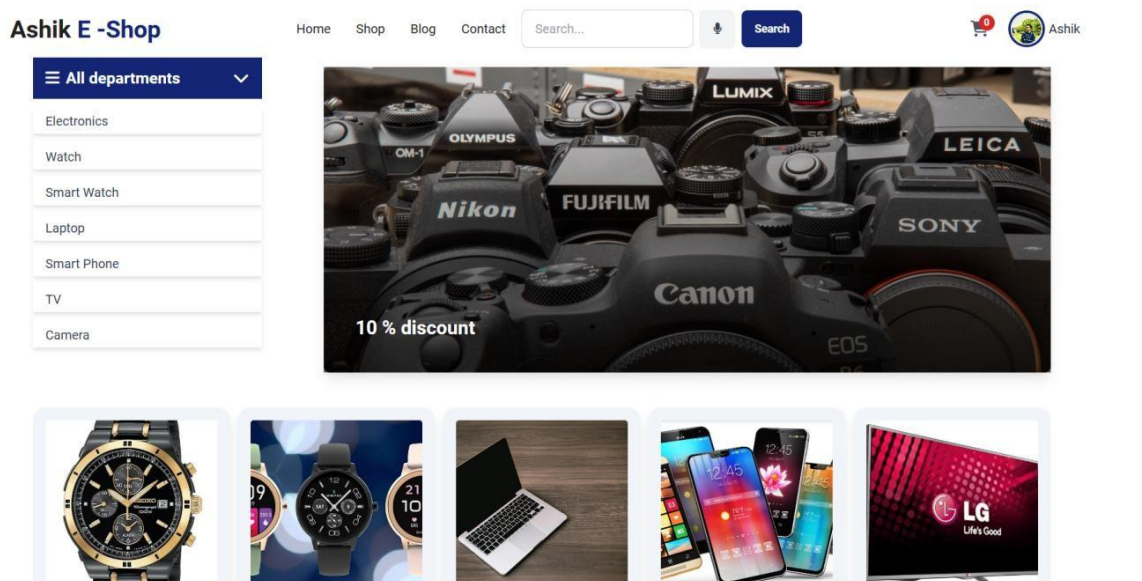


Figure 3.1.5.1: Homepage

Nav Bar:

Navigation bar is a one of the main component of the web page .its generally a head section where we can easy access some Burton search option - specially voice search option also add card option some logo .Also we see the profile of a user.

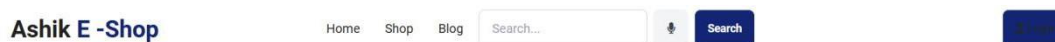


Figure 3.1.5.2: Navigation bar with out login

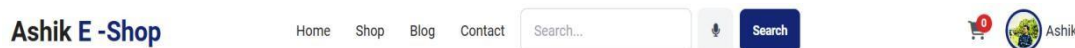


Figure 3.1.5.3: Navigation bar with login

You can clearly see the change in profile section. Where Figure 3.1.5.2 shows that with out login the profile is empty and just a button on sign up . After login the profile option is shown. In the Figure 3.1.5.3. In the navigation Bar we have the logo, Name, button(Home,shop,Blog), Search bar Where text and voice command also acceptable such a advance feature.

Search:

We have the two type search option Voice Search and Textual search . Definitely it's a advance option for any kind of web side.In this site we see in the navigation bar we have two type search option.

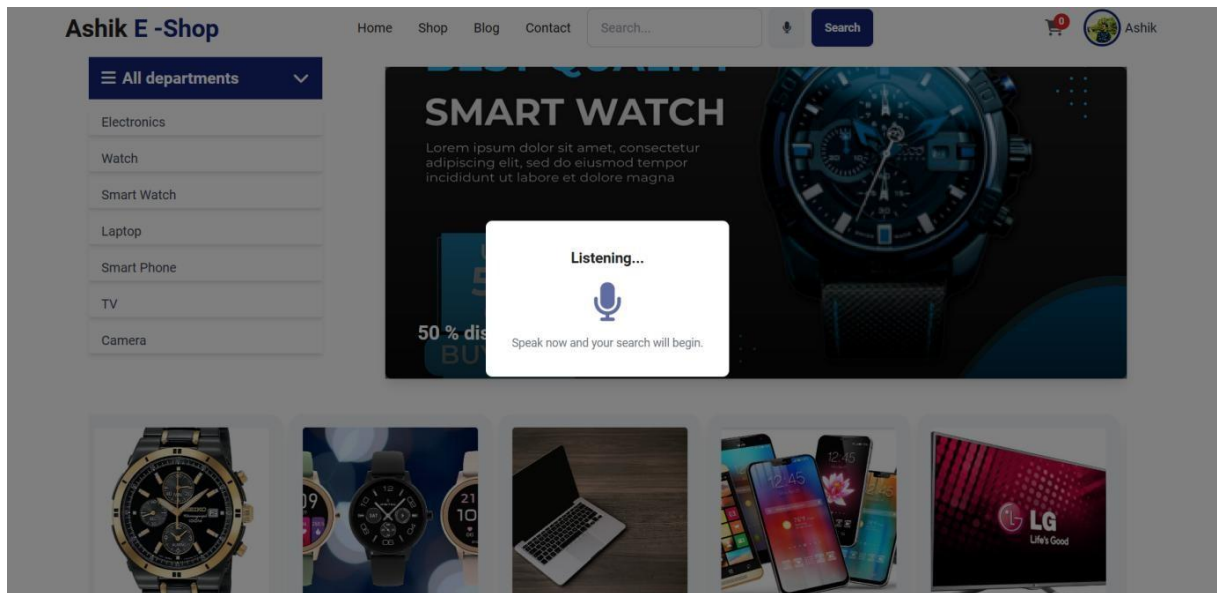


Figure 3.1.5.4:Voice Search

In the navigation bar Figure 3.1.5.2 figure we clearly see the text file base search and now Figure 3.1.5.4 voice search it makes the project more dynamic.

Login From:

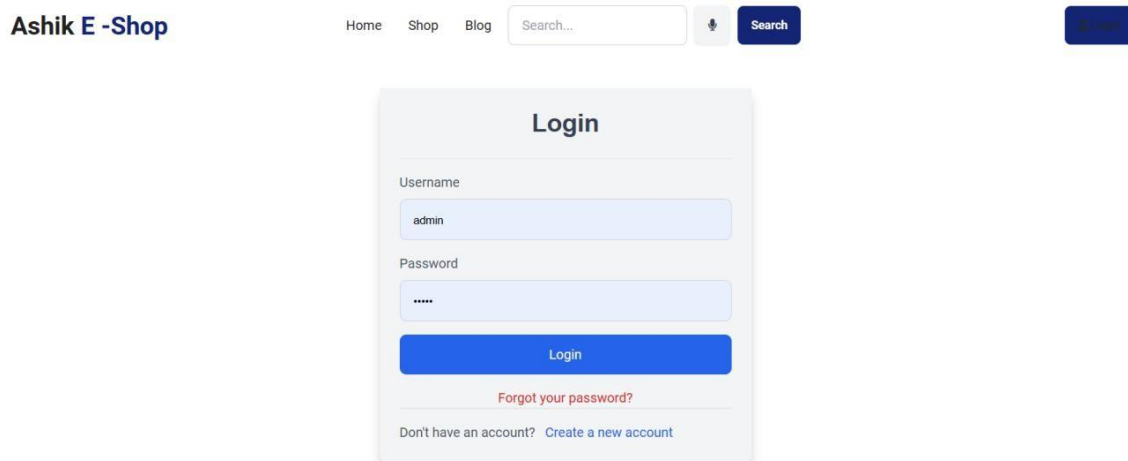


Figure 3.1.5.5: Login from Page

Anyone with a user name and password can log in to this. Also if you don't already have an account then have forget password option you can recover it. If you don't have account then you can get create option and a same form and you can fill the data and

create a account then you can login easily. Figure 3.1.5.5: Login from Page

Recent Activity Feature Template in the middle section of home page

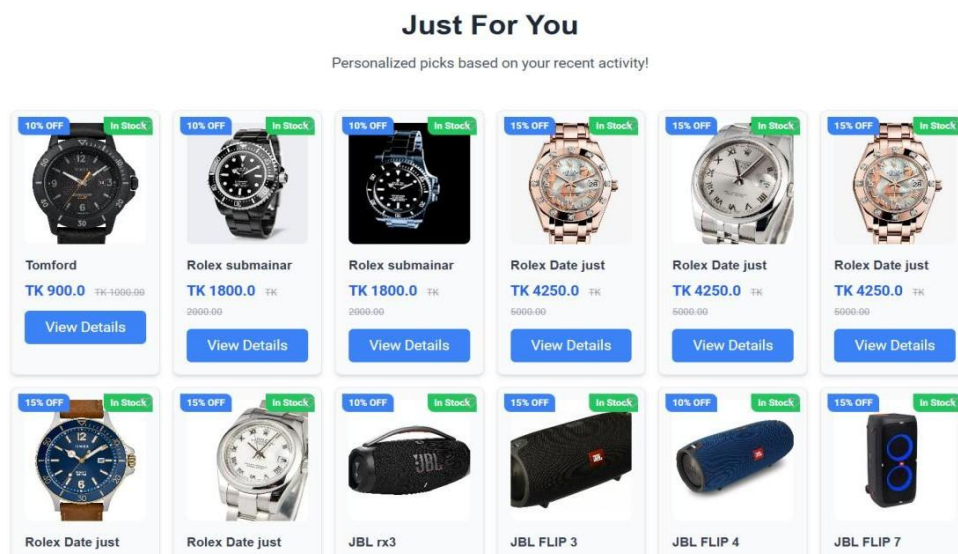


Figure 3.1.5.6 :Recent Activity feature

Its in the middle of the home page site it show the user activity by interest showing the filter of user interest product.it catch the product attract the user most.In the figure Figure 3.1.5.6 we see this

Trends Naw option:

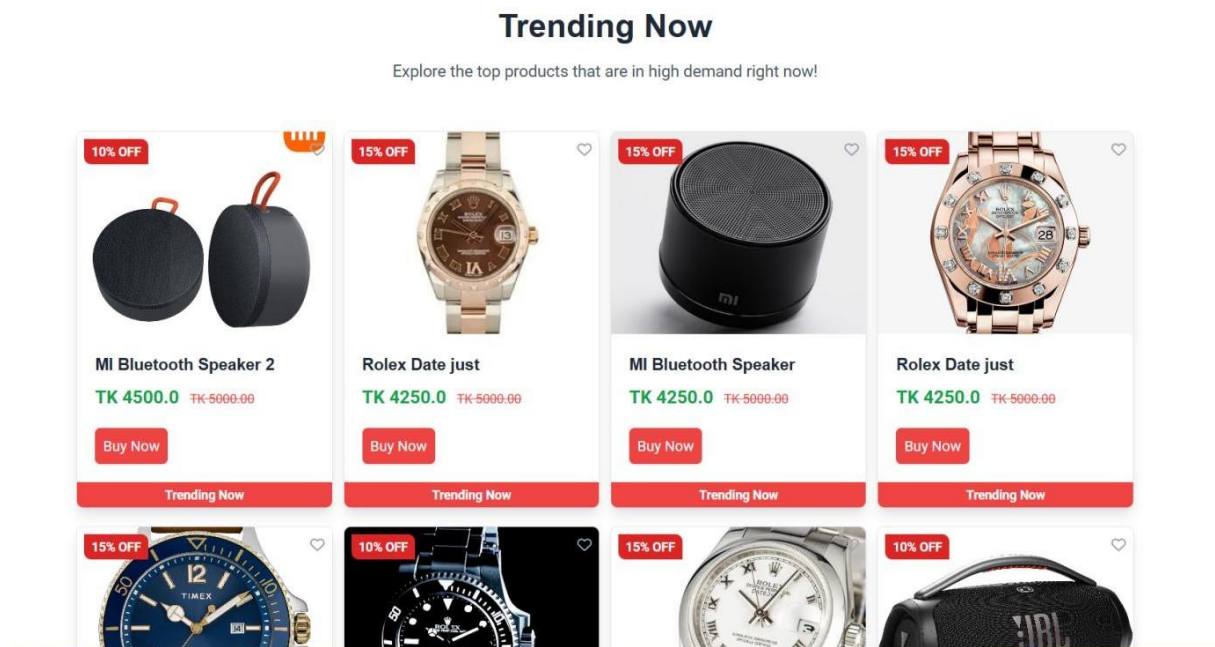


Figure 3.1.5.7 :Trends naw

In the trends naw option The middle part of font page actually lower middle after the Just for you option. Trends naw template table just showing you the newly app-load product of the market. Generally its An a advertise of the product Figure 3.1.5.7 show this

Featured Product

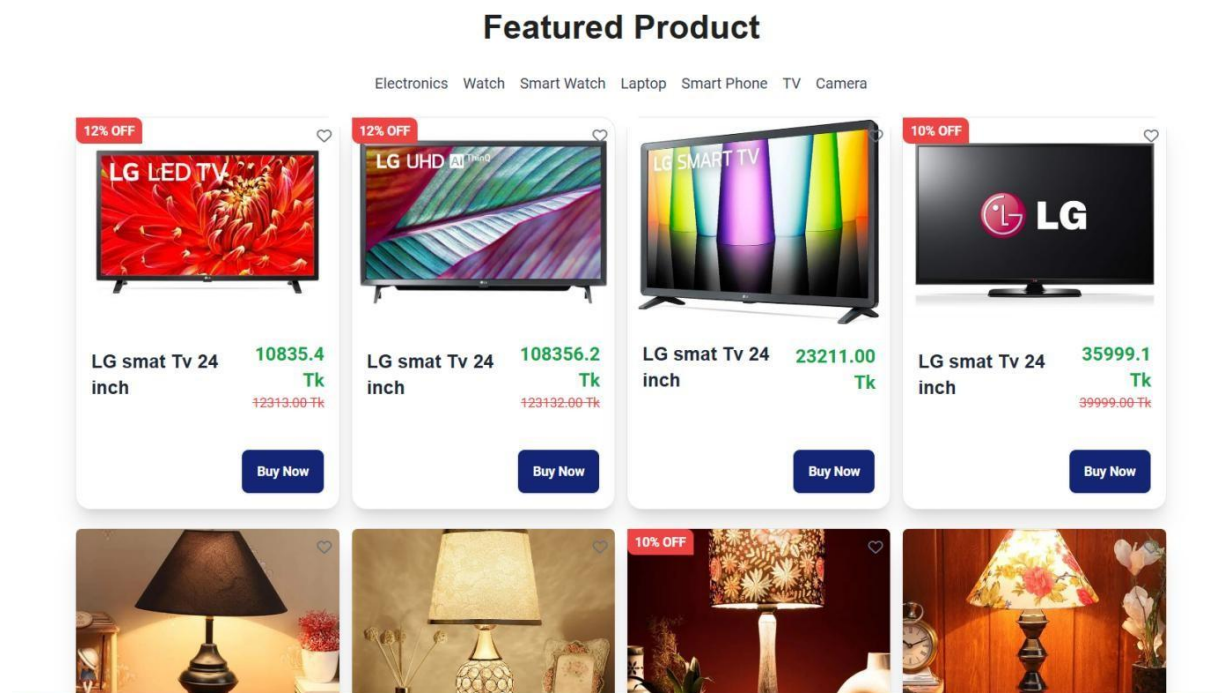


Figure 3.1.5.8 :Recent Activity feature

In the lower Middle part of the home page the featured product is just up from the footer section of the home page. The web site is created by the python inheritance method so the navigation bar and footer allays fix the page is dynamically changing by user interaction it's a dynamic give user definitely a good experience.

Special offer Banner :



Figure 3.1.5.9 :Special offer Banner

Special offer Banner it's the home page upper section and down section just for marketing discount and feature of marketing discounting.

Over all Activity template :

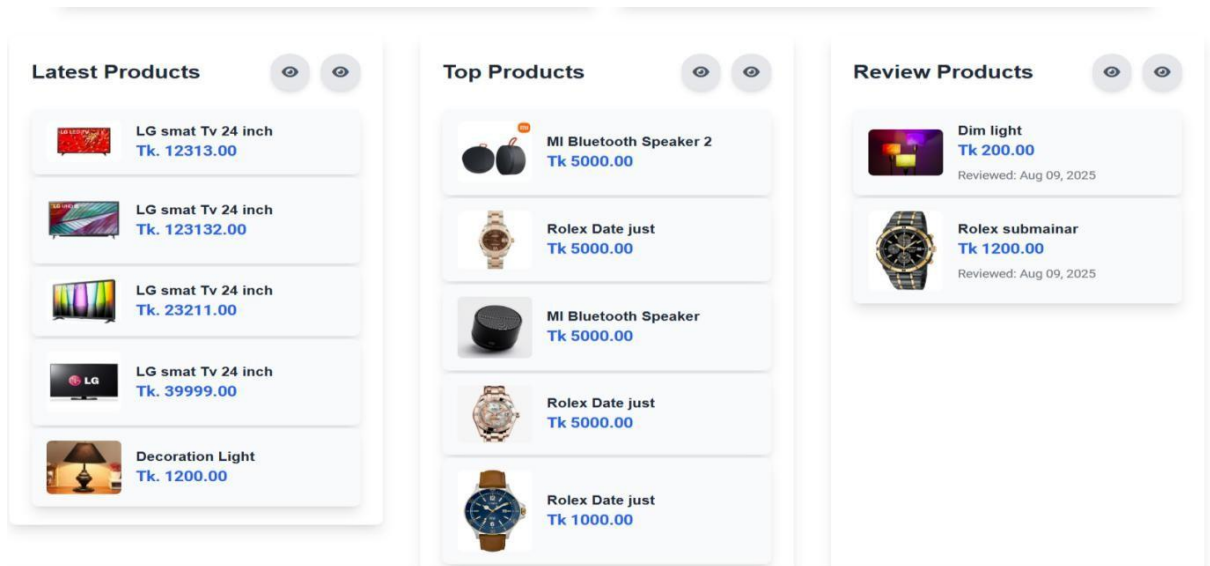


Figure 3.1.5.10:Over all Activity template

Over all activity template have three template latest product,Top products, Customer reviewed product. This are work on basis of real time data. Its continuously updated by the User interaction. Its in the base meant of this home page. Just up from the footer.

Shop:

In the shop section There are Categorical filter we see in the figure its help user get fined their interested product quickly access its give good experience to the user.

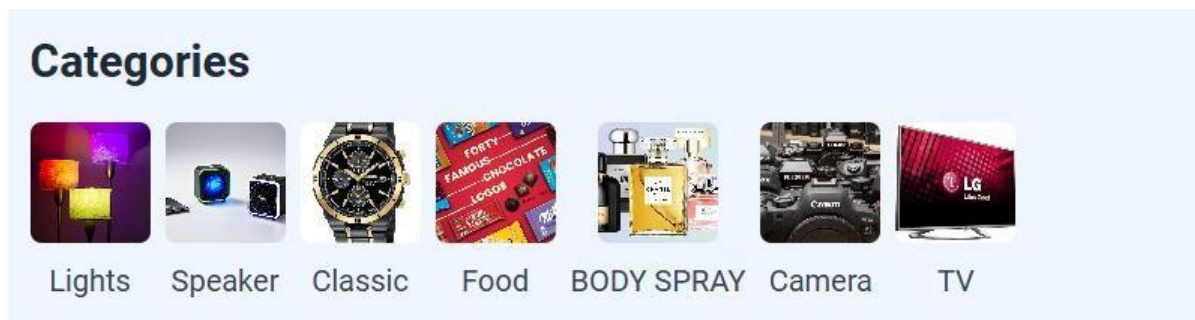


Figure 3.1.5.11:Cetagoris

In the every category there are many product in the shop we see in the figure.The shop page offers customers a thorough overview of every product that is offered, arranged logically by category for convenience. Users may easily filter products based on their interests thanks to the conspicuous display of each active category. This By enabling customers to find what they're looking for fast and avoid sifting through irrelevant items, classification improves the buying experience. Once a category is selected, the system dynamically retrieves and displays all active products under that category, ensuring up-to-date and relevant results. This intuitive filtering system simplifies product discovery and empowers users to make informed selections effortlessly.

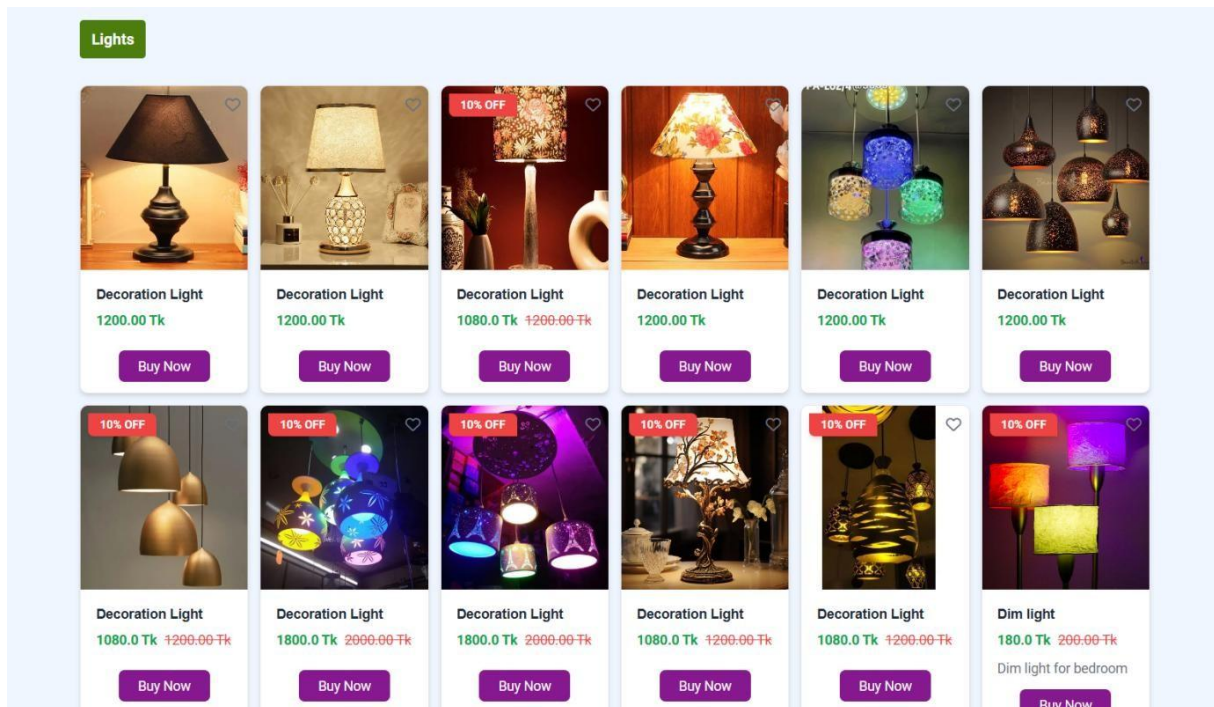


Figure 3.1.5.12:Shop section

In this figure 3.1.5.12 the light catalog only discipline light product. The clear display of the product offer detail about the product and price and add list every think

Product Template:

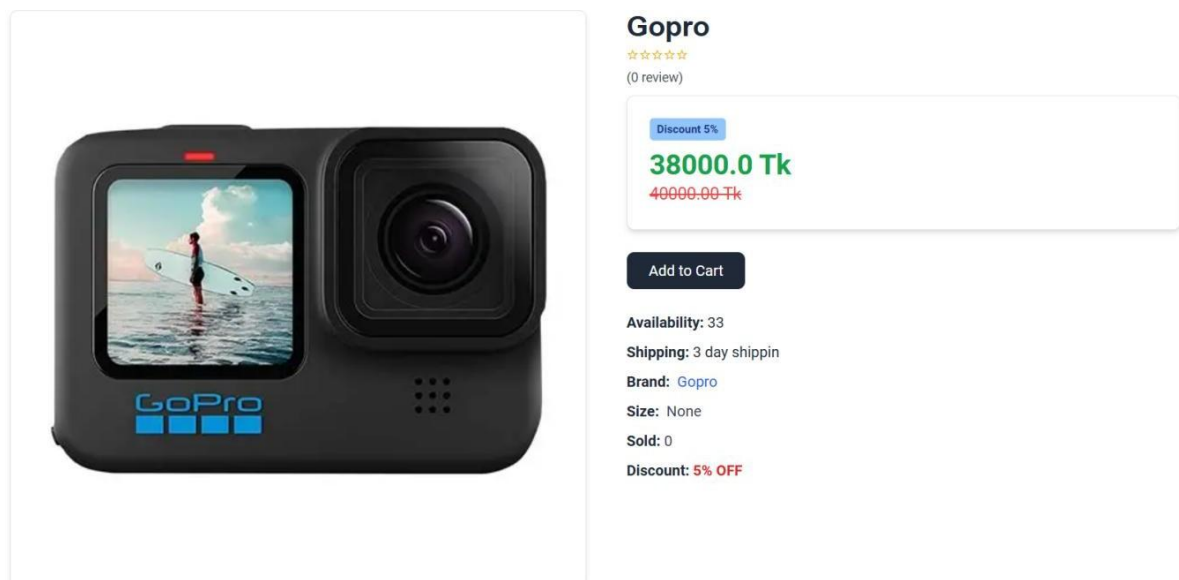


Figure 3.1.5.13:Product Template

The product every detailed view in the template .There are every details in the product template also offer price .The percentage of price auto calculate and show the user so they can easily take decisions to purchases it.in the Figure 3.1.5.13 we see this.

User profile:

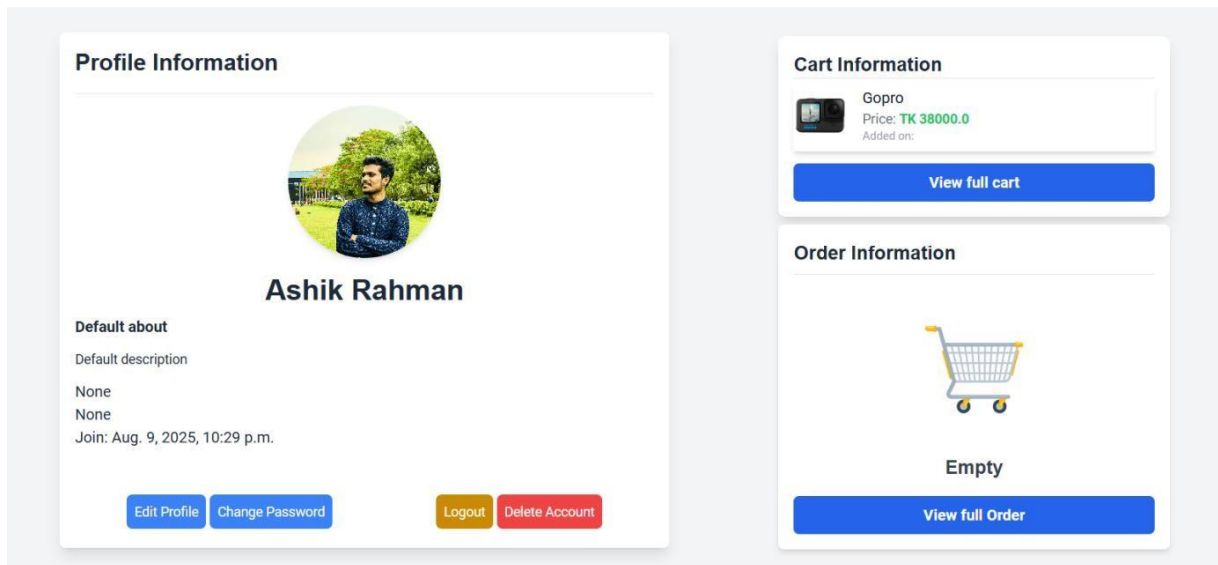


Figure 3.1.5.14 : Profile

Users can view all of their personal data, including their name, email address, social media links, and contact information, on the profile page. Interactive buttons like Edit Profile, Change Password, Logout, and Delete are included. Take account. Clicking the Edit Profile button redirects users to a dedicated page with a userfriendly form, allowing them to update their profile details. Users can modify all aspects of their information, including their name, profile picture, bio, description, location, phone number, and social media links, ensuring their profile remains up-to-date and reflective of their preferences.

AI Asistant:

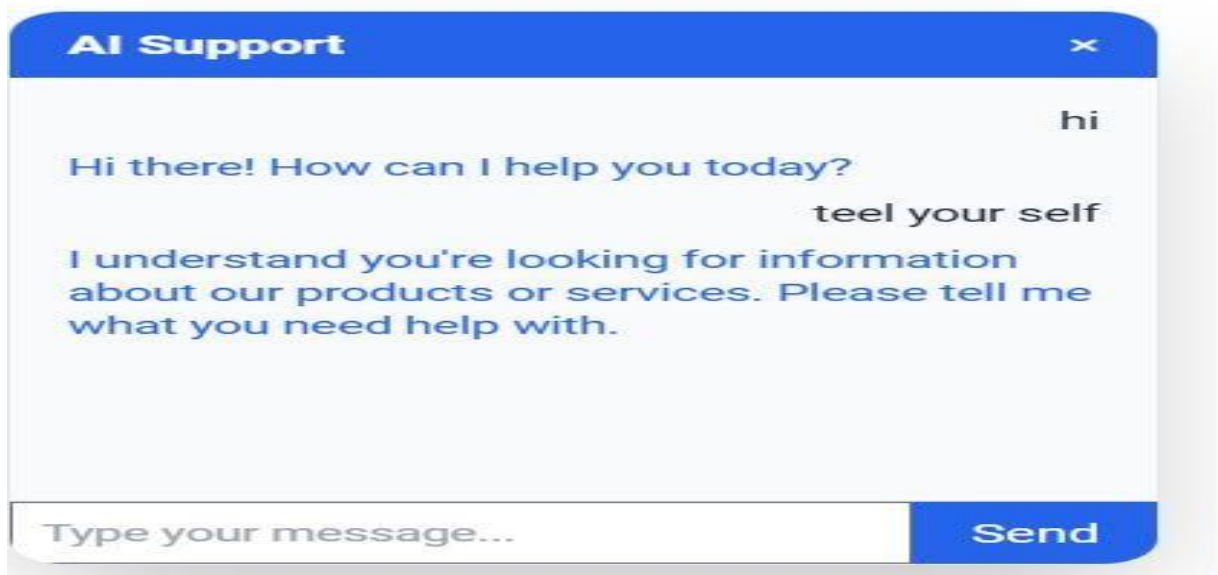


Figure 3.1.5.15 : Ai Asistant

The purpose of this e-commerce AI assistant is to offer immediate, individualized customer service right on your store's website. It is integrated inside a stylish chat

widget and uses Google's Gemini model to comprehend and intuitively reply to consumer inquiries, providing clear and useful advice without ever requesting private information like card numbers or passwords. Consumers may get prompt, precise answers to their questions concerning orders, returns, shipping, and items. As the assistant continuously learns from the context, users can review their chat history because the system saves every interaction within protected sessions. Common support requests are automated, which lessens the workload for human employees, speeds up response times, and increases overall customer satisfaction—all of which encourage customer engagement and loyalty.

Checkout From And Order payment system:

Checkout

First name

Last name

Country
(select country)

Division

District

Thana

Street

Your Order

Product	Quantity	Price
Gopro	1	38000.0
Subtotal		38000.0

Choose Payment Method

Payment Method

☐ Credit/Debit Card

☐ Mobile Banking

☐ Cash on Delivery

Pay Now

Figure 3.1.5.16:Payment and Check out from

Wish list and purchase History:

Wish list

Empty Wish List

View full Wish List

Purchase History

- JBL FLIP 4
Price: TK 6000.0
- JBL FLIP 4w
Price: TK 7000.0
- Rolex Date just
Price: TK 4250.0

View Purchase history

Figure 3.1.5.17:Wish list and purchase History

Its clearly show you the wish list for future purchase and the History

Odered Ditails:

We may view user order details and product information on this site.He Order Details

module is one of the core components of the e-commerce platform, designed to provide customers with clear and accurate information about their purchases. When a customer places an order, the system generates a detailed record that includes

Items

Product	Quantity	Price	Final price	Actions	
7  GoPro	1	38000.0 Tk	38000.00 Tk	Delivery	Order Cancel
8  Rolex submainar	1	1800.0 Tk	1800.00 Tk	Delivery	Order Cancel

Order Details

Order #7
 Placed on: kj, ih, jh, jnkj, AX
 Total Items: 2 Products
 Status: Not Paid

Figure 3.1.5.18:Odered Ditails

FAQ:

Frequently Asked Questions

Figure 3.1.5.19:FAQ

Contact:

Contact Us

Name:

Email:

Order number:

Message:

[Send Message](#)

Figure 3.1.5.20:Contact

Users can submit direct messages using the form on the Contact page, and the site administrators will receive them as emails. For easy access, a frequently asked questions (FAQ) section is provided, arranged by category. The main focus of this front-end design is delivering a comprehensive and user-friendly experience, with a visually

engaging layout and essential features that ensure users can easily navigate, explore, and purchase products on the platform.

Footer:

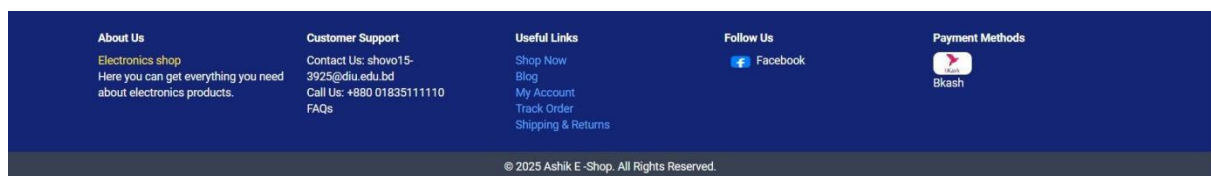


Figure 3.1.5.21:Footer

In the footer we can see the about . Some logo Developer information. Also some social media link. Contact mail. The help desk.Short discretion about the organization.

Admin Panel:

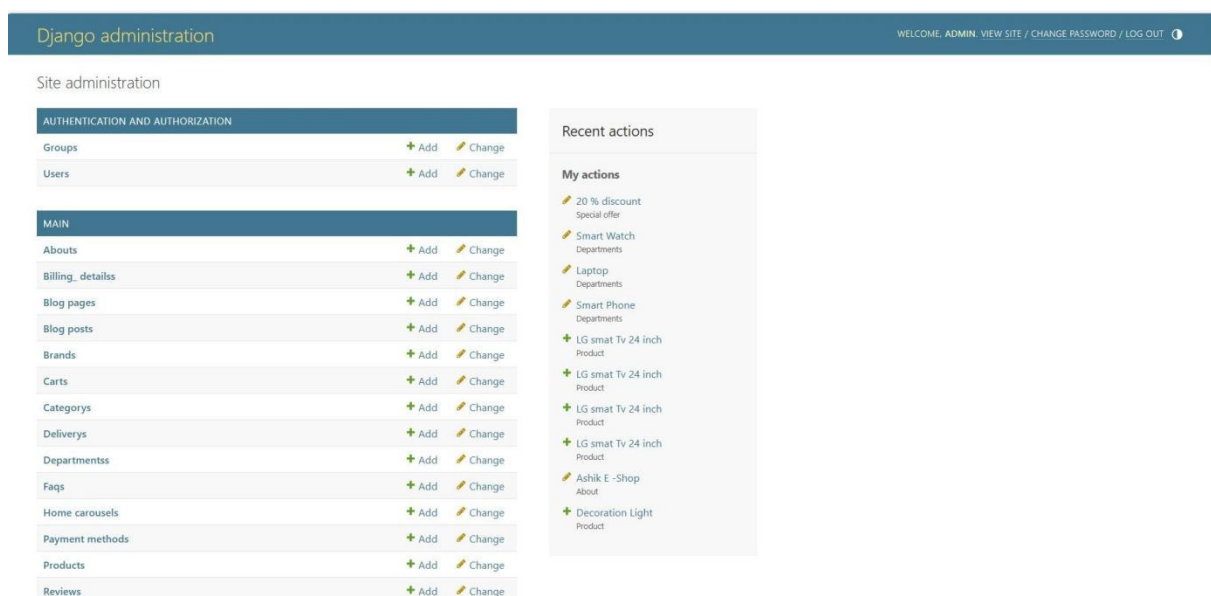


Figure 3.1.5.22:Admin Panel

From this section admin do every operational think . Maintenance and changes trough the Back-end.

3.2 Detailed Methodology and Design

Analysis of Requirements:

Stakeholder discussions, competitor analysis, and user surveys were used to collect comprehensive requirements at the start of the development process. Advanced voice and text-based search capabilities, tailored product suggestions, an intuitive user interface, and effective cart and checkout management were among the key aspects noted. The following phases of design and implementation were guided by these needs, which were prioritized and recorded.

Design of the System

The following technology stack was used to enable the development of a scalable and maintainable architecture:

- Front-end: Tailwind and JavaScript CSS for a contemporary and responsive user interface.
- Back-end: Django for SQLite3 integration and reliable server-side logic.
- SQLite3 is the database used to store transaction, product, and user data.

Workflows were visualized using UML diagrams:

- A use case diagram shows how users, administrators, and the platform interact.
- Class diagrams show the connections between things like orders, items, and users.
- Sequence diagrams are used to lay out detailed procedures, such as placing an order and searching for products.

Implementation:

The platform was developed interactively with ongoing feedback, adhering to agile principles. Among the important duties were:

- Creating a UI that is clear, responsive, and easy to use is known as frontend development.
- Backend Development: Using Django to implement order processing, product management, and authentication.
- Search Functionality: Making voice and text-based searches possible.
- Customized Suggestions: Producing product recommendations by analyzing past purchases and feedback.

Design of Databases

The primary tables of the schema, which was optimized for effective data retrieval, include:

- Users: keeping track of authentication and user information.
- Products: providing information on the product, including name, price, and category.
- Orders: keeping track of transactions, amounts, and purchases.

Evaluation and Enhancement

Included in the testing:

- Validating individual modules is known as unit testing.
- Optimizing load times and query execution rates is known as performance testing.
- Verifying seamless component interaction is known as integration testing.

Deployment and Maintenance

High availability was ensured by the platform's deployment on a reputable hosting provider. Periodic algorithm changes, database optimization, and user interface enhancements based on user analytics were all part of the post-launch maintenance.

3.3 Project Plan

The timetable, tasks, and milestones necessary for the e-commerce platform's successful development are described in the project plan. The method uses a phased, structured model to guarantee timely progress, unambiguous outputs, and effective use of resources.

Weeks 1-2: Planning and Requirement Analysis

Activities:

- To obtain practical requirements, do user surveys and market research.
- Examine rival platforms to find weaknesses and possible points of differentiation.
- Describe the requirements, including functional and non-functional.

Deliverables:

- Documentation of Requirements (SRS).
- first proposal for the project.

Weeks 3-4: Design of the System

Activities:

- Make use case, class, and sequence UML diagrams to map system functionality.
- Create a database schema that facilitates effective data retrieval and storage.
- Complete the Django, SQLite3, Tailwind CSS, and JavaScript technological stack.

Deliverables:

- Documentation for system design.
- Schematic diagrams for databases.

Weeks 5-8 Put into Practice

Activities:

- Use Tailwind CSS and JavaScript to create the front-end for a responsive user interface.
- Use Django to implement back-end logic, such as cart operations, product administration, and authentication.
- Include cutting-edge features like voice search, tailored suggestions, and popular items.

Deliverables:

- Both the front-end and back-end are functional.
- First deployment for internal testing.

Weeks 9–12: Testing and Evaluation

Activities:

- Conduct individual module unit tests.
- To confirm end-to-end functionality, perform integration testing.
- Improve performance and address issues.

Deliverables:

- Issue fixes are included in the testing report.
- stable platform version prior to release.

Weeks 13–14: Deployment and User Feedback

Activities:

- Install on a live hosting server that has been configured securely.
- Ask beta testers for their opinions.
- Put any needed repairs or enhancements into action.

Deliverables:

- Fully functional live platform.
- Report on user comments.

Weeks 15–16: Presentation and Documentation

Activities:

- Compile all project documentation, including the final technical report and user manual.
- Make and polish the project defense presentation slides.

Deliverables:

- Final report on the project.
- Slides for a project presentation.

3.4 Task Allocation

Weeks 2 through 16 of the project's timeline for the primary activities are shown in the following table. Every task is organized to provide a seamless transition from system design to the development of a prototype application.

Table 3.4.1 Task Allocation

Tasks	Weeks																		
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Design of the System, Design of the System																			
Put into Practice																			
Testing and Evaluationg																			
Deployment Documentation																			

3.5 Summary

From obtaining user requirements to deployment and documentation, the project plan depicts a methodical and transparent approach to creating the e-commerce platform. By emphasizing crucial elements like speech recognition, customized suggestions. With its secure checkout and search features, the project guarantees a quick and easy buying experience. A scalable and maintainable solution is produced by combining responsive frontend development using JavaScript and Tailwind CSS with Django for backend development. Allocating tasks across the planning, design, implementation, testing, and deployment stages guaranteed efficient development and on-time platform delivery. The methodical approach produced a strong solution for the target market and established a strong basis for further upgrades and enhancements.

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Chapter 4

Implementation and Results

The environment setup, performance testing, evaluation, and a thorough analysis of the outcomes achieved throughout the e-commerce web application's creation and optimization are presented in this chapter. Evaluating responsiveness, memory consumption, and general efficiency in authentic browsing scenarios is the aim.

4.1 Environment Setup

In order to replicate actual user interactions on the e-commerce platform, the testing environment was created.

Development Environment:

- Backend Framework: Django
- Frontend: HTML, CSS, JavaScript.
- Database: MySQL.
- API Integration: Product suggestions, payment gateway

Testing Tools:

- Performance, network, and memory profiling tools for Google Chrome.
- Development Tools and a local server hosted at <http://127.0.0.1:8000/> are among the testing tools.

Details of the system:

- CPU: Intel Core i5 (10th Gen) CPU
- RAM: 8 GB DDR4
- OS: Windows 10 pro (64-bit)
- Browser: the most recent version of Google Chrome

Test Pages:

- Product listing page
- Product details page
- Checkout flow

The setup focused on identifying rendering bottlenecks, JavaScript execution delays, and memory leaks.

4.2 Testing and Evaluation/Performance/ Comparative Analysis

Performance testing was carried out using Chrome Development Tools to measure key metrics:

4.2.1 Testing and Evaluation

Examining

verified specific elements, like search functionality, user registration, and cart operations, to make sure every module worked as it should have. Django's integrated testing framework was one of the tools utilized.

Testing for Integration

Front-end and back end component interactions were tested to guarantee seamless functionality and data flow. Verified situations include receiving customized suggestions, completing orders, and adding products to the basket.

System Testing

Carried out end-to-end testing to assess the platform's overall functionality and performance. Made sure functions like product filtering, voice search, and checkout operated in unison.

User Acceptance Testing (UAT)

Potential consumers participated in Testing for User Acceptance (UAT) for testing the platform. Also offered input on its responsiveness, usability, and design.

4.2.2 Performance

I monitored CPU, memory, and network usages during the application testing using Browser Developer Tools, as seen in figure 4.2.1: Testing Result.

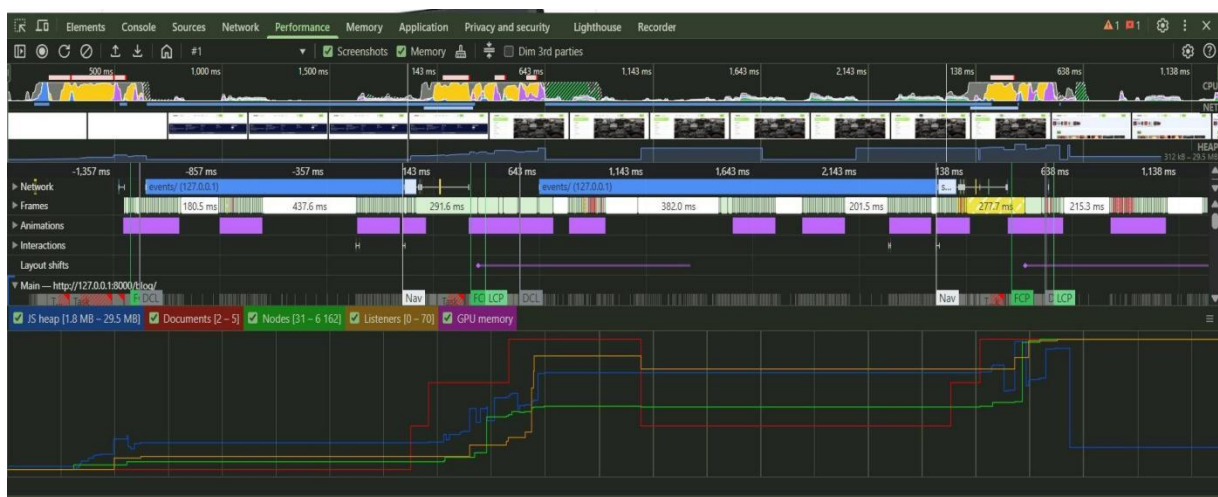


Figure 4.2.1: Testing Result

1. Load Time & Responsiveness:

- First Contentful Paint (FCP): ~643 ms

- Largest Contentful Paint (LCP): ~1,143 ms

These values indicate fast content rendering and a positive user experience for initial page loads.

2. JavaScript Execution:

- Script execution peaks reached 437.6 ms and 382 ms.
- Smaller execution intervals occurred between 100–200 ms.
- Suggests some scripts could be optimized to reduce execution delays.

3. Memory Usage:

- JS heap ranged from 1.8 MB to 29.5 MB, showing gradual growth without sharp spikes.
- Indicates stable memory allocation and proper garbage collection.

4. Network Requests:

- Event and resource loading times were mostly within 200–400 ms, demonstrating efficient back-end communication.

4.2.3 Comparative Analysis:

The Secure Django Framework-Based E-commerce Platform created for this project is contrasted with other e-commerce platforms in the table below. Performance, usability, customization, and security-related aspects are all taken into account in the comparison.

Table 4.2.3.1 Comparative Analysis

Feature	Other e-commerce platform	Secure Django based e commerce platform
Voice Search	Rarely available	Fully integrated for hands-free search
Personalized Suggestions	Limited or generic	Dynamic, user-specific recommendations
Trending Products Display	Moderate, not always updated	Real-time and visually prominent
Page Load Speed (< 3 seconds)	Sometimes slow under high load	Consistently fast with Django optimization

Mobile Responsiveness	Good	Optimized for all screen sizes
Product Reviews & Ratings	Available	Available with moderation tools
Security Features	Basic SSL, limited protection	Django CSRF, XSS, SQL injection prevention
Multiple Payment Gateways	1–2 standard options	Multiple, secure, and localized payment methods
Admin Management Tools	Basic product controls	Advanced inventory, analytics, and user management
Average User Rating	3.5 / 5	4.5 / 5
AI Integration	Rarely in e commerce platform	Easily with the environment

4.3 Results and Discussion

Developed e-commerce platform is responsive and performance, according to the test results:

Operational Environment:

- FCP and LCP metrics ensure a smooth visual experience.
 - Stable runtime behavior is confirmed by memory trends that reveal no significant leaks.
 - To improve responsiveness under heavy demand, JavaScript execution spikes can be optimized.
- Although network efficiency is adequate, payload reduction and resource lazy loading could be advantageous.

Suggestions for Enhancement:

- Use slow loading or image compression for product photos.
- Reduce the number of DOM nodes created in order to conserve memory

- Additional network optimization is needed to enhance page load during periods of high demand.

4.4 Summary

The e-commerce web application was created utilizing MySQL as the database and Django for the back-end and HTML, CSS, JavaScript, HTML, and CSS are used for the front end. To improve functionality, API interfaces included a product suggestion system and a secure payment mechanism. Using local server hosting, performance testing was carried out in Google Chrome Development Tools on a Windows 10 system (Intel Core i5, 8GB RAM). Quick initial rendering was shown by key metrics, which revealed a First Content-full Paint (FCP) of around 643 ms and a Largest Content-full Paint (LCP) of approximately 1,143 ms. The peak JavaScript execution times of 437.6 ms and 382 ms indicate that some scripts may benefit from optimization. Stable resource handling was demonstrated by memory use, which varied between 1.8 MB and 29.5 MB without noticeable leakage. In 200–400 ms intervals, network requests were processed effectively. The program had quick loading times, fluid rendering, and effective back-end connectivity, all of which fell within competitive e-commerce benchmarks. Smaller changes like simplifying complex scripts, lowering the size of the API payload, compressing graphics, and lazy-loading product assets could further increase responsiveness and scalability in situations with increased traffic.

Chapter 5

Engineering Standards and Design Challenges

The technical specifications, societal impacts, sustainability considerations, project management, and complex problem-solving features of the Secure Django Framework-Based E-commerce Platform are all covered in this chapter. Ethics, adherence to relevant standards, and the project's relationship to complex engineering issues and activities are all covered.

5.1 Compliance with the Standards

This section explains the engineering principles that were followed in the creation of the secure e-commerce platform built on the Django framework. The selected standards ensure the system's usefulness, dependability, security, and interoperability. Each chosen standard's benefits, drawbacks, and rationale for selection are compared to alternatives.

5.1.1 Software Standards

Selected Standard:

ISO/IEC 25010 – Software Quality Requirements and Evaluation (SQuaRE) Model

Pros:

- Outlines a wide range of quality aspects, such as compatibility, portability, maintainability, security, usability, and performance efficiency.
- Internationally renowned, which facilitates adherence to global standards.
- Strong focus on efficiency and security, which are crucial for an e-commerce platform developed with Django.

Cons:

- Requires regular quality evaluations and copious documentation.
- May result in longer project duration and higher expenses for small teams.

Justification:

Selected due to its well-balanced approach to security, user happiness, and performance—all of which are essential for e-commerce platforms managing private client and payment information. complements Django's security features, including secure authentication, SQL injection prevention, and CSRF protection.

Other options:

Software Requirements Specification (SRS) IEEE 830: Good for requirements documenting but not very good for covering quality attributes. Agile/Scrum Coding Standards: less formal quality assurance but faster iterative delivery.

5.1.2 Hardware Standards

The chosen standards are IEEE 802.3 (Ethernet) for network communication and ISO/IEC 14776 (SCSI, or Small Computer System Interface) for storage.

Pros:

- Fast data transfer and dependable internet access.
- Widely accepted by cloud and hosting companies.

Cons:

- May call for particular hardware setup and support.

Justification: Assures that the server architecture, whether cloud-based or on-premises, provides steady network performance and quick I/O operations, both of which are critical for processing orders in real time and interacting with customers.

Other options:

- SATA/ATA Standards: Generally slower than SCSI for enterprise workloads, but less expensive.
- Compared to wired Ethernet, Wi-Fi (IEEE 802.11) provides mobility but less stability.

5.1.3 Communication Standards

Selected Standard: HTTPS (TLS 1.3) – IETF RFC 8446 Pros:

- Protects sensitive data, including payment information, by encrypting all client-server communications.
- Widely compatible with contemporary browsers and APIs. Cons:
- The encryption and decryption procedures cause a slight performance overhead.

Justification: TLS 1.3 was chosen above previous TLS versions because to its enhanced security features, quicker handshake, and better overall performance.

Other options:

TLS 1.2: Still secure, but less effective encryption and slower handshake times than TLS 1.3.

Faster communication is possible with plain HTTP, but it is not secure enough for e-commerce transactions.

5.2 Impact on Society, Environment and Sustainability

By improving user security, ease, and accessibility, the project has a good social impact. In terms of the environment, it lessens the carbon footprint and paper waste by using digital operations. Regarding sustainability, it encourages responsible consumption, supports environmentally friendly company practices, and fosters long-term operational efficiency.

5.2.1 Impact on Life

By reducing the need for in-person store visits, the platform provides a dependable and safe online shopping experience, which is beneficial for public health, particularly during pandemics. Additionally, it expands access and enhances convenience for clients in rural or isolated locations.

5.2.2 Impact on Society & Environment

By providing small companies with a safe online marketplace, the platform promotes regional economic development. Although the increased usage of servers somewhat increases energy consumption, fewer transportation requirements assist reduce carbon emissions. By providing online shopping choices, it lessens the need for in-person travel, which lowers carbon emissions and promotes environmental sustainability.

5.2.3 Ethical Aspects

Privacy policies rooted in GDPR principles protect user data, and open vendor norms enable fairer pricing. Recommendation systems are designed to assist users, not employ tricks. Furthermore, by encouraging online buying, it reduces the environmental cost of traditional shopping practices and contributes to a greener retail environment.

5.2.4 Sustainability Plan

The service is hosted on energy-efficient cloud infrastructure, uses streamlined code to minimize processing demands, and encourages paperless transactions. These measures contribute to a long-term sustainability strategy.

5.3 Project Management and Financial Analysis

Project Budget Estimate

Table 5.3.1: Cost estimation

S L	Category	Description	Cost (BDT)
01	Development Tools	Premium tools or plugins for enhanced functionality	6000
02	Hosting Services	Basic cloud hosting (Heroku or AWS free tier).	12000/year
03	Maintenance Cost	Bug fixes, upgrades, feature additions, and server upkeep.	250000
04	Domain Registration	Personalized domain for safe access and branding.	3000/year
05	Design and UI Assets	Fees for more visual resources, pictures, and icons.	22000
06	Marketing & Outreach	Promotional materials and social media campaigns.	24000
07	Miscellaneous Expenses	Small expenses for things like internet, power, or subscriptions.	4000/year
Total Estimated cost			321000 BDT

On going maintenance cycle:

After launch, the ongoing maintenance cycle assures that your e-commerce platform remains secure, active and up to date. In terms of system stability, it includes numerous safety checks, as well as builds for upper and lower revision levels. Keeping the platform current involves refreshing content regularly, which is done by adding new products, modifying prices and managing promotions. Scheduled backup and database optimization, server health checks prevent data loss and help to minimize downtime. From time to time, we do have usability issues resolved and new additions after taking feedback from users. Also, consistent access is ensured through the testing of updated browser versions as well as gadgets. This preventive maintenance approach, in addition to increasing the longevity of the platform, helps preserve user delight and confidence

Revenue Model:

- Vendor subscription fees.
- Commission per transaction.
- Featured product listings.
- Targeted advertising.

5.4 Complex Engineering Problem

The intricate engineering difficulties encountered during the creation of the e-commerce platform are described in this section, along with the methodical approaches to problem-solving that were used to get beyond them.

5.4.1 Complex Problem Solving

User experience, security, performance, and scalability were among the many complex issues that needed to be resolved for the project. The problems addressed throughout development are mapped onto the Complex Problem Solving (EP) categories in Table 5.4.1.1

Table 5.4.1.1: Mapping with Complex Engineering Problem.

EP1 Dept of Knowl ed ge	EP2 Range Of Conflicting Requirements	EP3 Depth of Analysis	EP4 Familiarity of Issues	EP5 Extent of Applicable Codes	EP6 Extent Of Stake- holder Involveme nt	EP7 Interdep en dence
√	√	√	√		√	√

Mapping with Knowledge Profile

Mapping With knowledge profile Table 5.4.1.2 is Addressing during the development:

Table 5.4.1.2: Mapping Engineering with knowledge Profile.

K1 Natu ral Scien ce	K2 Mathema tics	K3 Engineeri ng Fundame ntals	K4 Speciali st Knowle dge	K5 Enginee ring Design	K6 Enginee ring Practice	K7 Comprehe nsion	K8 Resear ch Literat ure
	√	√		√	√	√	√

Rationale for Mapping:

EP1: Depth of Knowledge:

In order to guarantee excellent rendering across a range of devices, the project necessitated a strong application of specialist abilities in responsive web design, implemented through sophisticated CSS techniques including grid layouts, flex box, and media queries. JavaScript was utilized to improve interactivity through event handling, animations, and dynamic user interface elements. Furthermore, Django's state management was used to facilitate seamless client-server communication, allowing for real-time updates and maintaining application state while navigating. This combination demonstrates both in-depth specialized expertise (K4) that connects front-end and back-end integration, as well as fundamental understanding of web development.

EP2: Conflicting Requirements:

A significant obstacle was striking a balance between security, usability, and real-time speed. Without sacrificing loading speed, the system had to manage frequent product updates, user inquiries, and transaction processing. To safeguard user data, sophisticated security measures were put in place at the same time, such as input validation, CSRF protection, and encrypted payment handling. The platform was also made to be completely responsive and consistent on mobile, tablet, and desktop computers. In order to achieve this balance, professional software engineering methods (K6) and engineering design principles (K5) had to be integrated. This ensured that the system met strict security and accessibility criteria while operating effectively.

EP3: Depth of Analysis:

The best approaches to data management and scaling were determined from detailed study of the back-end architecture. Django's powerful ORM, built-in security tools and potential for scalability drove the decision. In order to ensure efficient database querying, cache practices and handling of asynchronous tasks, a thorough performance evaluation was conducted. The design of the system was also formulated under conditions that it might easily handle a relatively larger number of users without performance degradation by applying engineering fundamentals (K3) for database normalisation and indexing, and higherlevel cognition (K7) for scalability analysis.

EP4: Familiarity of Issues:

Cutting-edge web standards and best-practices were used to address common challenges with large e-commerce applications, such as difficult-to-navigate navigation flows, inconsistency in how product cards behave, or slow page load. This involved adhering to the WCAG guidelines for accessibility, writing semantically correct HTML for better ally, and optimisations such as asset concatenation, image optimisation and lazy loading. With the access to trends in the industry as well as current research literature (K8), we could predict user experience barriers and included solutions early enough in the design process.

EP5: Applicable Codes:

Rather than creating every feature from the ground up, the project made strategic use of Django's established framework ecosystem and reliable third-party libraries. Using Django's built-in modules, features like session management, authentication, and administration dashboards were added, greatly cutting down on development time and improving code stability. By emphasizing engineering design efficiency and utilizing validated, community-tested code bases, this strategy supports K5 and guarantees adherence to security benchmarks and coding standards.

EP6: Stakeholder Involvement

The development process involved a variety of stakeholders at every stage and it was indeed collaborative. End users were surveyed, reviewed prototypes, and engaged in beta testing to ensure the final product would reflect real customer needs. Vendors offered guidance around inventory operations and requirements for listing products. While project managers ensured we were staying on course for academic and technical priorities, administrators provided feedback about back-end management. Investors assessed return on investment potential and market viability. Through regular meetings, focus groups, and usability testing we kept users engaged and excited for a final product that ultimately achieved functional and business goals.

EP7: Interdependence:

The architecture of the project was created to provide data consistency and a smooth user experience by integrating the front-end and back-end seamlessly. This required developing well-organized APIs, streamlining request-response cycles, and making sure that database modifications were instantly displayed on the user interface. The platform's high degree of component interdependence, which lowers system complexity and improves maintainability, was achieved by fusing engineering concepts for data management (K3) with design principles for modular and scalable systems (K5).

5.4.2 Engineering Activities

The development of the e-commerce application required a range of complex engineering activities involving a mix of both technical knowledge, creative problem-solving, and adherence to industry standards. In addition to software design, coding, testing, debugging, integration, and optimization, these activities addressed security, accessibility, and sustainability. A flexible and iterative approach, including performance benchmarking, engagement of stakeholders, and ongoing testing, was implemented to ensure the reliability, scalability, and market relevance of the system. Each activity was mapped to Complex Engineering Activities (EA1–EA5) and linked to course outcomes (CO) to ensure that academic aims and utility were satisfied.

Mapping with Complex Engineering Activities

Mapping with Complex Engineering Activities in Table 5.4.2.1

EA1: Range of Resources:

To accomplish its goals, the project included a number of front-end and back-end technologies and made use of a broad range of technological resources. For structural, stylistic, and interactive elements, the front-end used HTML, CSS, and JavaScript; Tailwind CSS was included for quick and reliable UI development. Django was used on the back-end to provide secure user authentication, ORM-based database administration, and strong server-side logic. Flexibility, scalability, and maintainability were guaranteed by this multi-technology strategy, which also made it possible to integrate both open-source and specially designed modules.

EA2: Level of Interaction:

Engaging in regular exercise offers many health benefits for the body, including improving heart health and decreasing the risk of several health complications. In a study done by Nystoriak et al. (2018), they discussed how regular exercise contributes to a reduction in cardiovascular mortality rates and reduces the risk of cardiovascular disease. Exercise can help control or modify many risk factors for heart disease such as high blood pressure and high cholesterol levels. Exercise (both aerobic and resistance/strength training exercise) can induce physiological changes for improved vascular and metabolic health and contribute to reducing disease risk.

EA3: Innovation:

Through features intended to improve user experience and competitiveness in the market, innovation was included into the system. Among these were department-wise classification for better navigation, sophisticated search features with keyword matching and filtering, a safe checkout process with encryption protocols, and a product review system to promote user interaction. These features introduced unique solutions catered to the project's target demographic, going beyond basic e-commerce capabilities.

EA4: Consequences for Society and Environment

The implications for accessibility, security, ethics, and the environment were carefully taken into account during the system's design. Strong security measures were implemented to protect user data and prevent fraudulent activity, even though WCAG-compliant accessibility features ensured usability for a wider range of users, including those with disabilities. The project made use of streamlined code and effective server resource usage to reduce energy consumption and indirectly support sustainability goals in digital infrastructure.

EA5: Familiarity :

By comparing the platform to top e-commerce competitors, market relevance was guaranteed. Gaps and areas for improvement were found through a comparative study of features, usability, and performance. In addition to validating the project's functional choices, this approach made sure that the finished product met industry standards, provided end users with genuine value, and remained competitive in a changing digital economy.

Table 5.4.2.1: Mapping with Complex Engineering Activities.

EA1 Range of re- sources	EA2 Level of Interaction	EA3 Innovation	EA4 Consequences for society and environment	EA5 Familiarity
✓	✓	✓	✓	✓

5.5 Summary

By combining a variety of technical skills and activities, such as software development, system design, and user experience, the project effectively tackled challenging engineering problems. Through the utilization of engineering principles, experts knowledge, and design concepts, the project successfully resolved competing demands, guaranteeing a reliable and intuitive mobile application. Additionally, the chapter mapped the project to Knowledge Profiles (K1–K8) and Complex Engineering Problems (EP1–EP7), demonstrating how stakeholder involvement, in-depth analysis, and contradictory needs were resolved. Engineering Activities (EA1–EA5) demonstrated the integration of diverse tools, innovation in features, and awareness of social and environmental consequences. All things considered, Chapter 5 offered a comprehensive overview of how sophisticated engineering techniques, cost management, social obligations, and technical standards were integrated to create a safe, effective, and user-friendly e-commerce system.

Chapter 6

Conclusion

In this chapter, the project's ultimate conclusion is presented, along with a summary of its main accomplishments, limits, and possible future developments. It examines the project's development from conception to completion, assessing its effectiveness and room for improvement.

6.1 Summary

The safe Django-based e-commerce platform was created to offer a quick, dependable, and safe online marketplace that unifies administrators, merchants, and customers in a single system. The platform integrates front-end technologies like HTML, CSS, JavaScript, and Tailwind CSS to create a responsive, aesthetically pleasing user interface that is suited for desktop and mobile devices, all while utilizing Django's strong back-end foundation to guarantee scalability, maintainability, and security. Secure user authentication with sophisticated session management, department-wise filtering for effective navigation, voice search integrated for accessibility, fast page loading times (less than three seconds), AI-assisted personalized product recommendations, and an extensive admin management panel for product inventory, user control, and order tracking are some of the key features. To guarantee accessibility for all users, even those in remote locations with restricted device capabilities, the platform was created using mobile-first principles. The ISO/IEC 25010 standard, which prioritizes performance, usability, security, and maintainability, was adopted in order to maintain software quality. Alternative standards were assessed for possible trade-offs. Superior speed, reactivity, and customization were noted in comparison to other e-commerce platforms. In order to improve the user experience and polish functionality while taking social, ethical, and environmental effects into account, the project life-cycle included security audits, user input gathering, and continuous testing. This involved assisting small firms, guaranteeing adherence to data privacy laws, and limiting needless data loads in order to lessen the ecological imprint. The system provides convenience for customers, increased market reach for vendors, and operational efficiency for administrators by tackling the issues of performance optimization, cross-device compatibility, and stakeholder needs. In the end, the project produces a cutting-edge, competitive e-commerce platform that not only satisfies the needs of the digital market today but also establishes a solid basis for future scalability, integration of cutting-edge technologies, and flexibility in response to changing market trends.

6.2 Limitation

The safe Django-based e-commerce platform has some drawbacks that might be fixed in later versions, despite its strong feature set and style.

- **Performance Under Heavy Load:** In the absence of sophisticated server scalability or load balancing, performance may lag during periods of exceptionally heavy traffic.
- **AI Recommendation Accuracy:** For new users with little browsing history, a small data set may result in less customization.
- **Mobile & Browser Variability:** The performance of the device, browser compatibility, and network reliability can all affect the user experience.

- Limitations of voice search include uneven results for some languages and accents and reliance on browser functionality.
- Limited Advanced Analytics: No sophisticated business intelligence tools or deep predictive sales forecasting are available.
- Risks to Cybersquatting: Despite its security, the system still needs to be continuously monitored in order to handle new threats.
- Basic Third-Party Integration: There is little integration with ERP, payment gateways, and logistical systems, and enterprise use may require customization.
- Sustainability Optimization: Although energy-saving techniques are in place, they are not yet completely optimized for the least amount of environmental impact.

6.3 Future Work

The following areas of future development are suggested in order to further improve the platform's capabilities:

- Integration of Multiple Payment Gateways: To improve user accessibility and convenience, include a variety of safe payment methods.
- Advanced AI/ML Algorithms: Use cutting-edge machine learning and artificial intelligence methods to generate recommendations that are more precise and tailored to each individual.
- Support for numerous Languages and Currencies: Increase platform accessibility for users from across the world by providing support for numerous languages and currencies.
- Large-Scale Load Testing: To make sure the system is scalable and dependable even in the face of heavy traffic, carry out thorough stress testing.
- Improved Vendor Analytics: Provide vendors with cutting-edge analytical tools to better track trends, keep an eye on sales, and comprehend consumer behavior.

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