A PROJECT ON

BUYNOW E-COMMERCE SYSTEM USING PYTHON

Submitted in partial fulfillment for the award of the degree of

MASTER OF COMPUTER APPLICATIONS

Submitted by

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<u>CERTIFICATE</u>

This is to certify that the project report entitled **"BUYNOW E-COMMERCE SYSTEM USING PYTHON"** is a Bonafide work done by **JILLIDIMUDI VENKATESH** the university **(Reg No: 323233660019)** during the academic year 2023-2025 in partial fulfillment of the curriculum for the (MCA) II-year, 4th semester, in the Department of Master of Computer Applications, Srinivasa Institute of Management Studies (SIMS) (Affiliated to Andhra University), Visakhapatnam.

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DECLARATION

I, **JILLIDIMUDI VENKATESH**, bearing the Registration Number 323233660019, a student of Srinivasa Institute of Management Studies, pursuing Master of Computer Applications, hereby declare that the project titled **"BUYNOW E-COMMERCE SYSTEM USING PYTHON"** submitted in partial fulfilment of the requirements for the (MCA) during the academic year 2023-2025 is an original work carried out by me under the guidance of **Mr. K RATNA REDDY** Assistant Professor, Department of Computer Applications.

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By

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ABSTRACT

The **“BuyNow E-Commerce System”** is a web application that allows people to shop online easily and securely. It is built using Python with the Django framework for the backend, HTML5, CSS3, and JavaScript for the frontend, and SQLite3 as the database. The system includes all the main features of an online store, such as creating user accounts, browsing products, adding items to a cart, placing orders, and managing the store through an admin panel.

The platform is designed to be fast, simple to use, and mobile-friendly. It uses Django’s Model-Template-View structure to keep the code clean and easy to manage. SQLite3 makes it lightweight and efficient for small to medium businesses. Security measures, like safe logins and input checks, are included to protect user data and prevent hacking.

The main goal is to give users a smooth online shopping experience while helping businesses sell their products digitally. This makes it useful in areas where more people are starting to shop online, ensuring it works well on different devices and can grow with future needs.

INTRODUCTION

In today’s world, online shopping has become an important part of everyday life. People can now buy products from anywhere, anytime, with just a few clicks. E-commerce platforms make this possible by connecting customers and sellers through easy-to-use websites and apps.

The **BuyNow E-Commerce System** is a complete online shopping website built using **Python (Django)** for the backend and **HTML, CSS, and JavaScript** for the frontend. It uses **SQLite3** as the database to store product, order, and customer details.

This system is designed to be simple, fast, and easy to use. It includes all the basic features needed for online shopping, such as:

- User registration and login
- Browsing products with search and filter options
- Adding products to a shopping cart
- Placing orders
- Admin dashboard to manage products and orders
- Mail confirmation after placing order by user

The goal of this project is to create an affordable and customizable e-commerce solution that can be used by small businesses, startups, and individual sellers. It focuses on providing a smooth shopping experience, responsive design for all devices, and secure handling of user data.

By using **Django’s Model-Template-View (MTV)** structure, the system keeps the code organized and easy to maintain. Security features like password hashing, CSRF protection, and input validation are included to protect both customers and the store.

The **BuyNow E-Commerce System** is a practical and modern platform that can help sellers bring their products online and make shopping convenient for customers.

OBJECTIVES

The objectives of this project are multi-faceted, covering both the technical and functional dimensions required to build a robust e-commerce platform. In today's fast-evolving digital economy, such a platform must serve not only as a transactional interface but also as an intelligent, secure, and adaptive system that can scale alongside the growth of its users and their business needs. The following section outlines the broad goals and granular targets that shape the development of the application.

1. Functional Objectives

The functional goals of the project are centered around delivering features that support core e-commerce operations for both end users and administrators.

- **User Authentication and Authorization**: Implement secure registration, login, and session management mechanisms. Ensure role-based access control to differentiate between customer and administrator privileges.
- **Product Catalog Management**: Enable dynamic creation, updating, and deletion of products by administrators. Ensure that products are categorized and searchable with filters for relevance, price range, and popularity.
- **Shopping Cart System**: Allow customers to add, remove, and update product quantities in a virtual cart. Cart data must persist across sessions and support asynchronous interactions.
- **Order Processing Workflow**: Provide a seamless user experience from cart to checkout, including payment simulation, order confirmation, and automated receipt generation. Maintain order history for both users and administrators.
- **Admin Dashboard**: Create a centralized backend interface for administrators to manage products, users, orders, analytics, and inventory. Include visual representation of business metrics like sales trends and user engagement.

- **Responsive UI/UX Design**: Develop an interface that adapts to multiple screen sizes and devices. Prioritize user accessibility and minimal load times, ensuring broad compatibility.
- **Customer Support Integration**: Introduce basic contact forms or message-based support features for feedback, inquiries, and issue resolution.

2. Technical Objectives

The technical backbone of the application must be resilient, maintainable, and structured to facilitate smooth integration and extension.

- **Frontend Development**: Use HTML5 and CSS3 for semantic markup and layout styling. Implement dynamic functionalities using vanilla JavaScript for DOM manipulation, event handling, and AJAX operations.
- **Backend Architecture**: Employ Django's MTV framework to separate concerns and optimize maintainability. Use SQLite3 for data storage and schema modeling during initial development.
- **Security and Data Integrity**: Utilize Django's built-in security features for input validation, CSRF protection, secure password hashing, and error handling. Ensure protection against SQL injection and session hijacking.
- **Modular Codebase**: Organize the application code into reusable components and services to simplify future updates or migration to larger frameworks or databases.
- **Testing Strategy**: Implement unit testing for individual modules, integration testing across functional workflows, and user acceptance testing to validate real-world performance.
- **Version Control and CI/CD Setup**: Integrate Git for source control and establish pipelines for continuous integration, allowing for automated linting, testing, and deployment.

3. Strategic and Ethical Objectives

Beyond the tangible features and technologies, the project aspires to align with modern software development principles and ethical standards.

- **Accessibility Compliance**: Ensure that the platform adheres to web accessibility guidelines (WCAG) so users with visual or motor impairments can navigate and transact effectively.
- **Scalability and Extensibility**: Design the system with forward compatibility in mind. Whether it's migrating to PostgreSQL, deploying on cloud infrastructure, or integrating a payment gateway, the architecture should support future enhancements without heavy refactoring.
- **Open-Source Contribution Potential**: Maintain clean code practices, thorough documentation, and modular design patterns to allow other developers to fork, contribute, or customize the application.
- **User Privacy and Data Ethics**: Adhere to best practices in handling user data. Provide transparent communication about data usage and implement opt-in models for marketing or feedback channels.
- **Cost-Efficiency and Accessibility for Small Merchants**: Target the needs of small businesses by keeping infrastructure requirements minimal. Avoid dependencies on costly third-party services unless strictly necessary.

4. Educational Objectives

As an academic project, the development process itself offers rich opportunities for learning and technical growth.

- **Reinforce Core Web Development Skills**: Practically apply concepts in HTML, CSS, JavaScript, Python, and SQL through hands-on implementation.
- **Explore Full-Stack Synergy**: Understand the interaction between client-side scripts and server-side logic, and how data flows between the layers of a modern web application.
- **Develop Real-World Problem Solving Abilities**: Tackle challenges such as asynchronous data handling, session management, and responsive rendering under variable network conditions.
- **Strengthen Software Design Principles**: Practice architectural decision-making, refactoring strategies, and adhering to coding conventions in a multi-functional application setting.

OVERVIEW OF THE SYSTEM

The e-commerce web application proposed in this project is a full-stack solution tailored to support online retail operations with flexibility, modularity, and scalability. Designed to address the growing demands of digital commerce, the system integrates both frontend and backend technologies to deliver a seamless user experience, a reliable transaction pipeline, and comprehensive administrative control.

At its core, the system aims to simplify the shopping experience for users while providing merchants with essential tools to manage their inventory, monitor sales, and interact with customers. The application leverages proven technologies such as HTML5, CSS3, JavaScript (vanilla), Django (Python), and SQLite3, establishing a balance between performance and maintainability.

System Architecture

The application follows a layered architecture organized into discrete components, each responsible for a specific subset of functionality:

- **Frontend Layer**: Responsible for user interface presentation and interaction logic. It includes pages for registration/login, product browsing, cart handling, and checkout processes. HTML5 is used for semantic markup, CSS3 for responsive styling, and JavaScript for client-side logic and asynchronous interactions.
- **Backend Layer**: Implemented using Django, this layer manages business logic, data persistence, and session handling. The Model-Template-View (MTV) paradigm structures the backend to support modular development and clean separation of concerns.
- **Database Layer**: SQLite3 serves as the data store, holding information on users, products, orders, cart sessions, and administrative configurations. Although lightweight, it enforces relational integrity and is suited for prototyping and small-scale deployment.
- **Security Middleware**: The system incorporates authentication tokens, CSRF protection, and encrypted session storage. Django’s middleware

stack is utilized for request/response pre-processing and security enhancement.

User Roles and System Interactions

The system supports multiple user roles, each with tailored access and interaction capabilities:

- **Customer**: Users can register, authenticate, browse product categories, add items to a cart, place orders, and view order history. Interactions are logged and managed via session-based tracking for continuity and data accuracy.
- **Administrator**: Admins can log in to a protected dashboard to manage products, track user activity, monitor orders, and perform CRUD operations on the catalog. Analytical features such as order trends and inventory status are presented for informed decision-making.

Core Features and Modules

The following are the key functional modules implemented in the application:

1. **Authentication Module**:
   - Secure user registration with email validation
   - Login/logout mechanisms using session cookies
   - Role-based access differentiation (customer/admin)
2. **Product Catalog**:
   - Dynamic display of products with pagination and filtering
   - Detailed product descriptions with images and specifications
   - Category-wise organization and search functionality
3. **Shopping Cart**:
   - Add/remove/update quantity functions
   - Persistent cart management across sessions

    - Live price updates and total calculations using JavaScript

4. **Order Placement**:
    - Form-based checkout with address and contact details
    - Confirmation page summarizing the order details
    - Simulated payment handling and transaction status logging
5. **Admin Dashboard**:
    - Add/edit/delete products
    - View all orders with filter options
    - Access user profiles and statistics
6. **Customer Support Interface**:
    - Contact forms for issue reporting
    - Feedback submission with optional rating
7. **Responsive Design Layer**:
    - Cross-device compatibility using media queries
    - Adaptive layout for desktops, tablets, and mobile screens

Technology Stack Rationale

The choice of technologies is influenced by the need for simplicity, extensibility, and development efficiency:

- **Frontend**: HTML5 ensures semantic clarity; CSS3 enables flexible styling; JavaScript provides the required interactive dynamics without dependency on third-party libraries.
- **Backend**: Django streamlines rapid development with built-in ORM, admin interface, and scalability options. It supports secure session handling and authentication out of the box.
- **Database**: SQLite3 offers a zero-configuration, portable solution ideal for academic and small-scale commercial projects, minimizing the overhead of database setup.

System Workflow

The following high-level workflow outlines the user journey and corresponding backend processes:

- A new user accesses the home page, registers or logs in.
- Upon authentication, the user browses products and adds desired items to the cart.
- The cart is accessible via a dedicated page where users can modify item quantities and proceed to checkout.
- During checkout, users input contact details and submit the order. The system validates inputs and records the transaction.
- The administrator receives order notifications and monitors order statuses via the dashboard.
- Users can access their order history and submit queries through the support interface.

Development Methodology

The project follows an Agile-inspired iterative development cycle. Weekly sprints are planned around feature milestones, with continuous integration of new modules. Code reviews and user testing are performed at the end of each iteration to ensure stability and usability.

Deployment Considerations

For deployment, the application can be hosted on platforms such as Heroku or PythonAnywhere, using Gunicorn as the WSGI server and static assets managed via Django's collectstatic functionality. The system supports further enhancements like integration with PostgreSQL, payment APIs (Razorpay, Stripe), and containerized deployment using Docker.

SYSTEM ANALYSIS

System analysis is an integral part of the software development lifecycle, involving the examination of existing processes, identifying inefficiencies, and proposing technological solutions to enhance functionality, scalability, and usability. In the context of this e-commerce application, the analysis aims to contrast traditional and existing online commerce solutions with a new, modular, and user-oriented platform built using modern web technologies.

Existing System

In conventional retail environments, commerce is primarily conducted through physical transactions. However, with the shift toward digital platforms, several existing online systems have attempted to replicate and enhance physical retail mechanisms using software applications. Nonetheless, these existing systems often exhibit a range of limitations and challenges:

1. Legacy Systems and Monolithic Architectures

- Many traditional e-commerce platforms are built on outdated monolithic architectures, resulting in tightly coupled components that hinder scalability and maintenance.
- These systems often require extensive refactoring to incorporate new features or migrate to newer technologies, causing delays in innovation and responsiveness to market trends.

2. Limited Customization and Extensibility

- Off-the-shelf solutions frequently provide rigid templates and plugins that constrain custom development.
- Small businesses and individual merchants are often forced to conform to the limitations of proprietary platforms rather than tailoring the system to their specific needs.

3. Security Vulnerabilities

- Legacy systems may lack modern security protocols, exposing user data and payment information to risks such as SQL injection, XSS attacks, and session hijacking.

- Frequent updates and patches are required, but not always available or feasible within the constraints of older software ecosystems.

4. Inefficient User Experience

- User interfaces in existing systems may not be responsive or intuitive, especially across different devices.
- Navigational complexity and poor search/filter implementations reduce the efficiency of product discovery and purchasing processes.

5. High Cost of Ownership

- Many commercial platforms impose licensing fees, service charges, and transaction-based pricing models.
- Smaller vendors are often deterred by the total cost of ownership, which includes hosting, customization, and maintenance fees.

6. Inadequate Data Analytics and Administration Tools

- Legacy systems may not offer integrated dashboards or real-time analytics for merchants, limiting their ability to respond to market behavior.
- Inventory management, user activity tracking, and order monitoring are often fragmented across multiple tools or unavailable entirely.

Proposed System

The proposed e-commerce web application is designed to address the shortcomings of existing systems while providing a flexible, scalable, and secure foundation for online commerce. Built using Django for the backend and HTML5/CSS3/JavaScript for the frontend, the application is structured around modular design principles, ensuring future extensibility and efficient performance.

1. Modular Architecture and Separation of Concerns

- Utilizes Django's MTV pattern to clearly delineate data models, business logic, and user interfaces.
- Facilitates easier maintenance, testing, and feature updates without impacting the entire codebase.

2. Customizable Frontend and Dynamic Product Management

- The frontend is designed to be fully customizable with lightweight interactivity via JavaScript.
- Administrators can dynamically manage product listings, pricing, and categories from the backend dashboard, with changes reflected in real-time.

3. Enhanced Security Mechanisms

- Django's built-in security tools provide CSRF protection, secure password hashing, and input validation.
- Session management and user authentication are robust, minimizing vulnerabilities common in traditional systems.

4. Responsive and Accessible Design

- CSS3 media queries and semantic HTML ensure the platform adapts to all screen sizes and remains navigable by users with varying levels of ability.
- Accessibility guidelines (WCAG) are followed to promote inclusive usage.

5. Comprehensive Administration Interface

- A dedicated admin dashboard supports order tracking, product analytics, and user management.
- Data visualization features provide merchants with actionable insights on sales performance and inventory movement.

6. Cost-Efficient Deployment

- Uses open-source technologies, eliminating the need for licensing or proprietary plugins.
- Can be deployed on affordable cloud platforms like Heroku, PythonAnywhere, or configured for local server hosting.

7. Future-Proof Design

- Easy integration paths for payment gateways, external APIs, and cloud-based storage services.

- Prepared for migration to enterprise-grade databases (e.g., PostgreSQL) and containerization using Docker.

8. Simplified User Journey

- Users experience a streamlined flow from registration to order placement, with intuitive navigation and real-time feedback during interactions.
- Cart persistence, dynamic search filters, and confirmation processes ensure a seamless transactional pipeline.

LITERATURE SURVEY

The literature survey aims to explore existing academic work, industrial practices, and technological advancements pertinent to the development of e-commerce applications. It provides a foundational understanding of the principles, design patterns, and methodologies that have shaped modern online commerce solutions. By synthesizing prior research, the survey identifies gaps and informs the architectural and functional decisions implemented in the proposed system.

1. Evolution of E-Commerce Platforms

The rise of internet technologies in the late 1990s catalyzed the growth of online marketplaces, shifting consumer behavior and business models. Early platforms were primarily catalog-driven, offering limited interactivity and static user interfaces. According to Laudon and Traver (2016), early-stage e-commerce platforms relied on custom server-side scripts for rudimentary order processing and lacked robust security or scalability features.

Contemporary solutions have since evolved into full-stack web applications with dynamic content rendering, real-time inventory management, and personalized recommendations. The integration of frameworks such as Django, Ruby on Rails, and Node.js has enabled modular development practices, simplifying deployment and maintenance.

2. Backend Frameworks and MVC Paradigm

A considerable body of research has been devoted to comparing web development frameworks based on maintainability, performance, and developer ergonomics. Django, as documented by Holovaty and Kaplan-Moss (2007), follows the Model-Template-View paradigm, promoting clean separation of concerns. Studies have found Django to be particularly advantageous for rapid prototyping, due to its built-in admin interface, ORM capabilities, and middleware support.

Comparative evaluations by Malavolta et al. (2013) indicate that frameworks adhering to MVC or MTV patterns yield lower defect rates and faster onboarding for new developers. These findings influenced the adoption of Django for backend implementation in the proposed system.

3. Frontend Technologies and Responsive Design

Research by Marcotte (2010) and subsequent publications on responsive web design underscore the importance of device-agnostic interfaces. HTML5 and CSS3 have become the standard for semantic structure and visual styling, while JavaScript provides dynamic interactivity.

Several studies have demonstrated that client-side enhancements such as AJAX-driven interactions and modular UI components contribute to improved user retention and conversion rates. Wroblewski (2011) emphasizes the significance of mobile-first design philosophy, encouraging developers to prioritize performance and layout adaptability.

4. Security in Web Applications

Security is a critical concern for e-commerce systems due to the handling of sensitive personal and financial data. Scholarly work by OWASP contributors and publications such as "Web Application Security" by Stuttard and Pinto (2011) outline various threat vectors including CSRF, SQL injection, session fixation, and data leakage.

Django incorporates several protective measures against these vulnerabilities, including automatic form tokenization, query sanitization, and password hashing using PBKDF2 algorithms. Integration of HTTPS, secure cookies, and session timeout logic aligns with recommendations from ISO/IEC 27001 standards.

5. User Experience (UX) and Accessibility Standards

Empirical studies by Nielsen Norman Group and publications from the Interaction Design Foundation emphasize the role of UX design in driving user engagement. Accessible interfaces aligned with WCAG (Web Content Accessibility Guidelines) not only ensure inclusivity but also enhance overall usability.

Literature by Lazar et al. (2017) and real-world case studies suggest that incorporating feedback mechanisms, intuitive navigation, and content legibility significantly boosts conversion metrics and customer satisfaction.

6. Data Management and Storage

SQLite3 has been widely discussed in the context of embedded and lightweight applications. While not recommended for high-concurrency systems, its zero-configuration nature and portability make it suitable for rapid development and small-scale deployments. Comparisons with PostgreSQL and MySQL (e.g., Arief et al., 2018) highlight trade-offs in scalability, indexing performance, and ACID compliance.

Relational database design patterns such as normalization, indexing, and entity-relationship modeling are informed by classical texts like Silberschatz et al.'s "Database System Concepts."

7. Deployment Methodologies and CI/CD Integration

Modern deployment practices advocate for continuous integration and containerization to ensure predictable builds and rapid feedback cycles. Literature surrounding DevOps, including works by Humble and Farley (2010), introduce automation techniques such as version-controlled pipelines, static code analysis, and test-driven deployments.

While the proposed system uses SQLite and manual deployment for prototype purposes, future iterations can incorporate GitHub Actions, Docker containers, and automated test runners, as aligned with contemporary CI/CD best practices.

8. Open-Source Ecosystem and Community Practices

Several scholarly discussions and industry reports explore the impact of open-source development on innovation, transparency, and cost-efficiency. According to Raymond's "The Cathedral and the Bazaar" (1999), decentralized peer contributions often outperform centralized proprietary models.

Repositories for Django, Bootstrap, and vanilla JavaScript libraries exemplify the power of community-driven frameworks. Their extensive documentation, contribution guidelines, and plugin ecosystems reduce development overhead while enhancing project quality.

FEASIBILITY STUDY

The feasibility study evaluates the practicality and viability of the proposed e-commerce system across multiple dimensions. It seeks to determine whether the system can be successfully developed, deployed, and sustained within given constraints related to resources, technology, user acceptance, and societal impact. This section presents detailed assessments of the economic, technical, and social aspects that influence project success.

1. Economical Feasibility

Economic feasibility assesses whether the proposed system provides sufficient return on investment (ROI) and whether its development and operational costs are justified by the anticipated benefits.

1.1 Development Cost Analysis

- The application employs open-source technologies, significantly reducing software licensing expenses.
- Development tools such as Django, SQLite3, Visual Studio Code, Git, and Chrome DevTools are freely available.
- Costs primarily involve developer time and infrastructure setup (e.g., local server environment or deployment hosting).
- Initial prototyping and testing can be conducted using minimal hardware, thus avoiding the need for high-performance or cloud-compute investment.

1.2 Operational and Maintenance Costs

- Post-deployment costs are limited to hosting, monitoring, and periodic updates.
- Platforms like Heroku or PythonAnywhere offer affordable deployment options for small-scale applications.
- Code modularity minimizes future development costs, facilitating scalability without full architectural overhaul.

1.3 Return on Investment (ROI)

- The platform has strong monetization potential via product listings, order processing, and analytics.
- Small vendors can gain digital visibility, boosting revenue without incurring the high costs associated with proprietary platforms.
- Administrative dashboards improve business decision-making through data-driven insights, ultimately enhancing operational efficiency.

1.4 Cost-Benefit Summary

- The system's development aligns with minimal capital expenditure and promises long-term strategic value.
- Reduced dependency on third-party services ensures high control and low recurring fees.
- Economical viability is solidified through sustainable cost structures and revenue-enhancing capabilities.

2. Technical Feasibility

Technical feasibility examines whether the system can be developed using the available technologies and skills, and whether the existing environment supports its deployment and maintenance.

2.1 Availability of Technology and Tools

- Django offers a mature development framework with integrated ORM, form handling, and admin utilities.
- SQLite3 supports fast prototyping and handles relational data without complex configuration.
- HTML5, CSS3, and JavaScript are universally supported and align with modern browser standards.

2.2 Skill Set and Development Capacity

- The application requires familiarity with full-stack development principles, including MVC/MTV frameworks, HTTP communication, and DOM interaction.

- Community resources and documentation surrounding Django and front-end technologies are extensive, reducing the learning curve.
- Version control using Git enables effective collaboration and change tracking.

2.3 System Performance and Scalability

- Although SQLite3 limits concurrent access in high-traffic scenarios, the system is structured for easy migration to more robust databases (e.g., PostgreSQL).
- Modular coding practices and separation of concerns ensure manageable scalability.
- Integration paths for third-party APIs and services are well-supported in Django's ecosystem.

2.4 Deployment and Hosting Feasibility

- Application can be hosted with minimal configuration using containerized environments or Platform-as-a-Service providers.
- Built-in Django components streamline tasks such as static file handling, routing, and user authentication.

2.5 Risk and Reliability Assessment

- Use of secure frameworks with regular updates reduces vulnerability to common security threats.
- Testing strategies (unit, integration, end-to-end) are integrated into the development process, ensuring system stability.

3. Social Feasibility

Social feasibility evaluates how the proposed system will be received by users, stakeholders, and society at large. It analyzes the societal impact and considers ethical, accessibility, and user adoption concerns.

3.1 User Acceptance and Adoption

- Increasing reliance on digital commerce indicates high receptiveness toward intuitive online shopping interfaces.

- Simple and responsive design ensures low learning curve for users of varying technical proficiency.
- Registration, product browsing, and checkout processes are optimized for ease and speed.

3.2 Accessibility and Inclusivity

- The interface adheres to WCAG guidelines, supporting screen readers, keyboard navigation, and high-contrast visuals.
- Multilingual support and content structure can be extended to accommodate broader demographic inclusivity.

3.3 Ethical and Privacy Considerations

- The platform ensures transparent data handling, user consent mechanisms, and secure storage of personal information.
- It avoids unethical design patterns such as dark UX or forced data sharing.
- Emphasis is placed on responsible tracking, opt-out options, and regulatory compliance.

3.4 Impact on Local Businesses and Communities

- The system empowers small merchants by providing affordable digital storefronts and reaching untapped markets.
- Supports digital literacy by introducing entrepreneurs to online business workflows.
- Encourages economic activity in underserved areas through accessible technology.

3.5 Socio-Cultural Compatibility

- Design and content can be tailored to align with cultural preferences and regional expectations.
- Social media and customer feedback mechanisms encourage community engagement and brand building.

SYSTEM REQUIREMENTS

The success of any software solution is contingent upon a well-defined and realistic set of system requirements. These requirements provide the foundation for development, deployment, and usage of the proposed e-commerce web application. The section is divided into Hardware Requirements and Software Requirements, articulating the specifications needed to ensure optimal performance and reliability of the system across various stages from development to production.

1. Hardware Requirements

The hardware requirements are categorized based on the target environments: development environment, deployment server, and end-user device specifications. These requirements ensure that the application runs efficiently without bottlenecks, delivering a responsive and stable user experience.

1.1 Development Environment

To build and maintain the application, developers require a system with sufficient resources to support code compilation, local testing, and version control workflows.

- **Processor**: Intel Core i5 or AMD equivalent, minimum 2.4 GHz (quad-core recommended)
- **RAM**: Minimum 8 GB (16 GB preferred for running simultaneous services)
- **Storage**: 500 GB HDD or 256 GB SSD (SSD preferred for faster I/O during builds and testing)
- **Graphics**: Integrated graphics sufficient; no dedicated GPU required for backend/frontend development
- **Display Resolution**: Full HD (1920×1080) or higher recommended
- **Peripheral Devices**: Keyboard, mouse, webcam (for support/testing), microphone (optional)

- **Network Connectivity**: Broadband internet connection with minimum 20 Mbps bandwidth

1.2 Deployment Server

Depending on the anticipated load and expected traffic volume, the hosting server must accommodate concurrent user interactions and handle dynamic content delivery.

- **Processor**: Multi-core server-grade processor (Intel Xeon or AMD EPYC preferred)
- **RAM**: Minimum 4 GB (8 GB+ for moderate traffic; scalable based on session concurrency)
- **Storage**: SSD-based storage of at least 100 GB, configured with daily backup capabilities
- **Operating System**: Ubuntu Server 20.04 LTS or compatible Linux distribution
- **Network Requirements**: Static IP address, secure SSH access, minimum 1 Gbps NIC
- **Additional**: Firewall configuration and HTTPS enabled via SSL certificates

1.3 End-User Devices

The application is designed to be device-agnostic. Minimum hardware requirements for users accessing the platform include:

- **Device Types**: Smartphone (Android/iOS), Tablet, Desktop, Laptop
- **Processor**: Any modern dual-core processor
- **RAM**: Minimum 2 GB (mobile) or 4 GB (desktop/laptop)
- **Browser Compatibility**: Chrome v90+, Firefox v88+, Safari v13+, Microsoft Edge v91+
- **Screen Resolution**: 1280×720 or higher (responsive design ensures accessibility)

2. Software Requirements

The software stack is built using modern, open-source technologies to support rapid development, ease of deployment, and long-term scalability. Requirements include tools, frameworks, libraries, and runtime environments essential for coding, testing, and hosting.

2.1 Operating Systems

- **Development OS**: Windows 10/11, macOS 12+, or any modern Linux distribution (Ubuntu recommended)
- **Server OS**: Ubuntu Server 20.04 LTS or higher, with root access and package management support

2.2 Development Tools

- **Code Editor**: Visual Studio Code, Sublime Text, or JetBrains PyCharm
- **Version Control System**: Git (with GitHub or GitLab integration)
- **Package Managers**:
  - pip for Python packages
- **Database Management**: SQLite3 with CLI access or DB Browser for SQLite
- **Python Environment**: Python 3.8+ (virtual environments recommended)
- **Browser Testing Tools**: Chrome DevTools, Firefox Developer Edition

2.3 Frameworks and Libraries

- **Frontend Technologies**:
  - HTML5 for semantic markup
  - CSS3 for layout and visual styling
  - JavaScript (vanilla); optionally Bootstrap for responsive components
- **Backend Stack**:
  - Django 3.2+ with built-in ORM and admin interface
  - SQLite3 as the relational database system for development

    - Django REST framework (optional, if API exposure planned)
- **Security Packages**:
    - django-crispy-forms for secure form rendering
    - django-cors-headers for managing cross-origin requests
    - bcrypt or similar libraries for password hashing
- **Testing Tools**:
    - unittest (standard Python)
    - pytest for structured testing
    - Postman or Insomnia for API endpoint verification (if REST features present)

2.4 Deployment Technologies

- **Web Server**: Gunicorn or uWSGI for serving Django applications
- **Reverse Proxy**: NGINX for traffic routing and SSL termination
- **Deployment Platform Options**:
    - Heroku (with gunicorn, whitenoise, and buildpack integrations)
    - PythonAnywhere or self-hosted VPS with SSH and Git integration
    - Docker (optional containerization for CI/CD workflows)
- **SSL Tools**: Let’s Encrypt for certificate issuance and renewal automation

2.5 Optional Integrations

- **Analytics**: Google Analytics, Matomo, or built-in Django dashboards
- **Email Service**: SMTP configuration or third-party integrations like SendGrid
- **Payment Gateway** (future scalability): Razorpay, Stripe, or PayPal APIs

SYSTEM IMPLEMENTATION

System implementation marks the transition from planning and design to actual development and deployment. It involves applying selected technologies to construct the application architecture and integrating core functional modules to achieve project objectives. This section outlines the rationale behind technology choices and provides in-depth analysis of key modules implemented within the application.

Technology Description

The technological stack selected for this project balances simplicity, extensibility, and performance. All technologies used are open source and widely supported, enabling sustainable development and community-driven improvement. The following subsections describe each component of the stack in detail.

1. Frontend Technologies

- **HTML5**: Provides a semantic structure to the application, facilitating accessibility and search engine optimization. Tags like <article>, <section>, and <nav> are used for logical document grouping.
- **CSS3**: Used for styling, layout management, and responsive design. Flexbox and media queries ensure cross-device compatibility.
- **JavaScript (Vanilla)**: Enables dynamic behavior on the client side, including DOM manipulation, event handling, and AJAX-based asynchronous requests. This supports features like cart updates, search filtering, and real-time feedback.

2. Backend Technologies

- **Django (Python Framework)**: Implements server-side logic following the Model-Template-View pattern. Its built-in ORM simplifies database interactions while offering scalability.
- **SQLite3**: A lightweight, file-based relational database used for prototyping and small-scale deployments. It handles data persistence for users, products, orders, and sessions without external configuration.

3. Supporting Tools and Services

- **Version Control**: Git is used for source code management and collaboration. GitHub hosts the project repository, enabling continuous integration.
- **Testing Frameworks**: Python’s unittest and pytest are used for backend logic validation. Browser-based testing tools assist in frontend verification.
- **Deployment Services**: Platforms like PythonAnywhere or Heroku are configured for hosting. NGINX and Gunicorn are adopted for production-grade deployment setups.

Module Descriptions

Each module of the application is designed to meet a specific functional need while maintaining cohesion and separation of concerns. The following subsections provide an overview of the major modules implemented.

1. User Authentication Module

- **Purpose**: Secure login and registration system for customers and administrators.
- **Features**: Password hashing, form validation, session handling, role-based access control.
- **Implementation**: Utilizes Django's User model and custom views for differentiated access. Session middleware maintains login state across pages.

2. Product Catalog Module

- **Purpose**: Displays products with support for categorization, search, and filtering.
- **Features**: Dynamic rendering of product cards, image integration, category-wise grouping.
- **Implementation**: Data is stored in a Product model and fetched using Django QuerySets. Frontend templating displays products based on filters and queries.

3. Shopping Cart Module

- **Purpose**: Manages temporary product selections prior to checkout.
- **Features**: Add/remove/update items, total price calculation, persistence during session.
- **Implementation**: Cart data is stored in user-specific session dictionaries. JavaScript handles item quantity updates without page reloads.

4. Checkout and Order Processing Module

- **Purpose**: Facilitates order confirmation and storage of purchase details.
- **Features**: Form submission, validation, order ID generation, simulated payment process.
- **Implementation**: Django forms capture shipping and contact details. Backend logic verifies product availability and logs transactions in the Order model.

5. Admin Dashboard Module

- **Purpose**: Backend interface for managing products, users, and orders.
- **Features**: CRUD operations, analytics, order tracking, inventory overview.
- **Implementation**: Django's admin interface is extended using custom ModelAdmin configurations. Filtering and inline editing enable efficient management.

6. Search and Filtering Module

- **Purpose**: Enhances user experience through rapid product discovery.
- **Features**: Search bar with keyword matching, price-based filtering, category selection.
- **Implementation**: JavaScript intercepts form submissions to dynamically filter results. Backend views query the database based on input parameters.

7. Contact and Support Module

- **Purpose**: Allows users to submit feedback and seek assistance.
- **Features**: Feedback form, contact validation, message logging.

- **Implementation**: Django forms handle user inputs. Messages are stored and displayed in the admin panel for follow-up.

8. Responsive UI Module

- **Purpose**: Delivers a consistent interface across mobile, tablet, and desktop platforms.
- **Features**: Media queries, adaptive grids, mobile-friendly navigation.
- **Implementation**: CSS rules adjust layout elements based on viewport size. Minimal JavaScript toggles support mobile menu interactions.

SDLC METHODOLOGY

Software Development Life Cycle (SDLC) refers to the structured process followed to develop, deploy, and maintain software systems. It encompasses various phases that guide the transformation of requirements into a functional and reliable software product. For this e-commerce web application, a modified Agile-based SDLC has been adopted to ensure iterative development, active stakeholder engagement, and adaptive change management.

1. Overview of SDLC Methodology

SDLC provides a framework that ensures software is developed systematically, meets functional and non-functional requirements, and is delivered with high quality standards. By incorporating planning, analysis, design, implementation, testing, deployment, and maintenance, the methodology establishes control checkpoints that align development efforts with user needs and performance goals.

Key benefits of SDLC in this context include:

- Improved project visibility and traceability
- Incremental delivery for faster validation
- Risk mitigation through early feedback loops
- Enhanced maintainability and scalability
- Cost and resource efficiency

2. Adopted SDLC Model: Agile-Inspired Incremental Development

Given the modular nature of the application and evolving user expectations, an Agile-inspired incremental development model has been selected. Unlike traditional Waterfall models, Agile encourages flexibility, rapid iterations, and ongoing collaboration.

Each feature or module (such as user authentication, shopping cart, or admin dashboard) is treated as an independent deliverable, developed and tested in short sprints. Feedback-driven iterations ensure alignment with usability and performance targets.

Sprint planning, backlog grooming, daily standups (informal review checkpoints), and retrospective analysis are simulated to match the academic development context. Tasks are prioritized based on user impact and technical feasibility.

3. SDLC Phases in the Context of the Application

3.1 Requirement Gathering and Analysis

- Stakeholder expectations were identified through competitive analysis and functional benchmarking.
- Use cases and user stories were defined for customers and administrators.
- Functional requirements (such as login, product listing, cart management) and non-functional requirements (scalability, security, responsiveness) were formalized.
- Constraints regarding cost, platform limitations, and target user base were also addressed.

3.2 System Design

- High-level architecture was created including data flow diagrams, Entity Relationship Diagrams (ERDs), and component interaction maps.
- Frontend design was conceptualized using wireframes, emphasizing layout clarity and responsive design principles.
- Backend structure adopted the Model-Template-View paradigm, mapping database schema to application logic and UI elements.
- Security strategies (form validation, session handling, CSRF protection) were incorporated into the design phase.

3.3 Implementation

- Codebase was developed using modular and reusable components.
- Frontend logic was written using HTML5, CSS3, and JavaScript to ensure lightweight responsiveness.

- Backend modules were implemented in Django with SQLite3 handling relational data storage.
- Version control was applied using Git, with branches for feature development and testing integration.

3.4 Testing

- Unit testing was performed for individual modules using Python's unittest.
- Integration testing ensured data consistency and correct behavior across feature boundaries.
- Manual validation and scenario-based testing were applied for frontend UX elements.
- Bug tracking logs were maintained to monitor issue resolution and test coverage.

3.5 Deployment

- The system was deployed to a staging environment using PythonAnywhere, with Django's development server and admin tools used for runtime validation.
- Static assets were managed using Django's collectstatic utility, and environment variables handled configuration control.
- Considerations for future deployment on Heroku or containerized environments were documented.

3.6 Maintenance and Enhancement

- Code review cycles were conducted post-deployment to identify areas for optimization.
- Feature enhancements (payment gateway integration, live analytics, internationalization) were documented as potential future sprints.
- Modular structure allows isolated updates and minimal impact on existing functionality.

4. Justification for Agile-Based SDLC Selection

The Agile-inspired SDLC model aligns well with academic, small-scale, and evolving project contexts. In this application, where user expectations and functionality evolve rapidly, the model offers:

- Adaptive planning and modular releases
- Greater involvement in verification and validation
- Faster time to market for each module
- Streamlined debugging and refactoring
- Continuous improvement based on usage feedback

It avoids the rigidity of sequential models and reduces delays in identifying design mismatches or implementation flaws. Moreover, Agile's iterative nature is particularly suited to developing responsive, user-driven interfaces typical of modern e-commerce platforms.

SYSTEM DESIGN

System design provides a blueprint for the application's structure, behavior, and interaction models. It translates requirements into implementable technical components and defines how various subsystems collaborate to deliver desired functionality. This section includes architectural overview and essential UML artifacts to represent functional, behavioral, and deployment aspects of the system.

1. System Architecture

The e-commerce application adopts a layered architecture, promoting modular development and separation of concerns. The major layers include:

a. Presentation Layer

- Manages user interface and client-side interactions using HTML5, CSS3, and JavaScript.
- Handles dynamic rendering of product data, cart operations, and form submissions.

b. Application Layer

- Implements business logic using Django views and services.
- Manages routing, input processing, session management, and validation.

c. Data Layer

- Uses Django ORM to interact with SQLite3 database.
- Models represent entities like Users, Products, Orders, and Cart Items.

d. Security Layer

- Ensures protection via authentication, CSRF tokens, input sanitization, and secure cookies.

e. Deployment Layer

- Hosted on platforms like PythonAnywhere or Heroku using Gunicorn and NGINX stack.

Supports HTTPS via SSL certificates and environment-based configuration.

2. UML Diagrams

The Unified Modeling Language (UML) offers standardized visual representations to describe the structure and behavior of the system. The following diagrams provide a well-rounded view of design decisions.

2.1 Use Case Diagram

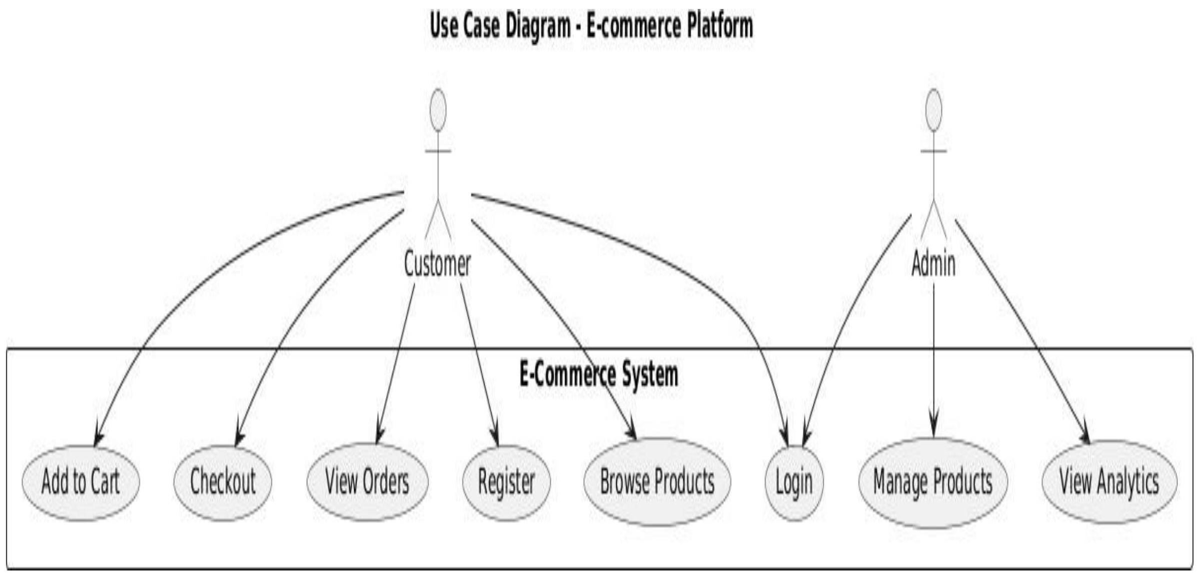
Represents user-system interactions.

Actors: Customer, Admin

Use Cases: Register, Login, Browse Products, Add to Cart, Checkout, View Orders, Manage Products, View Analytics

Key relationships:

- Customer can register, login, and manage orders.
- Admin manages products and analyzes sales.



2.2 Class Diagram

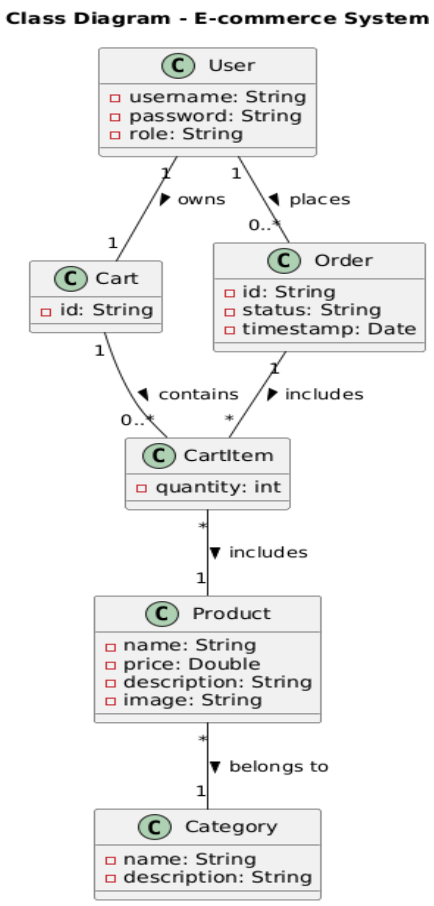
Defines the static structure of the system through classes and their relationships.

Major Classes:

- User: Attributes include username, password, role; associated with Orders.
- Product: Includes name, price, description, image; related to Category.
- Cart: Linked to User and contains multiple CartItems.
- Order: Includes items, status, timestamp, and linked User.

Relationships:

- One User can have multiple Orders.
- One Cart contains many CartItems.
- Products are grouped under Category.



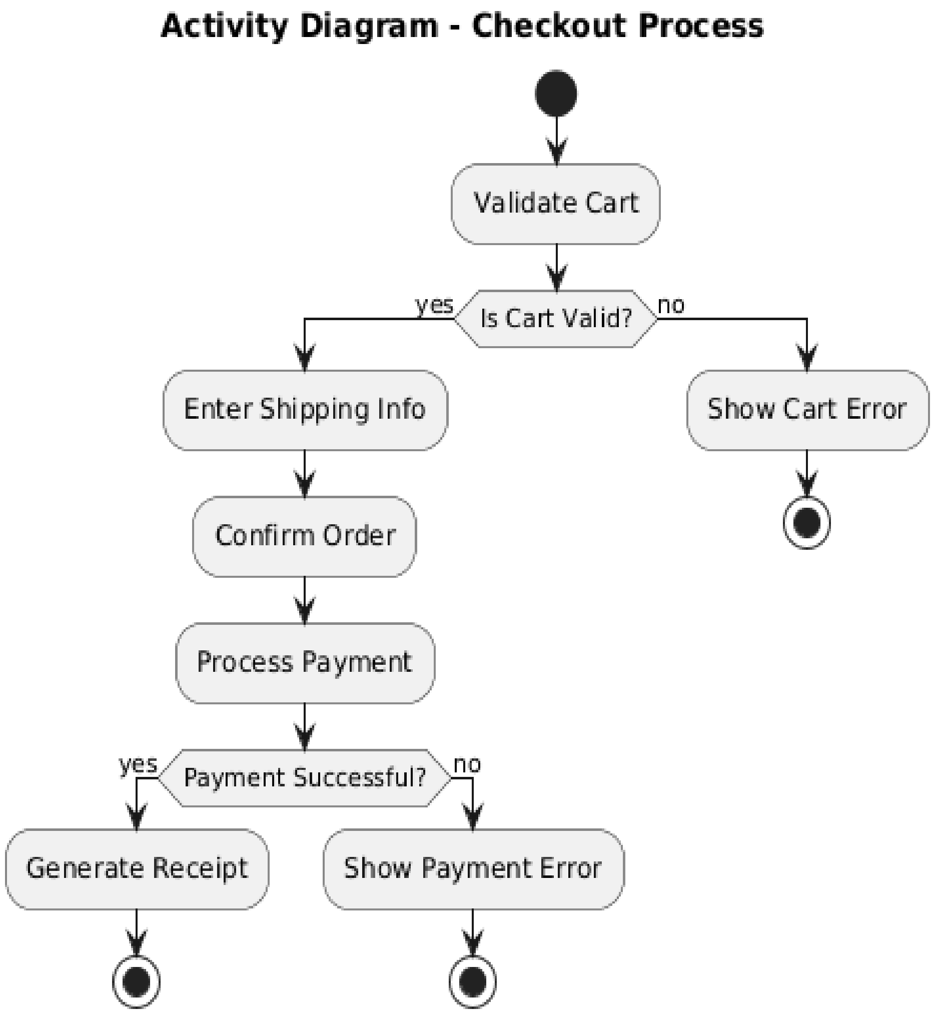
2.3 Activity Diagram

Visualizes workflows and decision logic.

Example: **Checkout Process**

- Start → Validate Cart → Enter Shipping Info → Confirm Order → Process Payment → Generate Receipt → End

Includes decision nodes for payment validation and error handling paths.



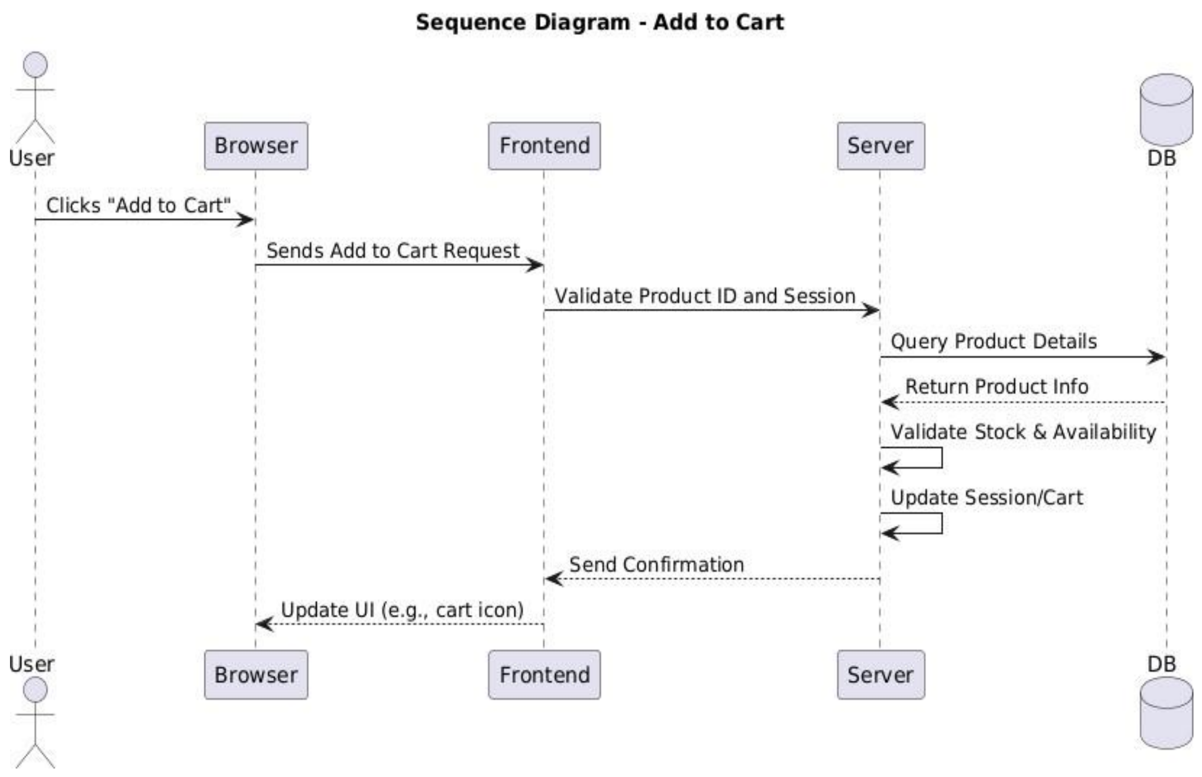
2.4 Sequence Diagram

Depicts interactions between objects over time.

Example: **Add to Cart**

- User → Browser → Add to Cart Request
- Frontend → Server → Validate Product
- Server → DB → Retrieve Product
- Server → Update Session → Response to Frontend → UI Update

Sequence illustrates real-time behavior and asynchronous feedback.


Sequence Diagram - Add to Cart
User
Browser
Frontend
Server
DB
Clicks "Add to Cart"
Sends Add to Cart Request
Validate Product ID and Session
Query Product Details
Return Product Info
Validate Stock & Availability
Update Session/Cart
Send Confirmation
Update UI (e.g., cart icon)

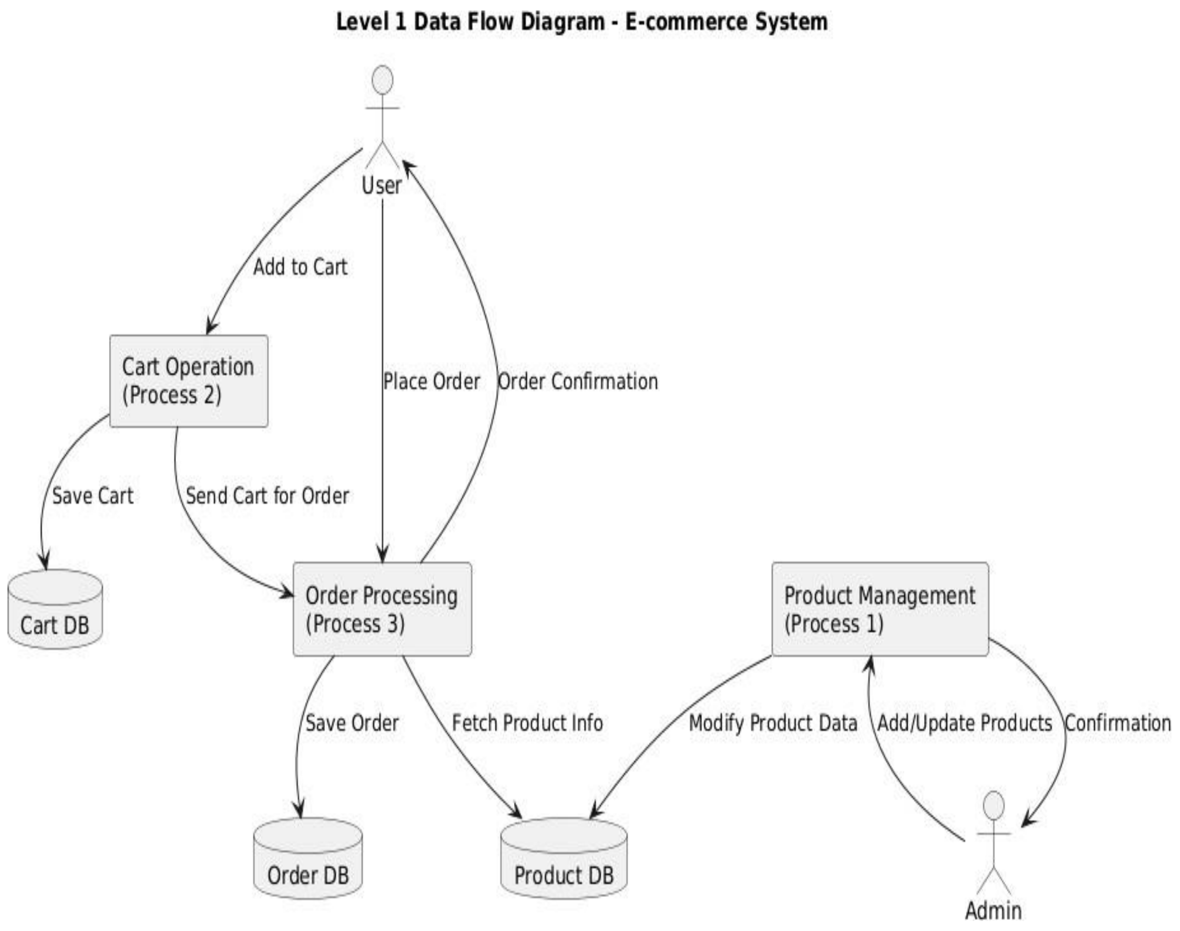
2.5 Data Flow Diagram (DFD)

Illustrates how data moves across the system.

Level 1 DFD includes:

- External Entities: User, Admin
- Processes: Product Management, Cart Operation, Order Processing
- Data Stores: Product DB, Cart DB, Order DB Flow:
- User inputs → Processed by Cart → Stored in DB → Output as Order Confirmation

DFD maps logical paths for secure and efficient data handling.



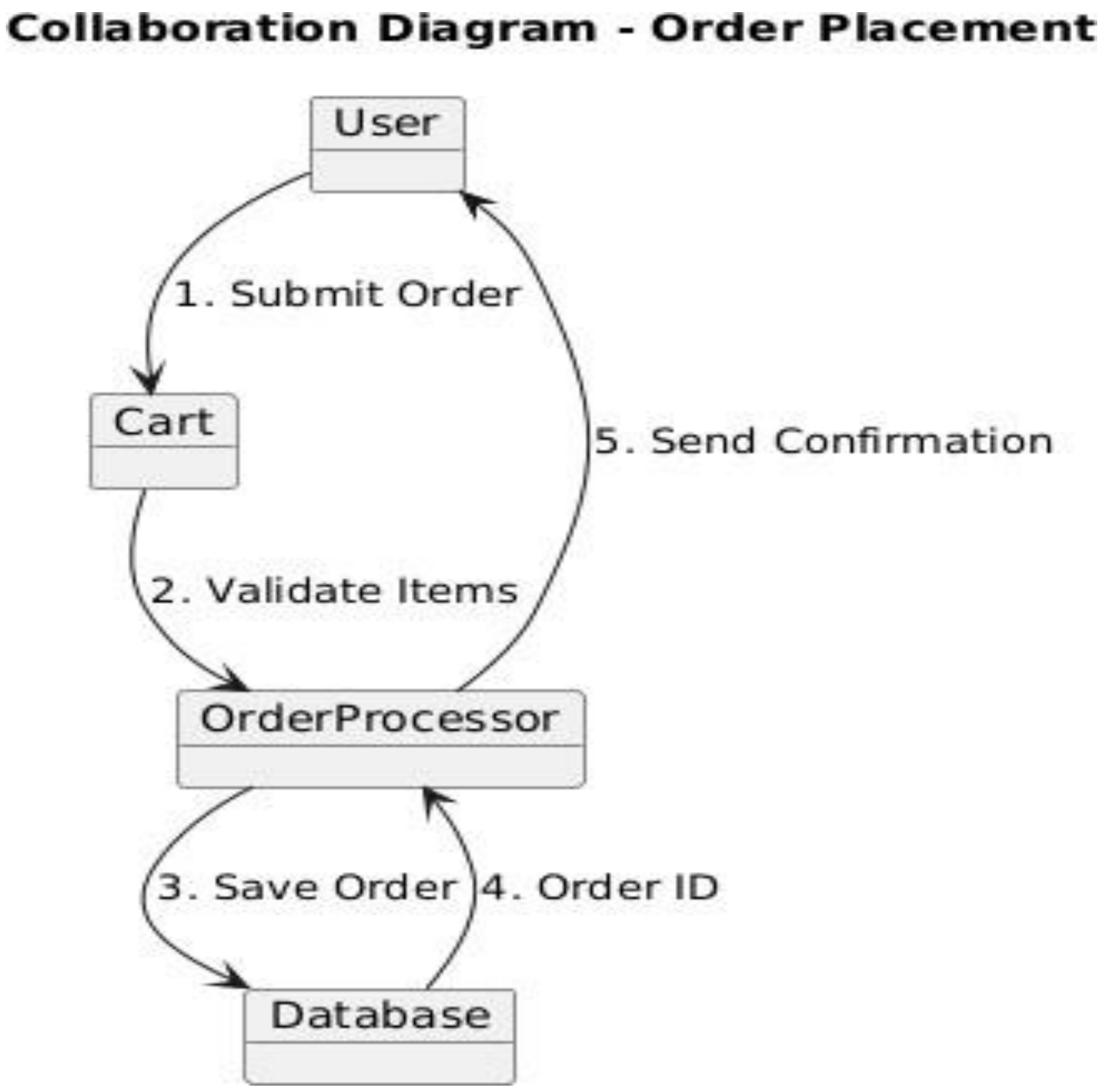
2.6 Collaboration Diagram

Shows how objects collaborate to fulfill use cases.

Example: **Order Placement**

- Objects: User, Cart, Order Processor, Database
- Interactions: User triggers cart submission → Processor validates → Database records order → Confirmation sent to user

Focuses on object roles and coordination rather than time flow.



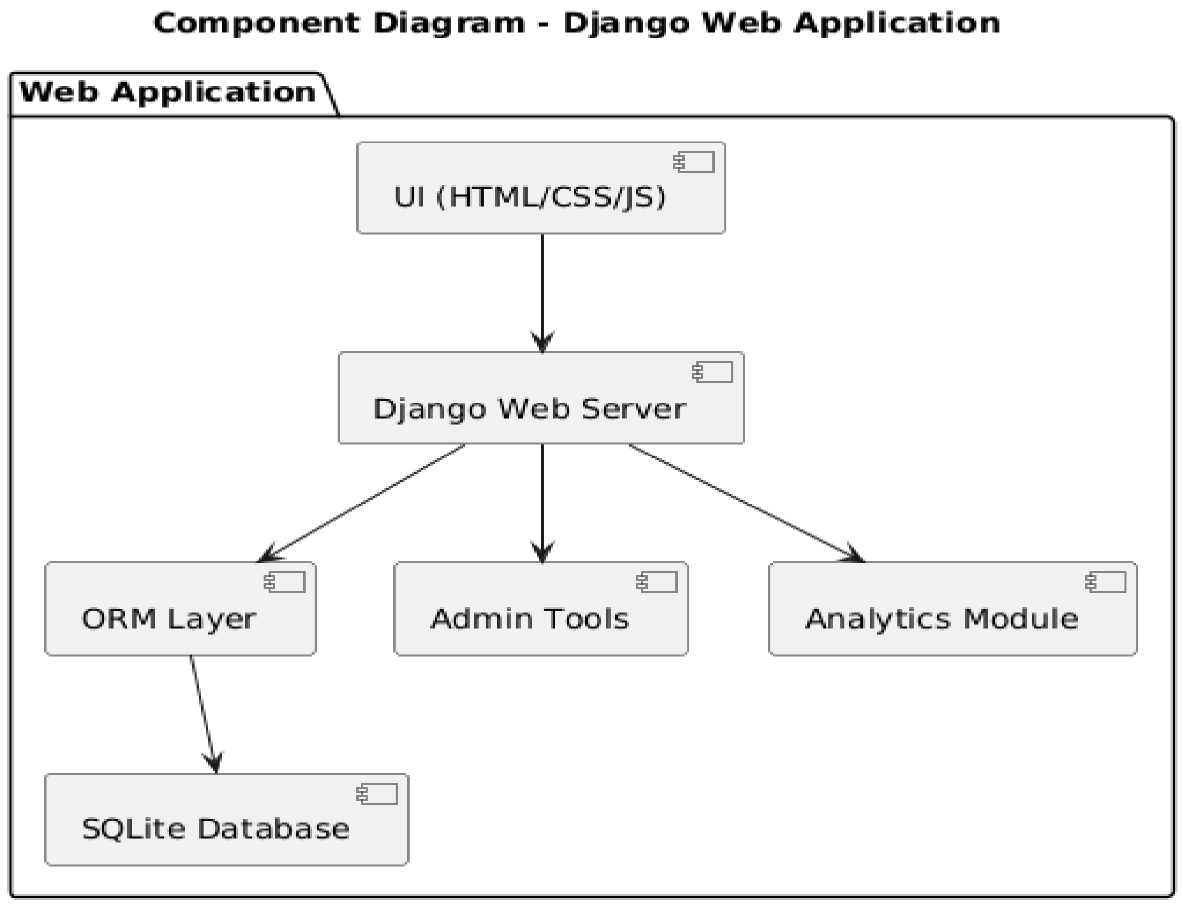
2.7 Component Diagram

Represents high-level structure of the software system.

Components:

- UI (HTML/CSS/JS)
- Django Web Server
- ORM Layer
- SQLite Database
- Admin Tools
- Analytics Module

Dependencies are drawn between modules indicating data access, control flow, and deployment interfaces.



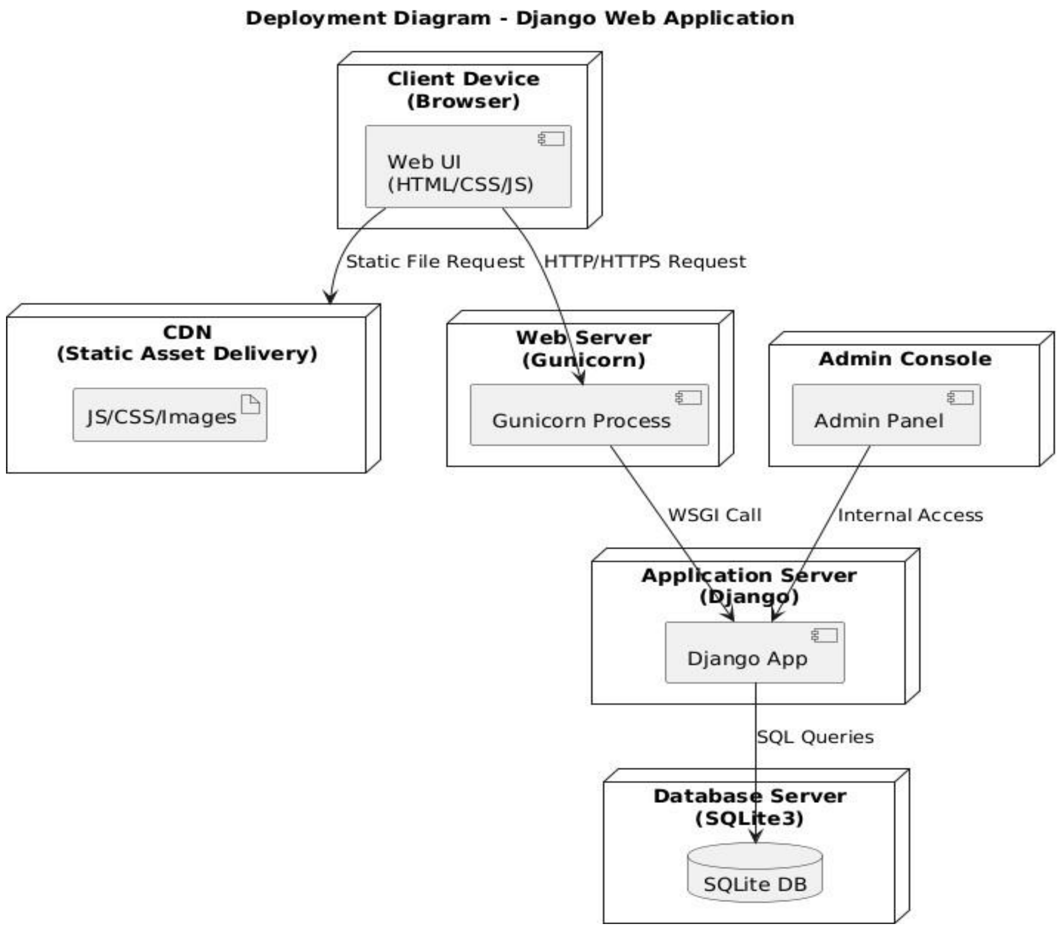
2.8 Deployment Diagram

Maps software components to hardware nodes.

Nodes:

- Client Device (Browser)
- Web Server (Gunicorn)
- Application Server (Django)
- Database Server (SQLite3)
- CDN (for static asset delivery)
- Admin Console

Connections via HTTP/HTTPS, with session and state management clearly indicated.



CODING

1. Coding Standards and Practices

- **Modular Design**: Code is organized into independent modules such as user authentication, product management, cart operations, and order processing.
- **Naming Conventions**: Descriptive and consistent naming is used for variables, functions, classes, and files to enhance readability.
- **Indentation and Formatting**: All source code adheres to PEP8 guidelines (for Python) and standard HTML/CSS/JavaScript formatting practices.
- **Commenting**: Inline and block comments are included to clarify logic and document assumptions or special conditions.
- **Code Reusability**: Common functionalities are abstracted into utility functions or classes to reduce redundancy.

2. Code Structure Overview

```
| e_commerce/                          # Root project directory

        ├── e_commerce/                # Main Django project package

|   ├── __pycache__/                   # Python bytecode cache (auto-generated)

|   ├── __init__.py                    # Marks this as a Python package

|   ├── asgi.py                        # ASGI config for async servers

|   ├── settings.py                    # Project settings and configurations

|   ├── urls.py                        # Main project URL routing

|   └── wsgi.py                        # WSGI config for production servers

├── logs/                              # Log files directory

├── media/                             # User-uploaded media files
├── shop/                          # Main Django app (e-commerce functionality)
│   ├── migrations/                   # Database migration files
│   ├── static/
│   │   ├── css/                      # All CSS stylesheets
│   │   │   ├── account.css           # User account styling
│   │   │   ├── address.css           # Address management styling
│   │   │   ├── admin_dashboard.css   # Admin panel styling
│   │   │   ├── base.css              # Base styles (shared across all pages)
│   │   │   ├── cart.css              # Shopping cart styling
│   │   │   ├── home.css              # Homepage styling
│   │   │   └── [20+ other CSS files] # Other page-specific styles
│   │   │
│   │   ├── js/                       # JavaScript files
│   │   │   ├── animation.js          # UI animations
│   │   │   ├── base.js               # Core JavaScript functions
│   │   │   ├── checkout_payment.js   # Payment processing logic
│   │   │   └── home.js               # Homepage interactivity
│   │   │
│   │   └── images/                   # Static images/assets
│   │
│   ├── templates/                    # HTML templates
│   │   ├── registration/                          # Auth-related templates
│   │   │   ├── login.html                          # Login page
│   │   │   └── signup.html                         # Registration page
│   │   │
│   │   ├── shop/                                  # E-commerce templates
│   │   │   ├── account/                           # User account management
│   │   │   │   ├── account_sidebar.html                # Account navigation
│   │   │   │   ├── add_address.html               # Address form
│   │   │   │   └── [5+ other account templates]
│   │   │   │
│   │   │   ├── base.html                          # Base template (inherited by others)
│   │   │   ├── cart.html                          # Shopping cart page
│   │   │   ├── fashion.html                        # Fashion category page
│   │   │   ├── mobile.html                        # Mobile accessories page
│   │   │   ├── product_detail.html               # Single product view
│   │   │   └── [15+ other page templates]
│   │   │
│   ├── __init__.py                                # App package marker
│   ├── admin.py                                   # Admin panel configurations
│   ├── apps.py                                    # App configuration
│   ├── context_processors.py                      # Template context processors
│   ├── forms.py                              # Form definitions
│   ├── models.py                             # Database models
│   ├── shop_tags.py                          # Custom template tags
│   ├── signals.py                            # Signal handlers
│   ├── tests.py                              # Test cases
│   ├── urls.py                               # App-specific URL routing
│   └── views.py                                      # View functions/classes
├── db.sqlite3                                # Development database
├── manage.py                                         # Django command-line utility
└── requirements.txt                          # Python dependencies
```

3. Technologies Used

- **Frontend Code**:
  - *HTML5*: Provides the structural foundation of each web page.
  - *CSS3*: Handles visual styling and layout for responsive user interfaces.
  - *JavaScript*: Implements dynamic interactions such as cart updates and form validations.
- **Backend Code**:
  - *Python (Django Framework)*: Implements server-side logic, routing, database interactions, and session management.
  - *SQLite3*: Stores relational data through models defined using Django's ORM layer.

4. Sample Code Snippet

Below is an excerpt demonstrating a Django view handling product detail retrieval:

```
def product_detail(request, product_id):
```

product = get_object_or_404(Product, id=product_id)

return render(request, 'product_detail.html', {'product': product})

This function:

- Accepts a request and product ID,
- Retrieves the corresponding product object from the database,
- Renders the product detail template with context passed to the frontend.

5. Implementation

1. asgi.py

```
import os

from django.core.asgi import get_asgi_application

os.environ.setdefault('DJANGO_SETTINGS_MODULE','E_commerce.settin
gs')

application = get_asgi_application()
```

2. urls.py

```
from django.contrib import admin

from django.urls import path,include

from django.conf import settings

from django.conf.urls.static import static

        urlpatterns = [

          path('admin/', admin.site.urls),

           path('', include('shop.urls')),

          path('accounts/', include('django.contrib.auth.urls')),

]

urlpatterns +=
static(settings.MEDIA_URL,document_root=settings.MEDIA_ROOT)
```

3. wsgi.py

```
import os

from django.core.wsgi import get_wsgi_application

os.environ.setdefault('DJANGO_SETTINGS_MODULE','E_commerce.settin
gs')

application = get_wsgi_application()
```

4. shop_tags.py

```
from django import template

from django.db.models import Avg

register = template.Library()

@register.filter

def avg_rating(reviews):

    return reviews.aggregate(Avg('rating'))['rating _ avg'] or 0
```

5. admin.py

```
from django.contrib import admin

from .models import Product, Cart, CartItem, Wishlist, Order, ProductReview,
CustomerAddress, Payment

class CartItemInline(admin.TabularInline):

    model = Order.items.through

    extra = 1

class ProductAdmin(admin.ModelAdmin):

    list_display = ('name', 'price', 'stock', 'created_at')

    list_filter = ('created_at',)

    search_fields = ('name', 'description')

class OrderAdmin(admin.ModelAdmin):
    list_display = ('id', 'user', 'product_names', 'product_quantities', 'total_price',
'status', 'created_at', 'estimated_delivery', 'total_sales')

    def product_names(self, obj):

        return ", ".join([item.product.name for item in obj.items.all()])

    product_names.short_description = 'Products'

    def product_quantities(self, obj):

        return ", ".join([str(item.quantity) for item in obj.items.all()])

    product_quantities.short_description = 'Quantities'

    list_filter = ('status', 'created_at')

    search_fields = ('user__username', 'id')

    readonly_fields = ('created_at', 'estimated_delivery')

    inlines = [CartItemInline]

    def total_sales(self, obj):

        from .models import Order

        return
Order.objects.aggregate(total_sales=admin.models.Sum('total_price'))['total_sa
les'] or 0

    total_sales.short_description = 'Total Sales (All Orders)'

class ProductReviewAdmin(admin.ModelAdmin):

    list_display = ('product', 'user', 'rating', 'created_at')

    list_filter = ('rating', 'created_at')

    search_fields = ('product__name', 'user__username')

admin.site.register(Product, ProductAdmin)

admin.site.register(Cart)

admin.site.register(CartItem)

admin.site.register(Wishlist)

admin.site.register(Order, OrderAdmin)
admin.site.register(ProductReview, ProductReviewAdmin)

admin.site.register(CustomerAddress)

admin.site.register(Payment)
```

6. apps.py

```
from django.apps import AppConfig

class ShopConfig(AppConfig):

    default_auto_field = 'django.db.models.BigAutoField'

    name = 'shop'

def ready(self):

    import shop.signals
```

7. context_processors.py

```
from .models import Wishlist, Cart

def wishlist_count(request):
    if request.user.is_authenticated:
        wishlist, created = Wishlist.objects.get_or_create(user=request.user)
        return {'wishlist_count': wishlist.products.count()}
    return {'wishlist_count': 0}

def cart_count(request):
    if request.user.is_authenticated:
        try:
            cart = Cart.objects.get(user=request.user)
            return {'cart_count': cart.items.count()}
        except Cart.DoesNotExist:
            return {'cart_count': 0}
    return {'cart_count': 0}
```

8. forms.py

```
from django import forms

from .models import ProductReview
from django import forms

from django.contrib.auth.models import User

from django.core.exceptions import ValidationError

from .models import Product

from .models import CustomerAddress, Order  # project a

class SignupForm(forms.ModelForm):

        password1      =      forms.CharField(widget=forms.PasswordInput,
label="Password")

      password2 = forms.CharField(widget=forms.PasswordInput, label="Confirm
Password")

    email = forms.EmailField(required=True)  # Make email required

  class Meta:

    model = User

    fields = ['username', 'email', 'password1', 'password2']  # Explicitly include
email field

  def clean_password2(self):

    # Check if password1 and password2 match

    password1 = self.cleaned_data.get('password1')

    password2 = self.cleaned_data.get('password2')

    if password1 != password2:

      raise ValidationError("The two password fields must match.")

    return password2

class ProductForm(forms.ModelForm):

  class Meta:

    model = Product

    fields = '__all__'

class AddressForm(forms.ModelForm):
    class Meta:
        model = CustomerAddress
        fields = ['address_type', 'street', 'city', 'state', 'postal_code', 'country', 'is_default']
        widgets = {
            'street': forms.Textarea(attrs={'rows': 3}),
        }
class PaymentMethodForm(forms.Form):
    PAYMENT_CHOICES = [
        ('COD', 'Cash on Delivery'),
       # ('RAZORPAY', 'Razorpay'),
        #('PAYPAL', 'PayPal'),
    ]
    payment_method = forms.ChoiceField(
        choices=PAYMENT_CHOICES,
        widget=forms.RadioSelect,
        initial='COD'  # Set COD as default
    )
class ReviewForm(forms.ModelForm):
    class Meta:
        model = ProductReview
        fields = ['rating', 'comment']
class UserProfileForm(forms.ModelForm):
    class Meta:
        model = User
        fields = ['first_name', 'last_name', 'email']
        widgets = {
            'first_name': forms.TextInput(attrs={'class': 'form-control'}),
            'last_name': forms.TextInput(attrs={'class': 'form-control'}),
            'email': forms.EmailInput(attrs={'class': 'form-control'}),
        }
class AddressForm(forms.ModelForm):
    class Meta:
        model = CustomerAddress
            fields = ['address_type', 'street', 'city', 'state', 'postal_code', 'country',
'is_default']
        widgets = {
            'address_type': forms.Select(attrs={'class': 'form-control'}),
            'street': forms.Textarea(attrs={'class': 'form-control', 'rows': 3}),
            'city': forms.TextInput(attrs={'class': 'form-control'}),
            'state': forms.TextInput(attrs={'class': 'form-control'}),
            'postal_code': forms.TextInput(attrs={'class': 'form-control'}),
            'country': forms.TextInput(attrs={'class': 'form-control'}),
        }
```

9. models.py

```
from django.db import models
from django.contrib.auth.models import User
from django.utils import timezone # project a
from django.core.validators import MinValueValidator, MaxValueValidator #
project a
from datetime import timedelta
from django.utils.text import slugify
class Product(models.Model):
    CATEGORY_CHOICES = [
        ('Mobiles', 'Mobiles'),
        ('Watches', 'Watches'),
        ('Smartwatches', 'Smartwatches'),
        ('Laptops', 'Laptops'),
        ('Electronics', 'Electronics Gadgets'),
        ('Fashions', 'Fashions'),
        ('Men', 'Men Fashion'),
        ('Women', 'Women Fashion'),
        ('Kids', 'Kids Fashion'),
        ('Footwear', 'Footwear'),
    ]

    SIZE_CHOICES = [
        ('XS', 'Extra Small'),
        ('S', 'Small'),
        ('M', 'Medium'),
        ('L', 'Large'),
        ('XL', 'Extra Large'),
        ('XXL', 'Double Extra Large'),
        ('28', '28'),
        ('30', '30'),
        ('32', '32'),
        ('34', '34'),
        ('36', '36'),
        ('38', '38'),
        ('40', '40'),
        ('6', '6'),
        ('7', '7'),
        ('8', '8'),
        ('9', '9'),
        ('10', '10'),
    ]

    COLOR_CHOICES = [
        ('Red', 'Red'),
        ('Blue', 'Blue'),
        ('Green', 'Green'),
        ('Black', 'Black'),
        ('White', 'White'),
        ('Yellow', 'Yellow'),
        ('Pink', 'Pink'),
        ('Purple', 'Purple'),
        ('Gray', 'Gray'),
        ('Brown', 'Brown'),
    ]
```

```
    # Existing fields
    name = models.CharField(max_length=255)
    category = models.CharField(choices=CATEGORY_CHOICES, max_length=50)
    price = models.DecimalField(max_digits=10, decimal_places=2)
    stock = models.PositiveIntegerField()
    description = models.TextField()
    image = models.ImageField(upload_to='products/')
    added_by = models.ForeignKey(User, on_delete=models.CASCADE)
    created_at = models.DateTimeField(auto_now_add=True)
    updated_at = models.DateTimeField(auto_now=True)
    slug = models.SlugField(max_length=255, unique=True, blank=True)

    # New fashion-specific fields
    size = models.CharField(max_length=10, choices=SIZE_CHOICES, blank=True, null=True)
    color = models.CharField(max_length=20, choices=COLOR_CHOICES, blank=True, null=True)

    def save(self, *args, **kwargs):
        if not self.slug:
            self.slug = slugify(self.name)
        super().save(*args, **kwargs)

    def _str_(self):
        return self.name
class ProductReview(models.Model):
    product = models.ForeignKey(Product, on_delete=models.CASCADE, related_name='reviews')
    user = models.ForeignKey(User, on_delete=models.CASCADE)
    rating = models.IntegerField(
        validators=[MinValueValidator(1), MaxValueValidator(5)]
    )
    comment = models.TextField(blank=True)
    created_at = models.DateTimeField(auto_now_add=True)

    def __str__(self):
        return f"{self.user.username}'s review for {self.product.name}"

class Cart(models.Model):
    user = models.ForeignKey(User, on_delete=models.CASCADE)
    created_at = models.DateTimeField(auto_now_add=True)
    updated_at = models.DateTimeField(auto_now=True
    @property
    def total_price(self):
        return sum(item.total_price for item in self.items.all())

    def __str__(self):
        return f"Cart of {self.user.username}"

class CartItem(models.Model):
        cart = models.ForeignKey(Cart, on_delete=models.CASCADE,
related_name='items')
    product = models.ForeignKey(Product, on_delete=models.CASCADE)
    quantity = models.PositiveIntegerField(default=1)

    @property
    def total_price(self):
        return self.product.price * self.quantity

    def __str__(self):
        return f"{self.quantity} x {self.product.name} in cart"

class Wishlist(models.Model):
    user = models.OneToOneField('auth.User', on_delete=models.CASCADE,
related_name='wishlist' )
        products = models.ManyToManyField('shop.Product',
related_name='wishlists')

    def __str__(self):
        return f"Wishlist of {self.user.username}"

class Order(models.Model):
    STATUS_CHOICES = [
        ('P', 'Pending'),
        ('PR', 'Processing'),
        ('S', 'Shipped'),
        ('D', 'Delivered'),
        ('C', 'Cancelled'),
    ]

    user = models.ForeignKey(User, on_delete=models.CASCADE)
    items = models.ManyToManyField(CartItem)
        total_price = models.DecimalField(max_digits=10, decimal_places=2
,default=0 )
    shipping_address = models.TextField(
        default="Address not provided", # Or any sensible defaul
        blank=True  # Also add this if the field can be empty
    )
    status = models.CharField(max_length=2, choices=STATUS_CHOICES,
default='PR')
   created_at = models.DateTimeField(auto_now_add=True)
   estimated_delivery = models.DateField(
     default=timezone.now() + timedelta(days=7)  # Default to 7 days from now
   )

   def __str__(self):
      return f"Order #{self.id} by {self.user.username}"

class CustomerAddress(models.Model):
   user = models.ForeignKey(User, on_delete=models.CASCADE)
      address_type = models.CharField(max_length=20, choices=[('HOME',
'Home'), ('WORK', 'Work')])
   street = models.CharField(max_length=255)
   city = models.CharField(max_length=100)
   state = models.CharField(max_length=100)
   postal_code = models.CharField(max_length=20)
   country = models.CharField(max_length=100, default='India')
   is_default = models.BooleanField(default=False)

   def __str__(self):
      return f"{self.get_address_type_display()} - {self.street}, {self.city}"

class Payment(models.Model):
    PAYMENT_METHOD_CHOICES = [
      ('COD', 'Cash on Delivery'),
      # Remove Razorpay option:
      # ('RAZORPAY', 'Razorpay'),
   ]
    order = models.ForeignKey(Order, on_delete=models.CASCADE)
    payment_method = models.CharField(
      max_length=50,
      choices=PAYMENT_METHOD_CHOICES,
      default='COD'
      )
    transaction_id = models.CharField(max_length=100)
    amount = models.DecimalField(max_digits=10, decimal_places=2)
    status = models.CharField(max_length=20)
    created_at = models.DateTimeField(auto_now_add=True)

    def __str__(self):
      return f"Payment #{self.id} for Order {self.order.id}"
```

10. signals.py

```
from django.db.models.signals import post_save
from django.dispatch import receiver
from django.contrib.auth.models import User
from .models import Wishlist

@receiver(post_save, sender=User)
def create_user_wishlist(sender, instance, created, **kwargs):
    if created:
        Wishlist.objects.create(user=instance)
```

11. views.py

```
from django.conf import settings

from django.shortcuts import render, redirect, get_object_or_404

from django.contrib.auth import authenticate, login, logout

from django.contrib.auth.decorators import login_required, user_passes_test

from .forms import SignupForm, ProductForm

from django.conf import settings

from django.shortcuts import render, redirect,get_object_or_404

from django.contrib.auth.decorators import login_required, user_passes_test

from .forms import SignupForm, ProductForm

from django.contrib.auth.models import User

from django.contrib.auth.forms import UserCreationForm

from django.views.decorators.http import require_POST

from django.contrib.auth.views import LoginView

from django.urls import reverse_lazy

from django.db.models import Sum
```

```
#views for the deshboard

from django.http import JsonResponse

from datetime import datetime, timedelta
```

6. Setting Up the Environment

- Created a virtual environment using venv to manage dependencies.

  Example: python -m venv demo

  demo\Scripts\activate

- Install essential libraries like Django.

TESTING

Testing is a critical phase in the Software Development Life Cycle (SDLC), aimed at verifying that the system meets its functional and non-functional requirements. It identifies defects, validates system behavior under expected and edge-case conditions, and ensures software reliability, maintainability, and usability. In this e-commerce application, a structured and layered testing approach has been adopted to cover different aspects of system functionality and performance.

1. Testing Objectives

- Validate individual components and their integration
- Ensure system behavior aligns with design specifications
- Identify and resolve errors before deployment
- Confirm usability, responsiveness, and security
- Measure performance under varying load conditions

2. Types of Testing Applied

a. Unit Testing

Unit testing focuses on verifying the correctness of individual functions, methods, or components in isolation.

- **Tools Used**: Python's unittest and pytest frameworks
- **Scope**: Model methods, form validation logic, utility functions
- **Examples**:
  - Testing if product price calculations are accurate
  - Validating user registration form inputs

b. Integration Testing

Integration testing assesses the interaction between modules to ensure cohesive operation.

- **Scope**:
  - User authentication integrated with session management
  - Product selection feeding into cart module
  - Checkout connecting to order storage mechanisms
- **Techniques**:
  - Simulated workflows using Django’s test client
  - Validation of data flow between frontend and backend layers

c. System Testing

System testing evaluates the application as a whole, ensuring that it behaves correctly across complete user scenarios.

- **Approach**:
  - Full-cycle testing from registration to order placement
  - Admin dashboard functionality verification
  - Edge case testing for cart and checkout operations

d. User Acceptance Testing (UAT)

UAT checks whether the system satisfies user expectations under real-world conditions.

- **Conducted by**: Peer reviewers simulating end-user roles
- **Focus**: Navigation, usability, content clarity, response time
- **Outcome**: Iterative improvements based on feedback

e. Performance Testing (Limited Scope)

Although not conducted with enterprise-grade tools, the application underwent basic load evaluation:

- **Tests Included**:
    - Concurrent session handling using multiple browser instances
    - Page load speed on mobile vs. desktop devices

3. Bug Tracking and Resolution

- **Issues Identified**:
    - Cart state not persisting across sessions (resolved by storing cart data in session middleware)
    - Form validation bypass through JavaScript (corrected via server-side checks)
- **Documentation**:
    - Bug logs maintained in GitHub Issues
    - Resolution notes recorded for future reference

4. Security Testing

Security aspects of the application were manually evaluated to prevent common vulnerabilities:

- **CSRF Protection**: Verified Django's token inclusion in POST requests
- **Input Validation**: Ensured sanitization of user inputs via form constraints
- **Authentication Logic**: Tested password hashing and access restriction for protected views

OUTPUT SCREENS

Output screens are the visual interfaces through which users interact with the application. They provide data representation, enable navigation, and facilitate input/output operations. A robust screen design ensures accessibility, usability, and performance across devices.

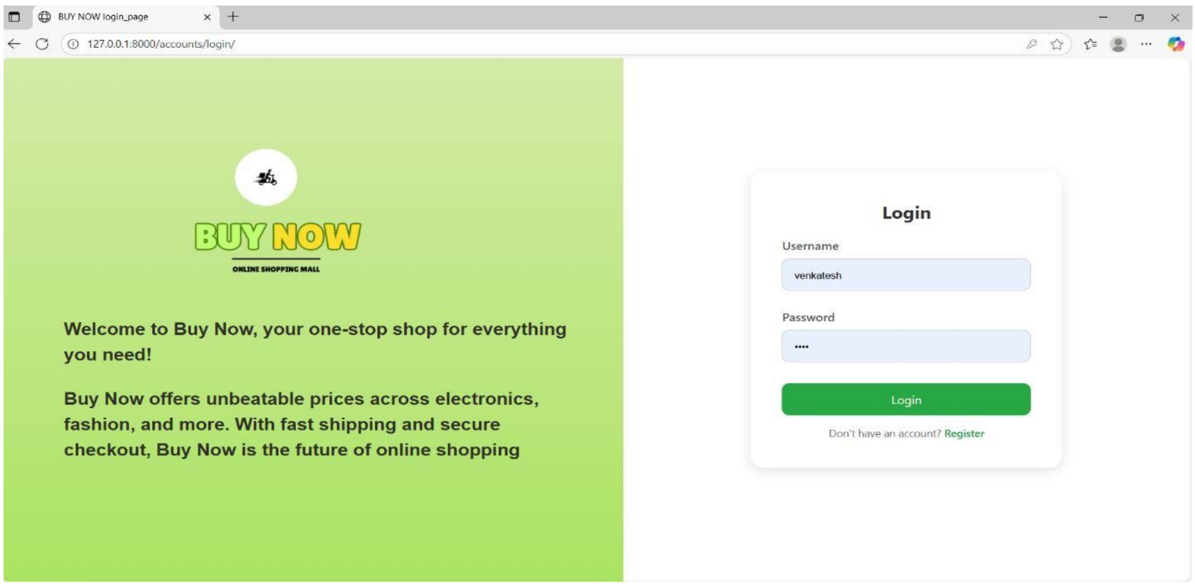
1.Login Page

The login page provides secure access to user accounts with:

- Email/username and password authentication
- Responsive design for all devices
- Visual feedback during interaction
- Link to registration for new users

1.1 Features

- Left side: Branding with animated cart + value proposition
- Right side: Clean login form
- Animated cart icon with javascript (animation.js)



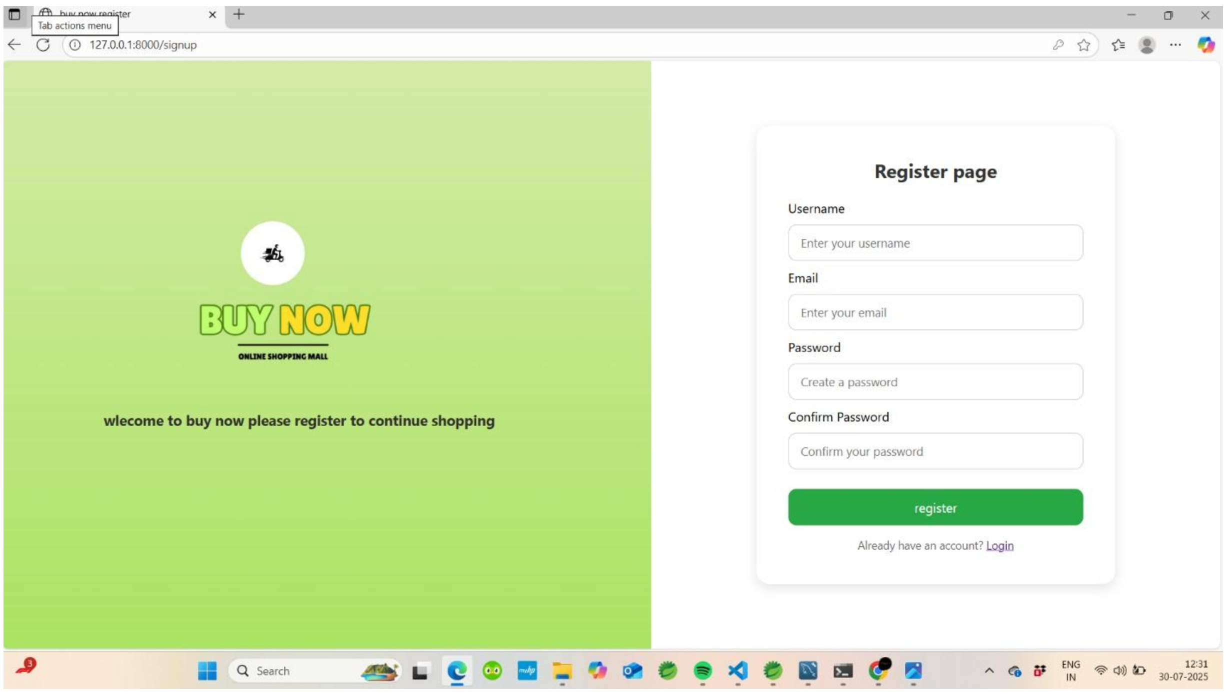
Welcome to Buy Now, your one-stop shop for everything you need!

Buy Now offers unbeatable prices across electronics, fashion, and more. With fast shipping and secure checkout, Buy Now is the future of online shopping

Username: venkatesh

2. Register Page

1. **User Registration Form**
   - Username (required)
   - Email (required, validated for format)
   - Password (required, with validation)
   - Password confirmation (must match password)
   - Client-side validation
   - Server-side validation (Django form validation)
2. **Visual Design**
   - Split-screen layout:
     - Left side: Branding with animated cart
     - Right side: Registration form
   - Responsive design (mobile, tablet, desktop)
3. **Error Handling**
   - Field-level error messages
   - Form submission error display
   - Existing username/email detection



wlecome to buy now please register to continue shopping

Register page

Username: Enter your username

Email: Enter your email

Password: Create a password

Confirm Password: Confirm your password

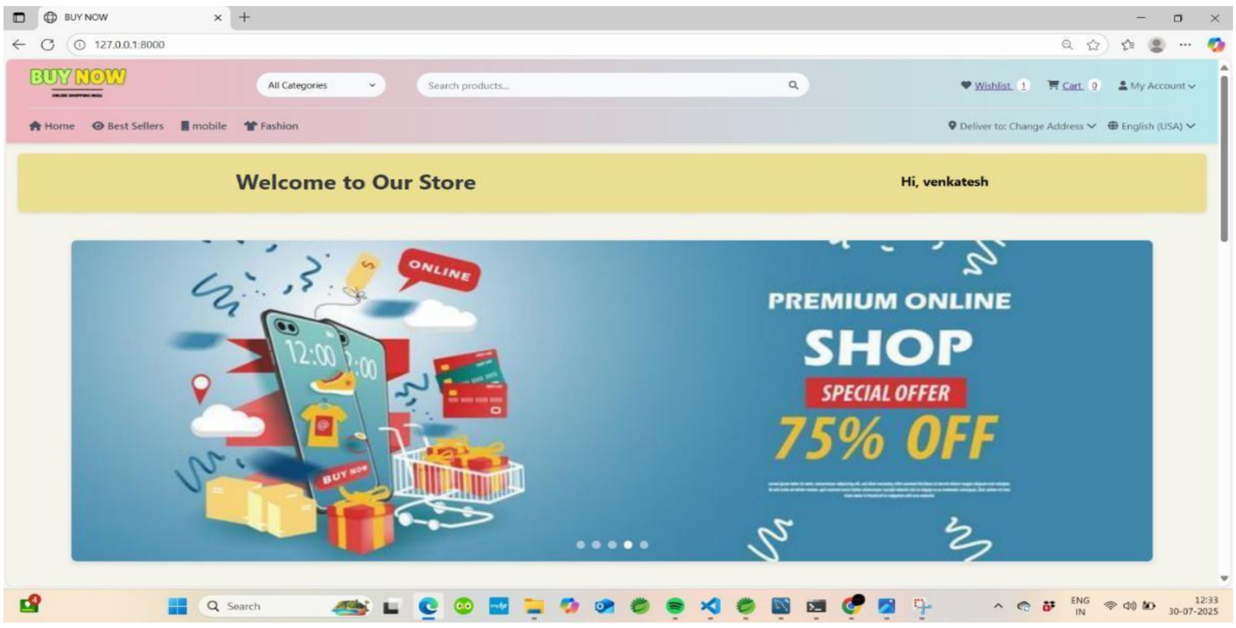
register

Already have an account? Login

3. Home Screen

The home screen serves as the entry point to the application and reflects its core purpose.

- **Features**:
  - Dynamic product banners and featured categories
  - Navigation bar with menu items
  - Search bar and login/register options
  - Promotional offers and call-to-action buttons
- **Design Considerations**:
  - Responsive layout using CSS Flexbox or Grid
  - Optimized media rendering
  - Accessible font sizes and alt text for screen readers



4. Product Listing Screen

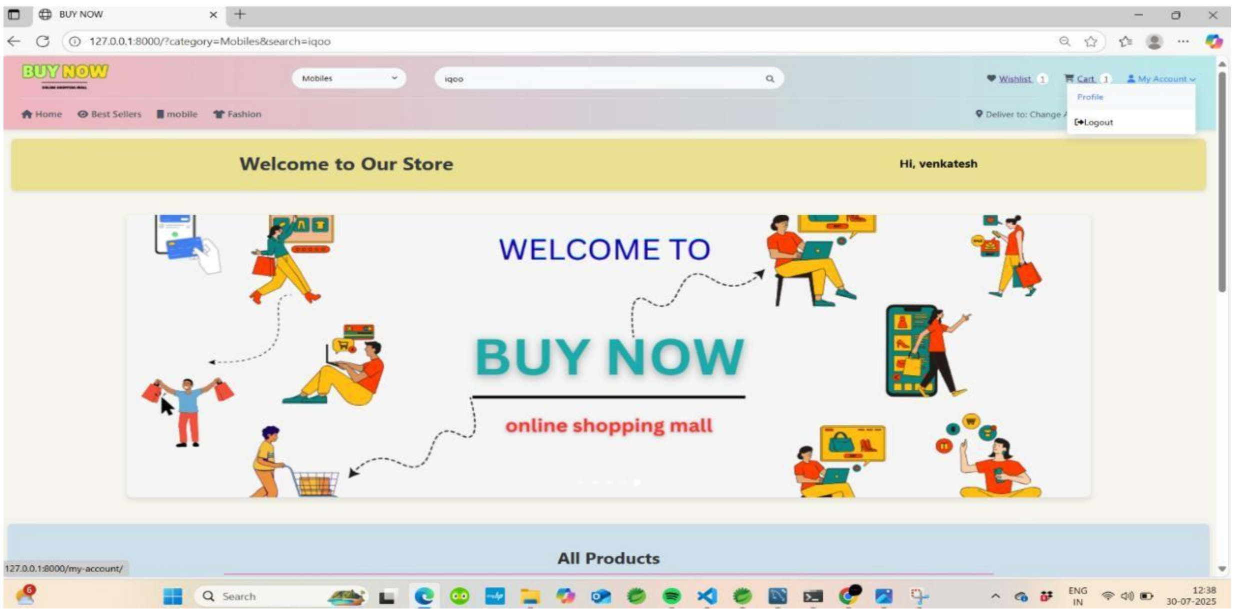
he Product Listing Screen displays all available products in a grid layout, allowing users to browse, view details, and add items to their cart or wishlist. This screen serves as the main product discovery interface.

Functionalities Reflected:

- Search Bar at the Top: Allows keyword-based product searches.
- "View" Button- Links to product_detail.html
- "Add to Cart"- Form submission to add_to_cart view
- Rating Display- Star icons based on avg_rating (★☆☆☆☆)
- Review Count- Shows total reviews (product.reviews.count)

Technologies Likely Used:

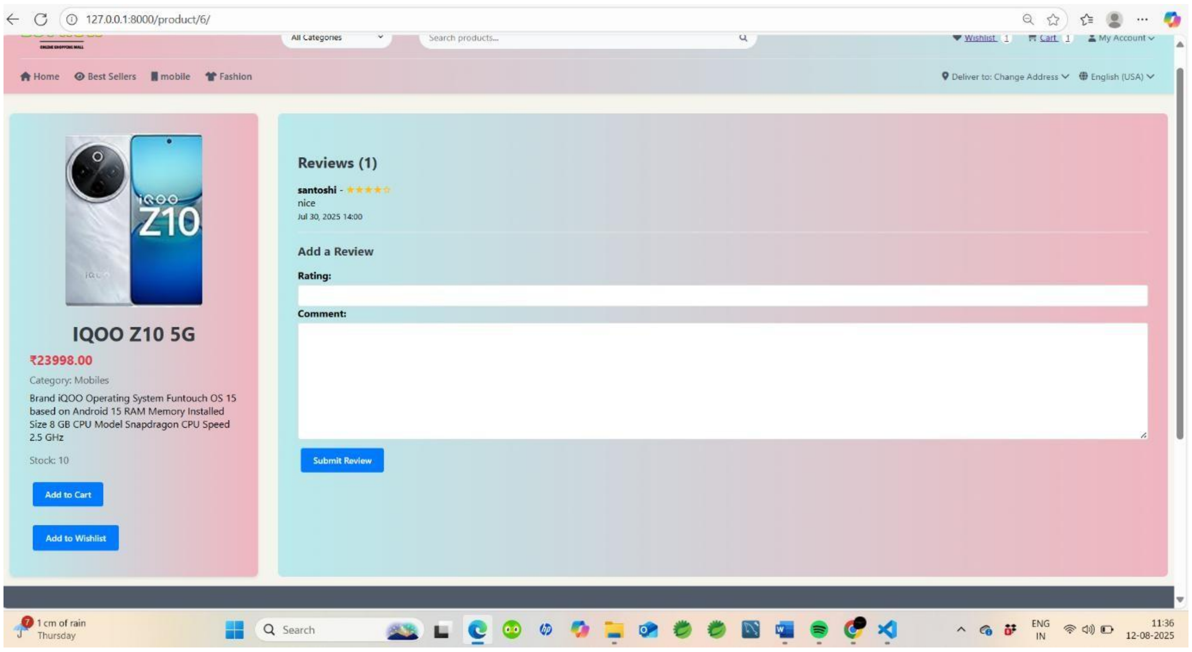
- Django components for rendering individual product cards and filtering sections.
- Lazy Loading and Suspense for performance optimization and smooth scroll behavior.
- CSS Modules for scoped and responsive styling.



5. Product Detail Screen

Displays comprehensive details of a single product.

- **Contents**:
  - Image carousel, zoom functionality
  - Price, discount, ratings, stock status
  - Add-to-cart and wishlist buttons
- **Implementation Notes**:
  - Modal popups for reviews
  - Structured layout using semantic HTML


127.0.0.1:8000/product/6/

All Categories | Search products... | Wishlist 1 | Cart 1 | My Account

Home | Best Sellers | mobile | Fashion | Deliver to: Change Address | English (USA)

IQOO Z10 5G

₹23998.00

Category: Mobiles

Brand iQOO Operating System Funtouch OS 15 based on Android 15 RAM Memory Installed Size 8 GB CPU Model Snapdragon CPU Speed 2.5 GHz

Stock: 10

Add to Cart

Add to Wishlist

Reviews (1)

santoshi - ★★★★☆
nice
Jul 30, 2025 14:00

Add a Review

Rating:

Comment:

Submit Review

1 cm of rain
Thursday

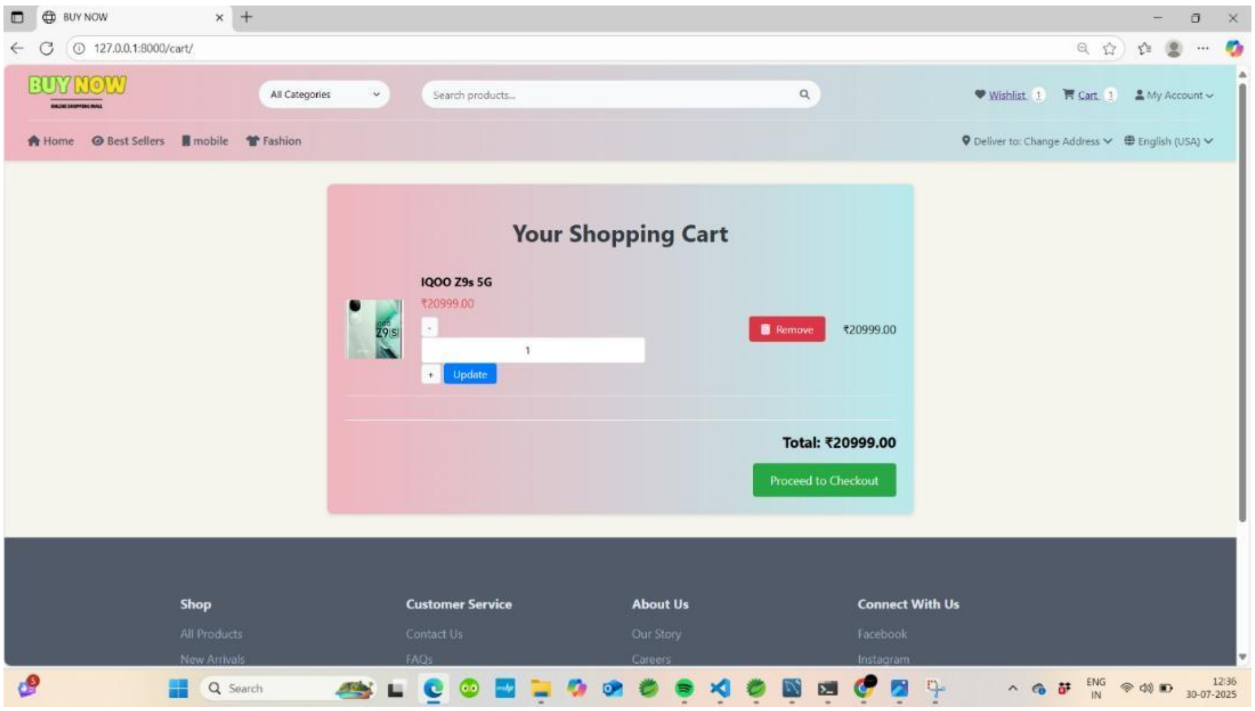
ENG
IN

11:36
12-08-2025

6. Shopping Cart Screen

Summarizes user selections before checkout.

- **Elements**:
  - List of items with thumbnail, quantity, price
  - Quantity update and item removal options
  - Dynamic total price computation
- **Technical Flow**:
  - Client-side state management via Context API
  - Server-side session handling for persistence
  - Unit tests validating cart mutation logic



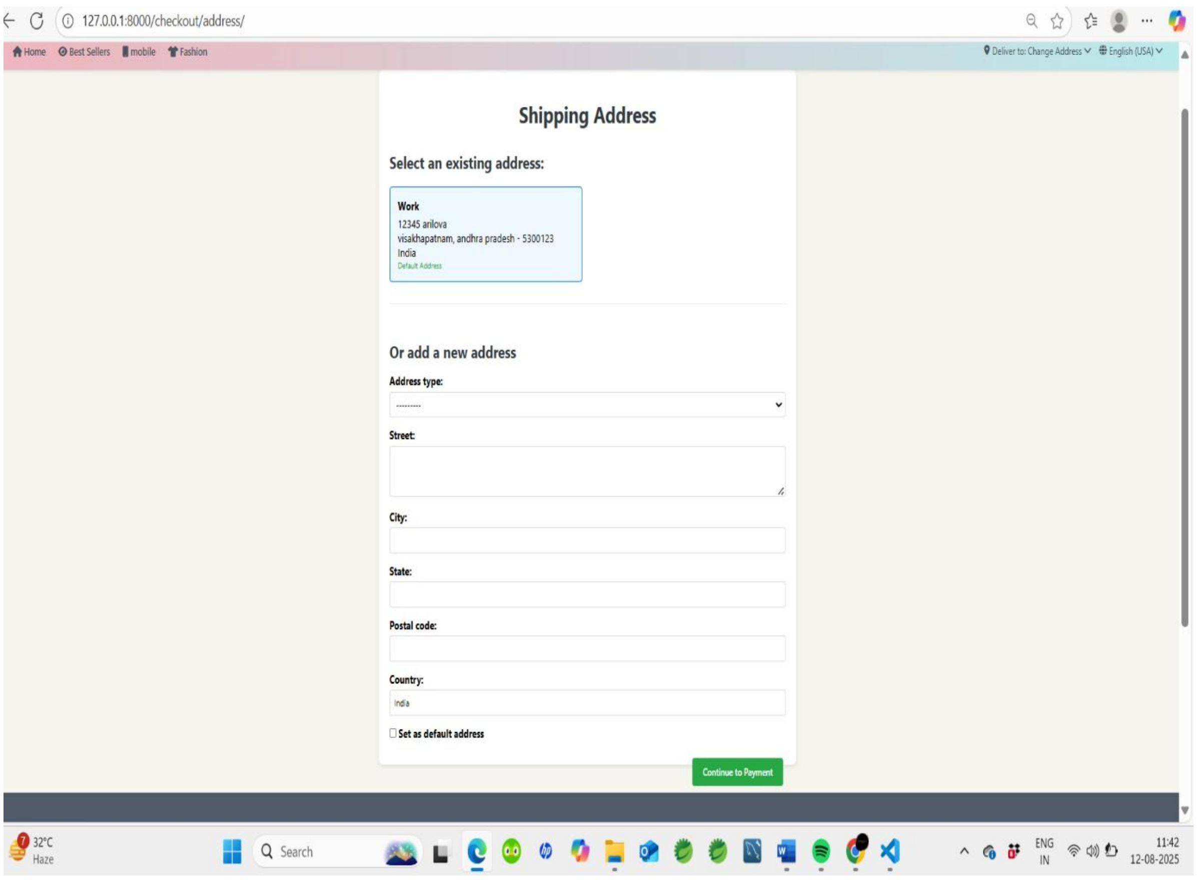
7.Shopping Address

The address management system provides users with the ability to:

- Store multiple shipping addresses
- Set a default address for checkout
- Manage addresses through CRUD operations
- Select addresses during checkout

7.1 features

- Displays all saved addresses in a responsive grid
- Visual indication of default address
- Edit/Delete actions for each address
- "Add New Address" button



Shipping Address

Select an existing address:

Work
12345 arilova
visakhapatnam, andhra pradesh - 5300123
India
Default Address

Or add a new address

Address type: ---------

Street:

City:

State:

Postal code:

Country: India

☐ Set as default address

8. Peyment Method

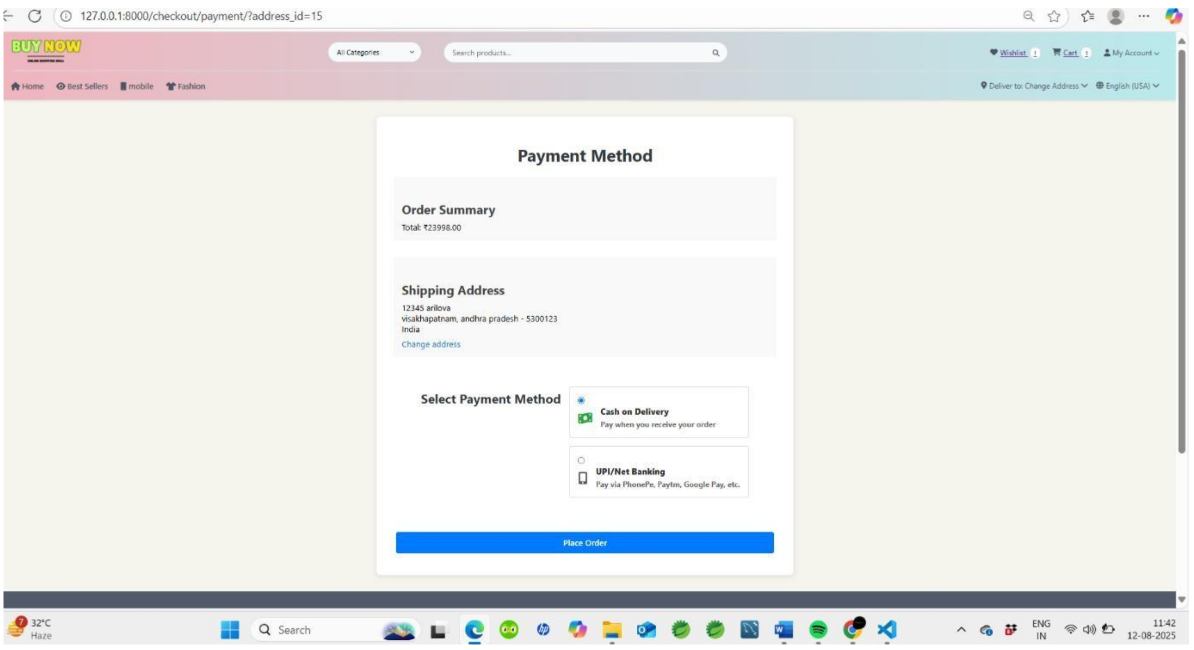
Captures user input and confirms the purchase process.

Data Fields:

- Address entry, shipping method selection
- Payment integration (e.g., Stripe, Razorpay)
- Order summary and confirmation

Security Measures:

- CSRF tokens for form submission
- HTTPS encryption for sensitive data
- Validation through Formik or native HTML5 constraints



Payment Method

Order Summary

Total: ₹23998.00

Shipping Address

12345 arilova
visakhapatnam, andhra pradesh - 5300123
India

Change address

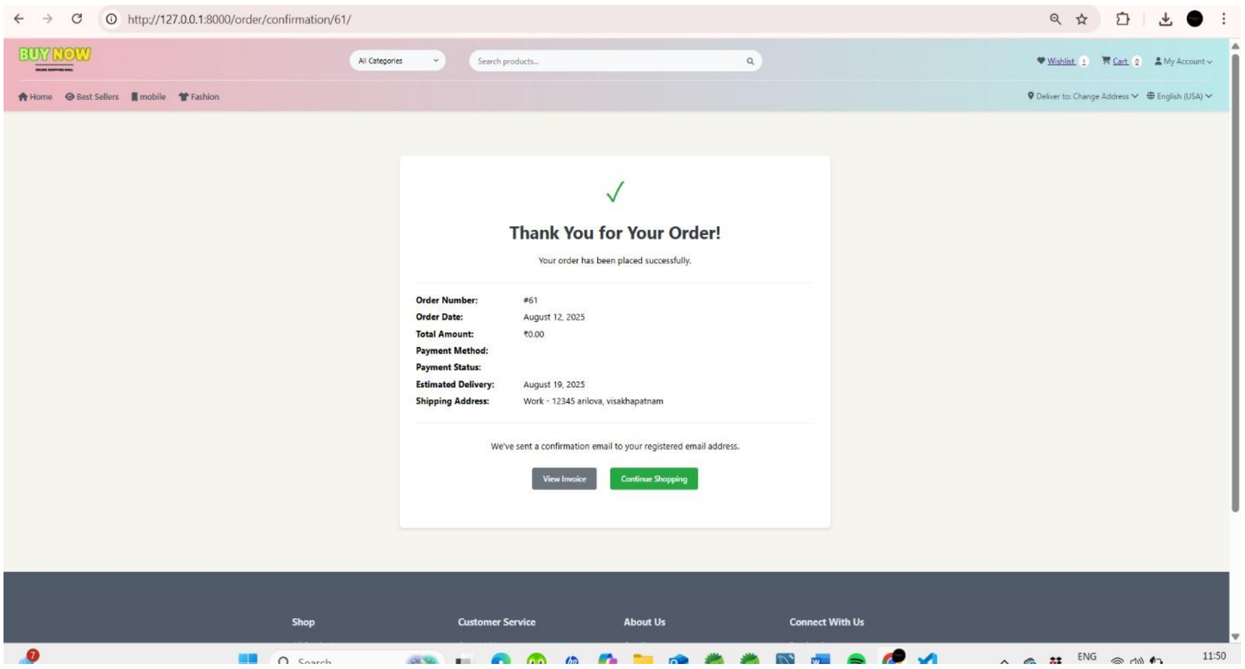
Select Payment Method

[✓ Cash on Delivery] Pay when you receive your order

UPI/Net Banking Pay via PhonePe, Paytm, Google Pay, etc.

9. Order Confirmation

- Order number (unique identifier)
- Date and time of purchase
- Total amount paid
- Payment method used
- Estimated delivery date
- Shipping address



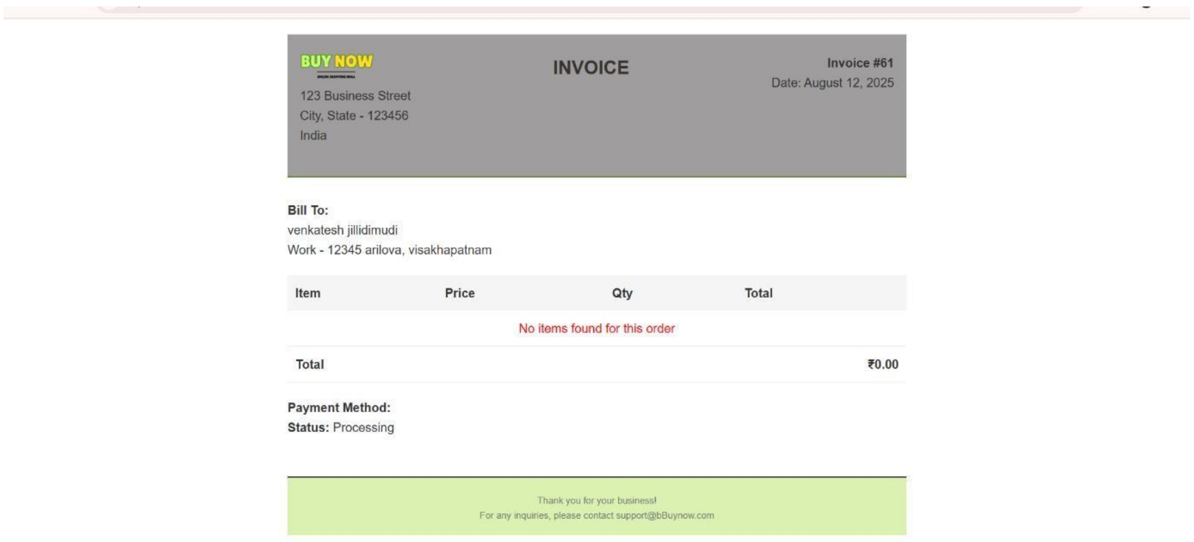
Thank You for Your Order!

Your order has been placed successfully.

Order Number:	#61
Order Date:	August 12, 2025
Total Amount:	₹0.00
Payment Method:	
Payment Status:	
Estimated Delivery:	August 19, 2025
Shipping Address:	Work - 12345 arilova, visakhapatnam

We've sent a confirmation email to your registered email address.

10. INVOICE



INVOICE

123 Business Street
City, State - 123456
India

Invoice #61
Date: August 12, 2025

Bill To:
venkatesh jillidimudi
Work - 12345 arilova, visakhapatnam

Item	Price	Qty	Total
No items found for this order			
Total			**₹0.00**

Payment Method:
Status: Processing

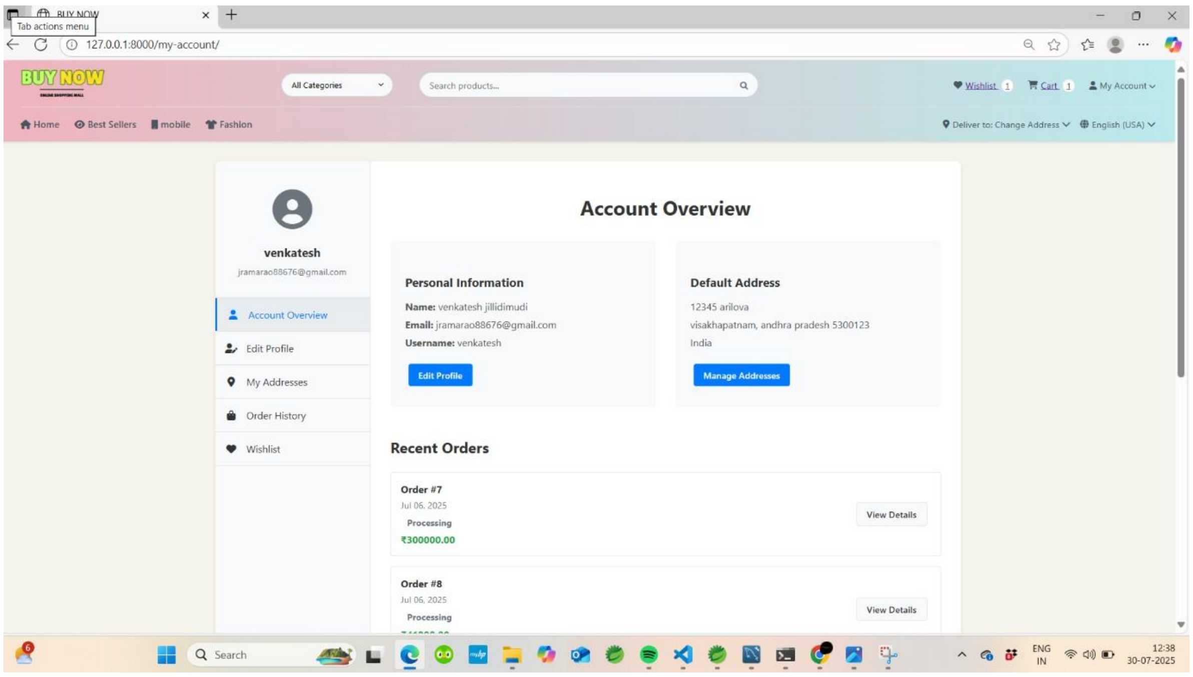
Thank you for your business!
For any inquiries, please contact support@bBuynow.com

11. User Dashboard

An individualized space for managing personal activities.

Views Available:

- Recent orders with tracking
- Profile update form
- Wishlist and saved items
- Messages or notifications (via WebSocket if real-time)



venkatesh
jramarao88676@gmail.com

Account Overview

Personal Information

Name: venkatesh jillidimudi
Email: jramarao88676@gmail.com
Username: venkatesh

Default Address

12345 arilova
visakhapatnam, andhra pradesh 5300123
India

Recent Orders

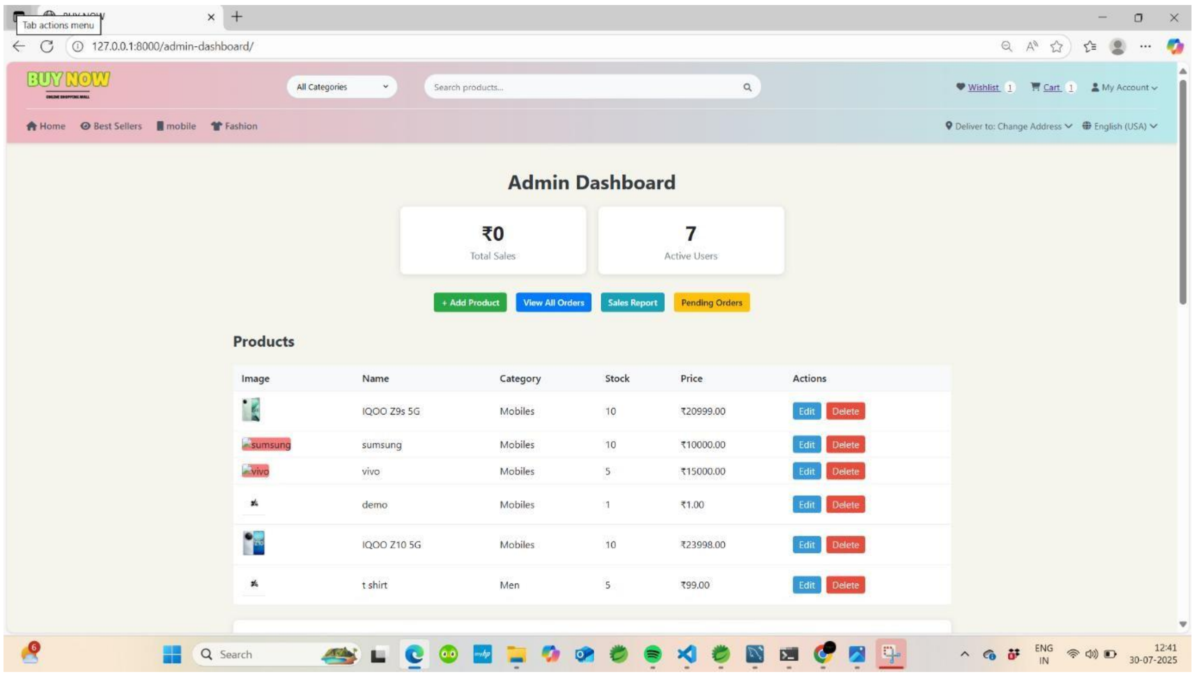
Order #7
Jul 06, 2025
Processing
₹300000.00

Order #8
Jul 06, 2025
Processing

12. Admin Panel Screens

Used internally for system control and analytics.

- **Modules**:
  - Product addition/edit/delete forms
  - Order fulfillment tracking
  - Graphical reports via Chart.js or D3.js
- **Access Control**:
  - Role-based rendering of admin routes
  - JWT token validation for secure entry



Admin Dashboard

₹0 Total Sales

7 Active Users

Products

Image	Name	Category	Stock	Price	Actions
	IQOO Z9s 5G	Mobiles	10	₹20999.00	Edit Delete
sumsung	sumsung	Mobiles	10	₹10000.00	Edit Delete
vivo	vivo	Mobiles	5	₹15000.00	Edit Delete
	demo	Mobiles	1	₹1.00	Edit Delete
	IQOO Z10 5G	Mobiles	10	₹23998.00	Edit Delete
	t shirt	Men	5	₹99.00	Edit Delete

CONCLUSION

The e-commerce web application developed in this project successfully integrates core functionalities essential for online retail such as secure user authentication, dynamic product browsing, interactive cart management, and order processing within a scalable and modular architecture. By leveraging modern web technologies including Django (Python), HTML5, CSS3, JavaScript, and SQLite3, the system demonstrates how open-source frameworks can be utilized to build efficient, user-friendly, and adaptable digital platforms.

Throughout the Software Development Life Cycle, the application adhered to systematic planning, iterative design, robust coding standards, and multi-level testing strategies. Each module was implemented with careful attention to usability, performance, and maintainability. The system's layered design ensures separation of concerns and promotes future scalability, whether in terms of traffic, features, or data volume.

In addition to addressing technical goals, the project emphasizes ethical design, accessibility, and cost-efficiency, making it a viable solution for small businesses or educational purposes. The outcome confirms the feasibility and effectiveness of building customizable commerce solutions using contemporary tools and frameworks. The application serves as a foundation for future enhancements such as integrated payment systems, customer analytics, and cloud-based deployment.

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- SQLite Documentation: https://sqlite.org/docs.html
- Mozilla Developer Network (MDN): https://developer.mozilla.org
- W3Schools Web Tutorials: https://www.w3schools.com

Books & Publications

- “Python Web Development with Django” by Jeff Forcier, Paul Bissex, and Wesley Chun
- “Designing Web Interfaces” by Bill Scott and Theresa Neil

Online Articles & Blogs

- Real Python tutorials on Django development
- Stack Overflow discussions on web development best practices
- CSS-Tricks articles on responsive design and layout techniques

Tools and Frameworks

- Bootstrap (https://getbootstrap.com) for UI styling
- GitHub repositories for source code examples and CI/CD workflows

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  → Used for creating a responsive, mobile-first frontend interface.

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  → Referenced for implementing user-centered design patterns and enhancing UX consistency.

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→ Provided structure for unit and integration testing practices.

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→ Used to identify and mitigate vulnerabilities such as XSS, CSRF, and SQL injection.

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→ Adopted for responsive layout and CSS optimization.

- Stack Overflow. *Discussion threads and community solutions*. https://stackoverflow.com
→ Referenced for debugging runtime issues and cross-browser behavior.