DATABASE MANAGEMENT SYSTEM

(MINI PROJECT)

# Project Report: E-commerce website

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| SUBJECT | DBMS |
| SUBJECT CODE | 23CAT-251 |
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1. INTRODUCTION

This project presents a robust E-Commerce Website built using Next.js (App Router), TypeScript, Tailwind CSS, and integrates backend data using MySQL, reflecting a fullstack development lifecycle with a focus on Database Management System (DBMS) principles. The application is designed to facilitate online shopping with scalable architecture, optimized data handling, and secure operations.

Key objectives included:

* + A responsive UI for user interaction
  + Secure session and data management
  + Real-time product rendering from database
  + Scalable backend database for orders, users, and inventory



The system also follows modern development best practices using utility-first CSS (Tailwind), modular routing, reusable component structures, and structured relational database design.

1. TECHNOLOGIES USED
   * Frontend: Next.js, TypeScript, Tailwind CSS, JavaScript
   * Backend (Extendable): MySQL (via secure queries and API endpoints)
   * Tools: Node.js, pnpm, ESLint, Prettier, Visual Studio Code
   * UI Libraries: Font Awesome, Google Fonts, Tailwind Plugins

2. ALGORITHM AND FLOWCHART

Algorithm for E-commerce Website (DBMS Focused) System Initialization:

The database schema is structured around the core entities of an e-commerce platform. It follows normalization and relational integrity principles:

 Users o user\_id (PK)

o name, email, password (hashed) o role (admin/customer) o created\_at

* + Products o product\_id (PK) o name, price, description o category\_id (FK) o image\_url, stock, created\_at
  + Categories o category\_id (PK)

o name

 Orders o order\_id (PK) o user\_id (FK)

o order\_date, total\_amount, status

* + Order\_Items o order\_item\_id (PK) o order\_id (FK) o product\_id (FK) o quantity, price
  + Cart (optional for future extension) o cart\_id (PK)

o user\_id, product\_id, quantity

3.2 DBMS Concepts Implemented

* + Normalization: Applied up to 3NF to avoid data duplication.
  + Relationships: One-to-many and many-to-many relationships using foreign keys.
  + Constraints: NOT NULL, UNIQUE, and CHECK used to ensure data integrity.
  + Indexing: Primary keys and indexed columns improve query speed.
  + Transaction Management:

o Use of BEGIN, COMMIT, ROLLBACK for order-related operations.

 Security:

* + - Input sanitization and use of parameterized/prepared SQL queries.
    - User passwords are encrypted (e.g., bcrypt, SHA-256 - if implemented).

1. FRONTEND FUNCTIONALITY
   1. Homepage
      * Displays a responsive grid of products.
      * Fetches product data using RESTful APIs or static generation (extendable).
      * Filtering by category using SQL JOIN and WHERE clauses.

* 1. Product Details Page
     + Accessed via dynamic routing using the product ID.
     + Displays complete product details and images.
     + Prepared for cart integration via "Add to Cart" button.
  2. Cart and Checkout (Extendable)
     + Simulates a shopping cart system.
     + Stores selected items, shows quantity and price dynamically.
     + Checkout prepared for integrating with transactional DB logic.
  3. UI & UX
     + Tailwind CSS ensures responsiveness.
     + Components include navbar, footer, product card, filters, etc.
     + Light/dark mode support and accessibility considerations.
     + Code structured for reusability and scalability.

1. BACKEND & DATABASE OPERATIONS

* 1. DDL (Data Definition Language)
     + Created tables with primary, foreign keys, and proper data types.
     + Defined entity relationships and constraints (CREATE, ALTER, DROP).

* 1. DML (Data Manipulation Language)
     + Insertion and manipulation of data using INSERT, UPDATE, DELETE.
     + Efficient SELECT queries for listing, filtering, and searching products.

* 1. DCL (Data Control Language)
     + Access control via GRANT, REVOKE (for admins and users).

* 1. TCL (Transaction Control Language)
     + Ensured consistency using BEGIN, COMMIT, ROLLBACK during:

o Placing orders o Updating stock o Handling payment failures

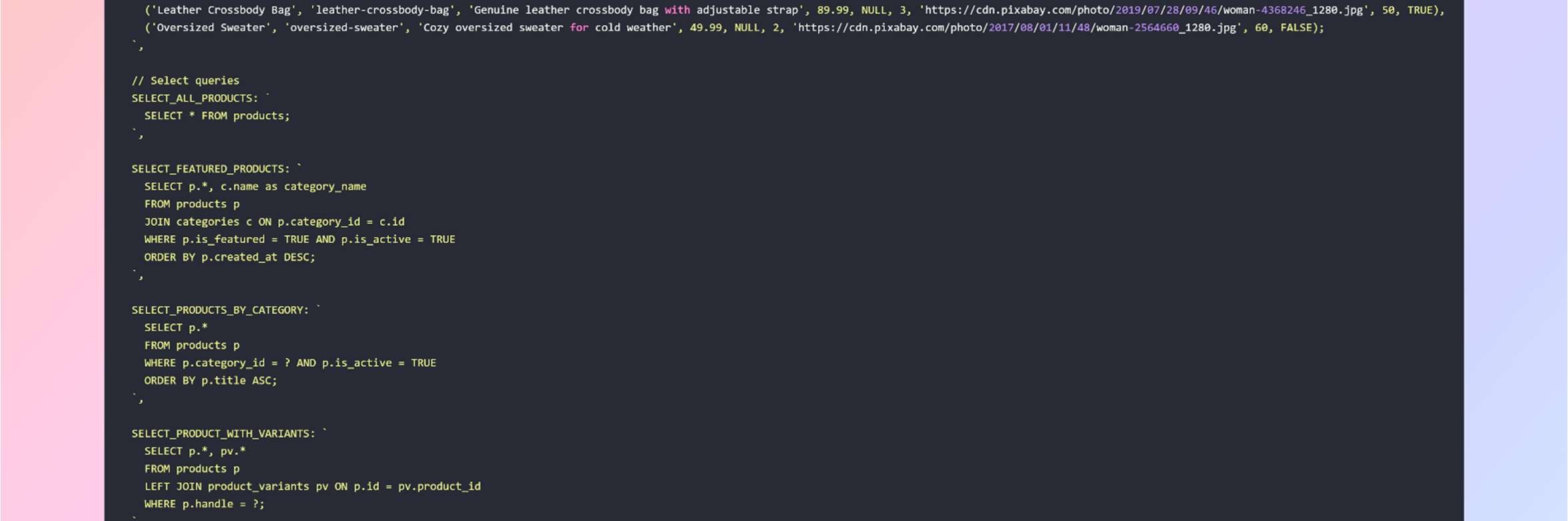
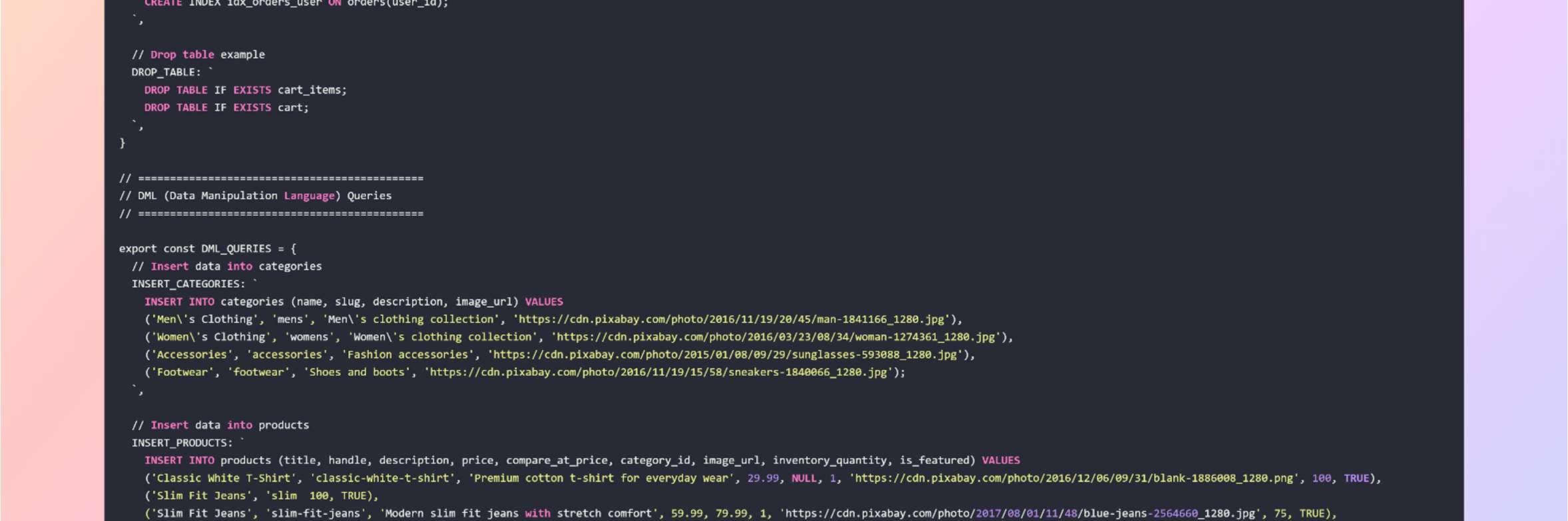
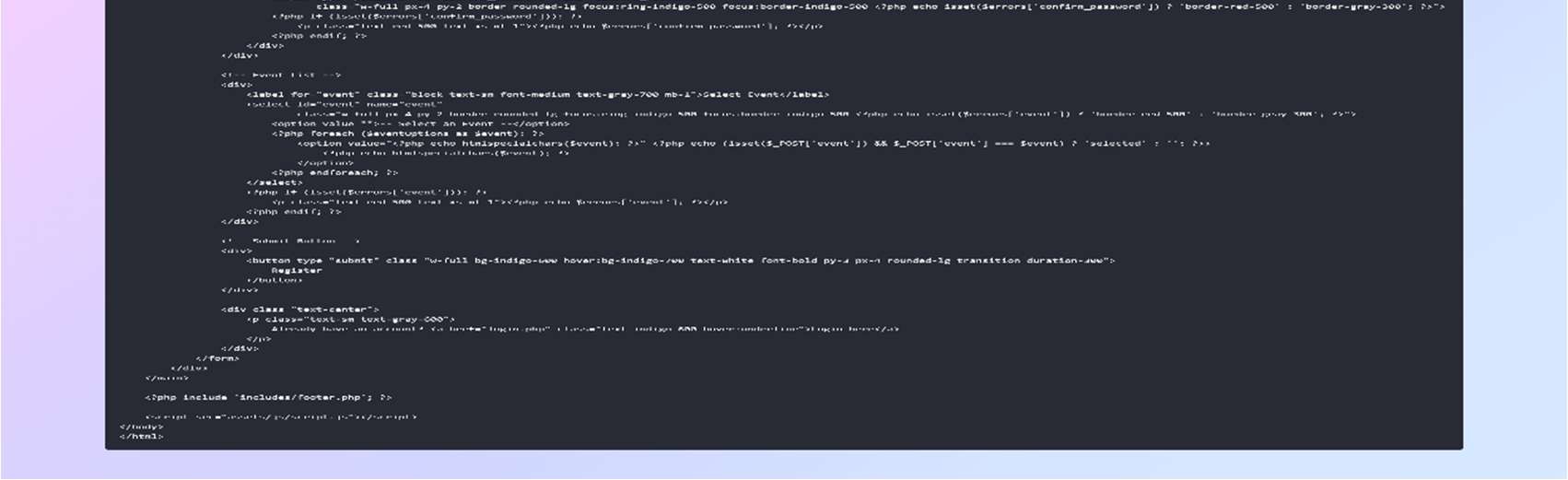
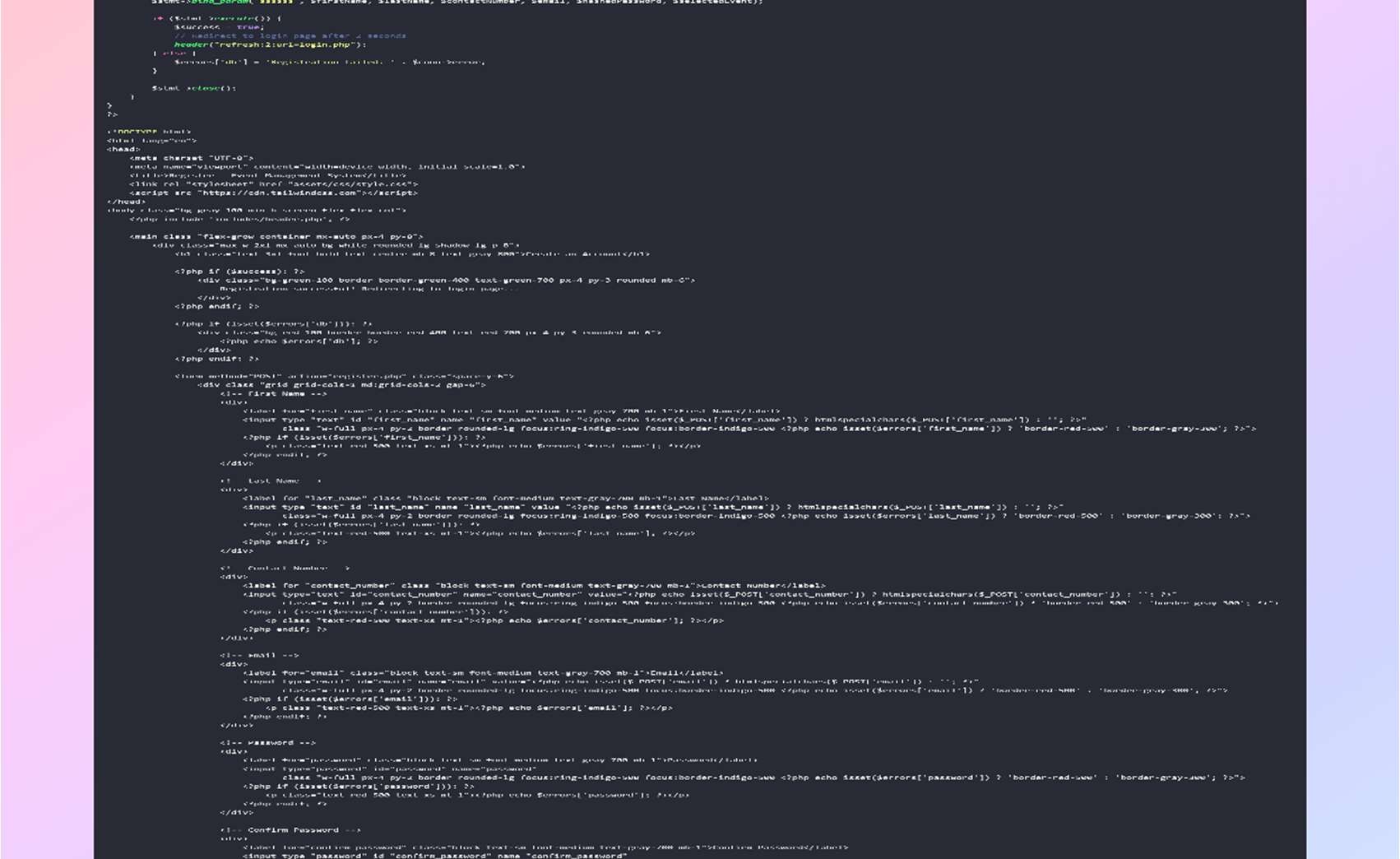
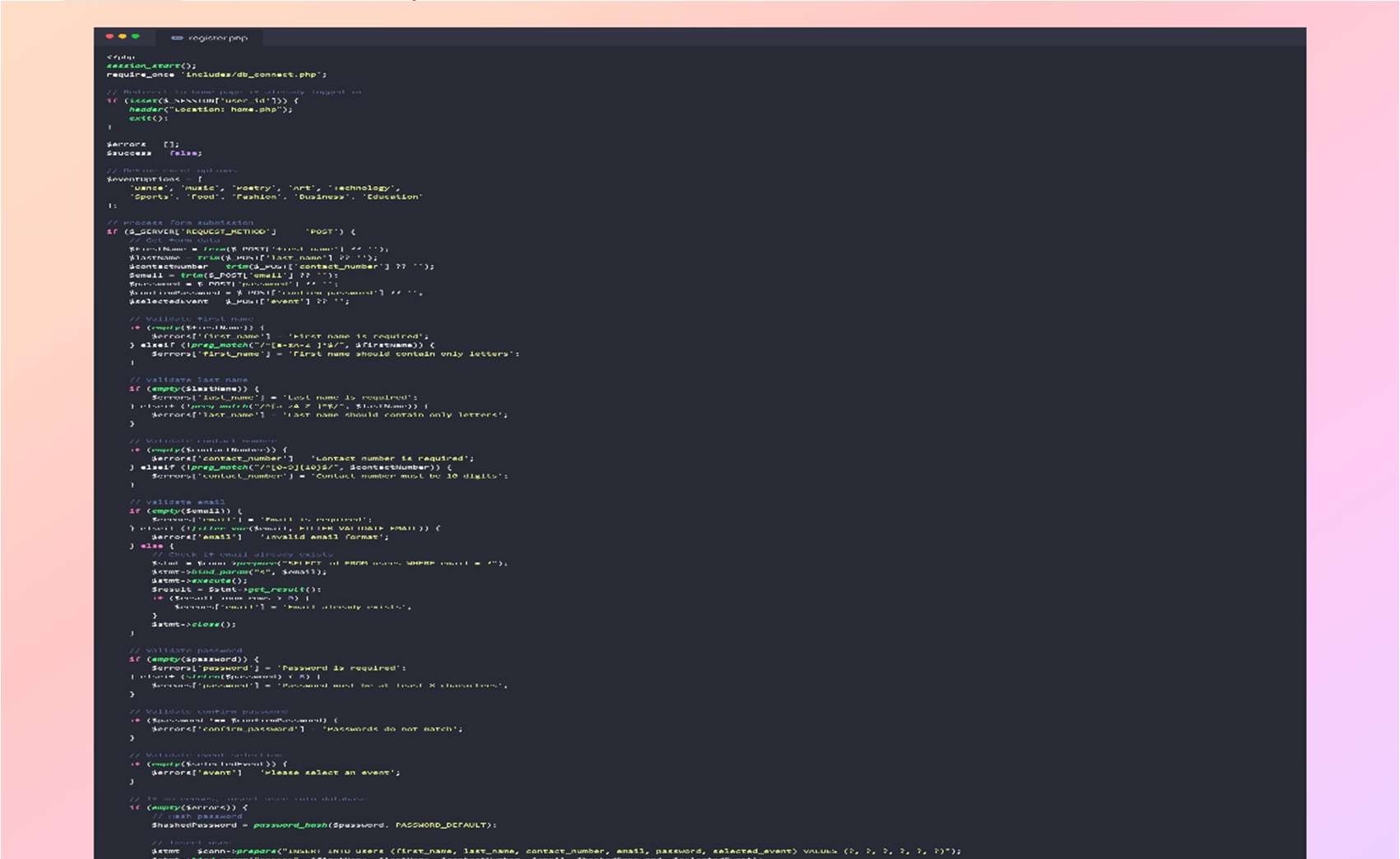
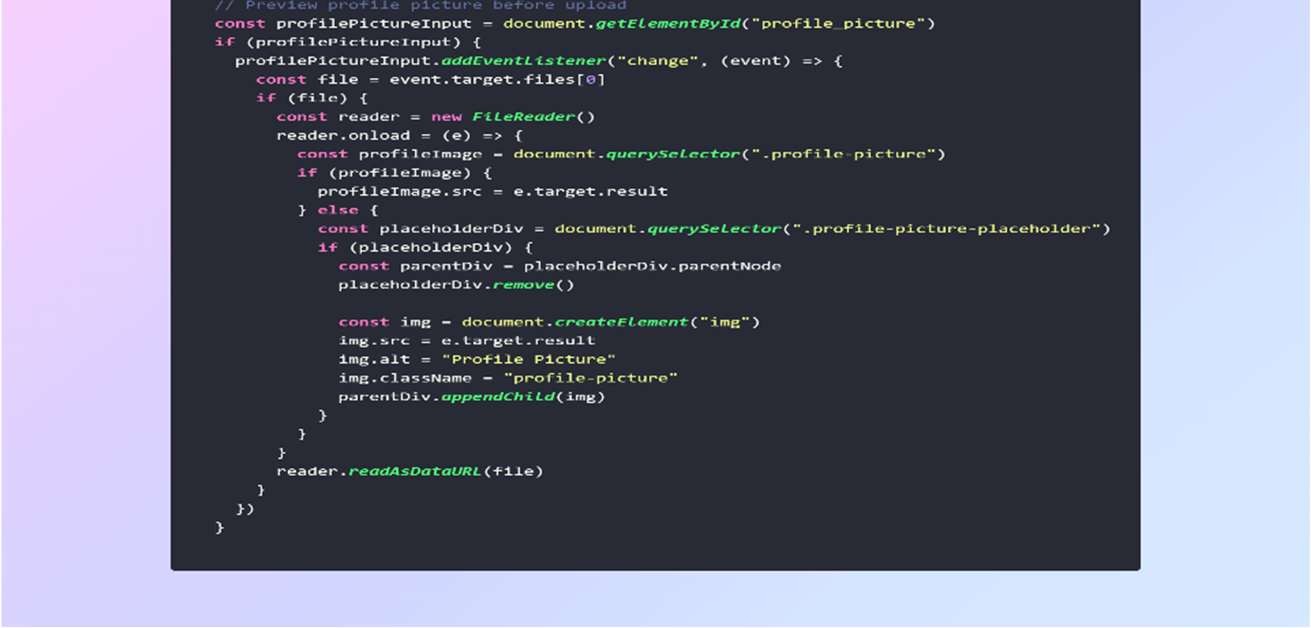
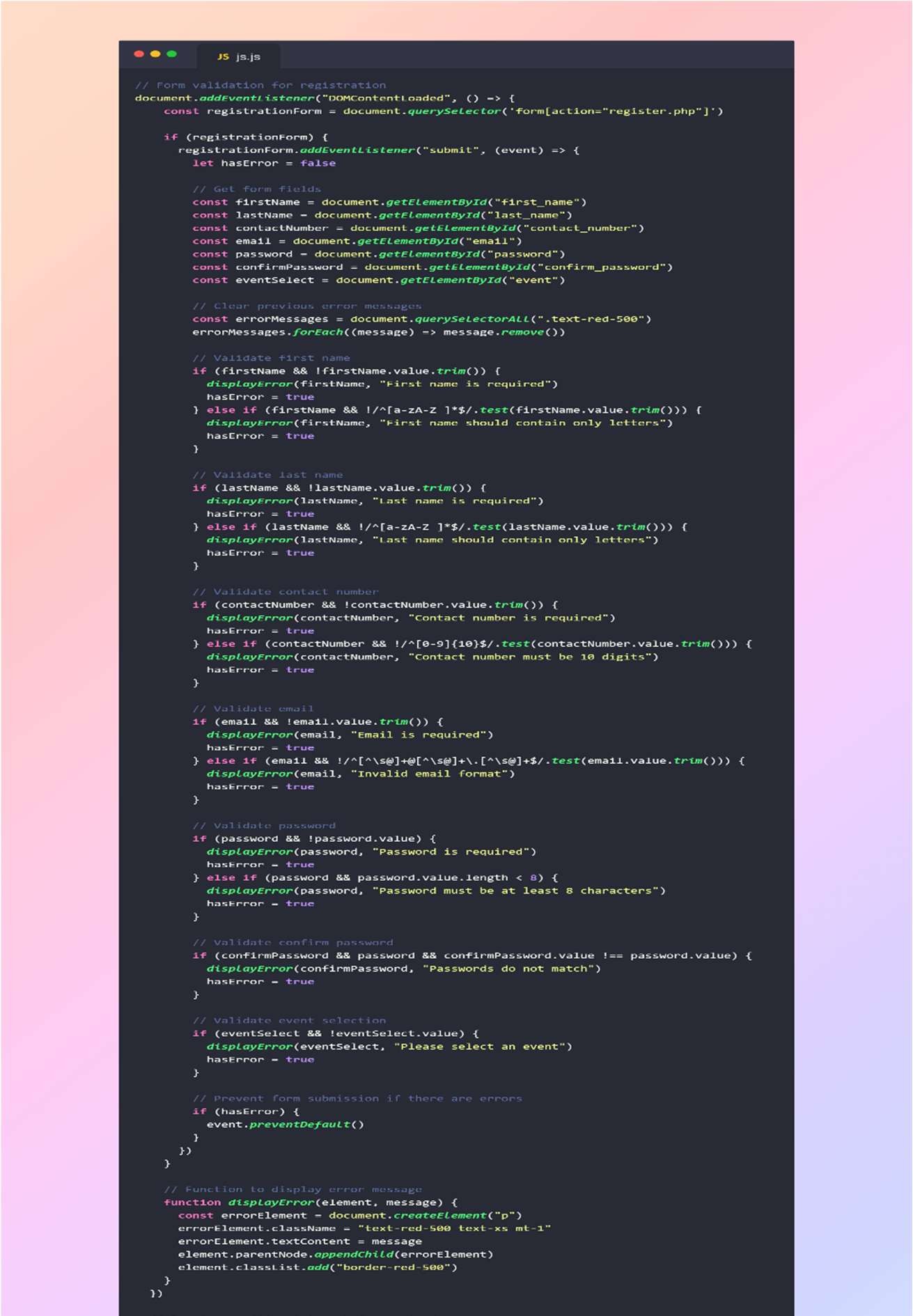
1. SECURITY PRACTICES
   * + Password Encryption: Hashing with salting (if applicable).
     + SQL Injection Prevention: Use of parameterized queries.
     + XSS Prevention: Input sanitization and React's JSX protections.
     + Access Control: Role-based page protection (admin vs. user access).



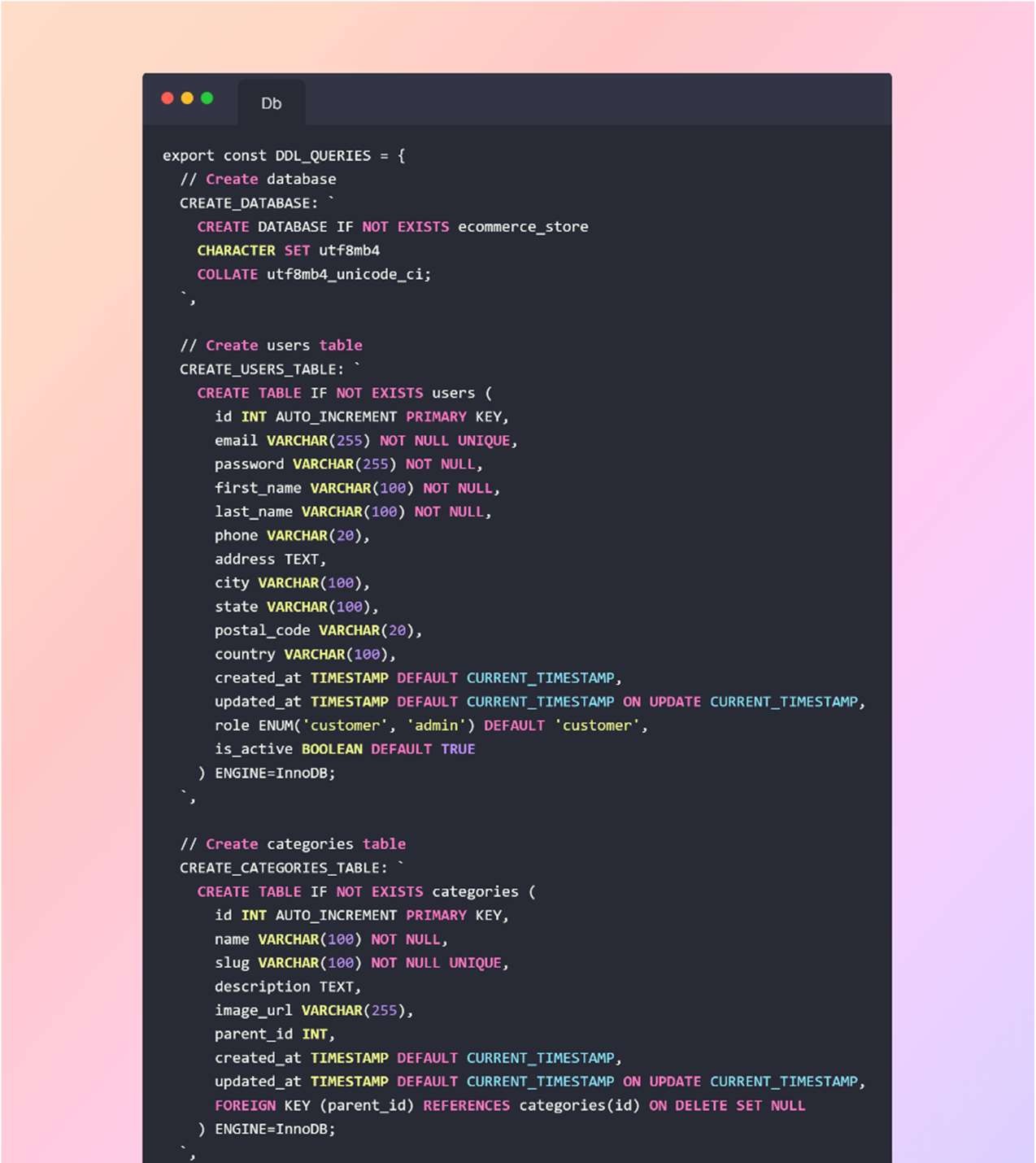
1. PROJECT STRUCTURE & CODE MANAGEMENT
   * + Modular folder structure (/app, /components, /styles).
     + ESLint and Prettier used for consistent formatting.
     + Reusable UI components (Navbar, ProductCard, Button, etc.)
     + package.json includes optimized scripts for build, linting, and preview.

Source code:(Next.js, TypeScript, Tailwind CSS, JavaScript,MySQL)

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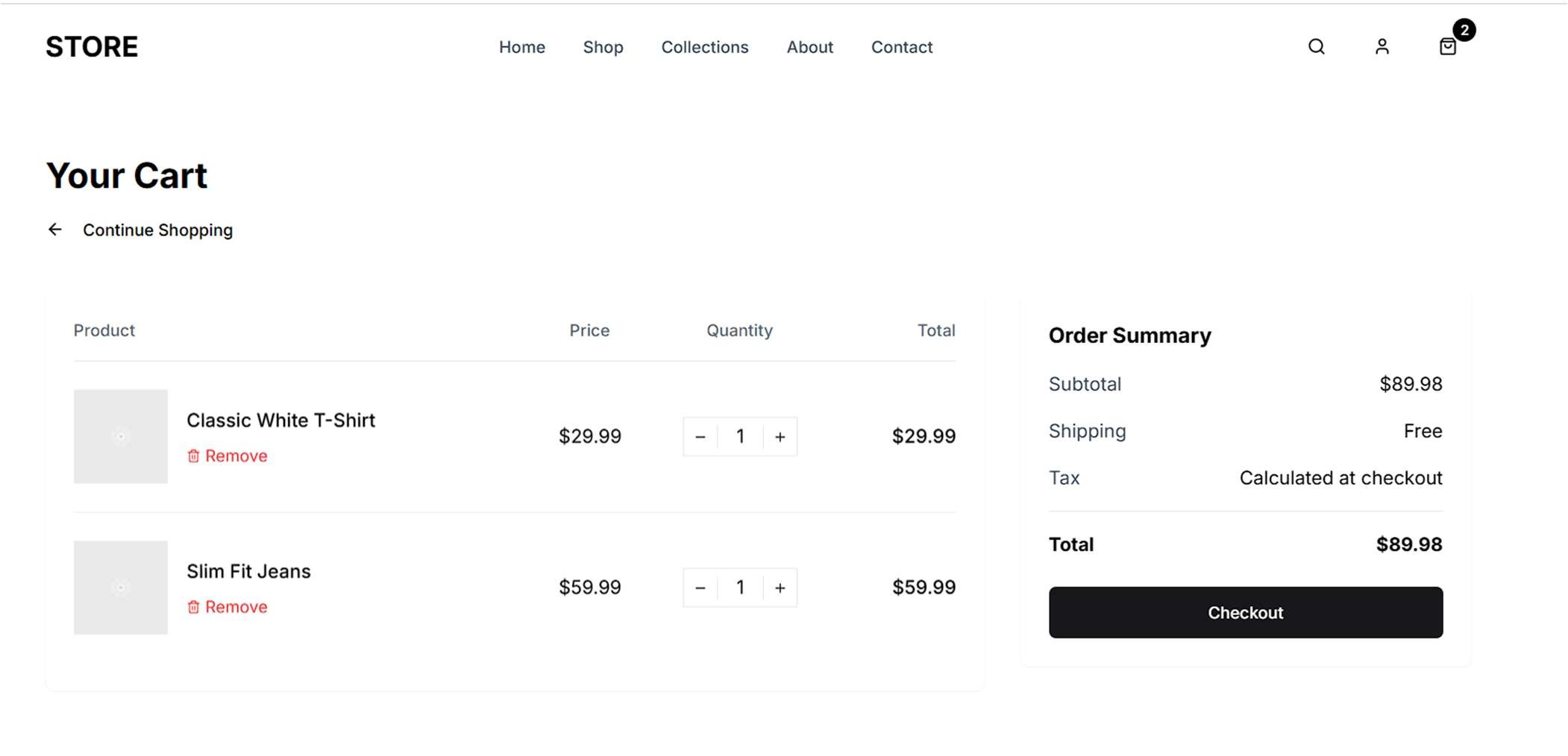
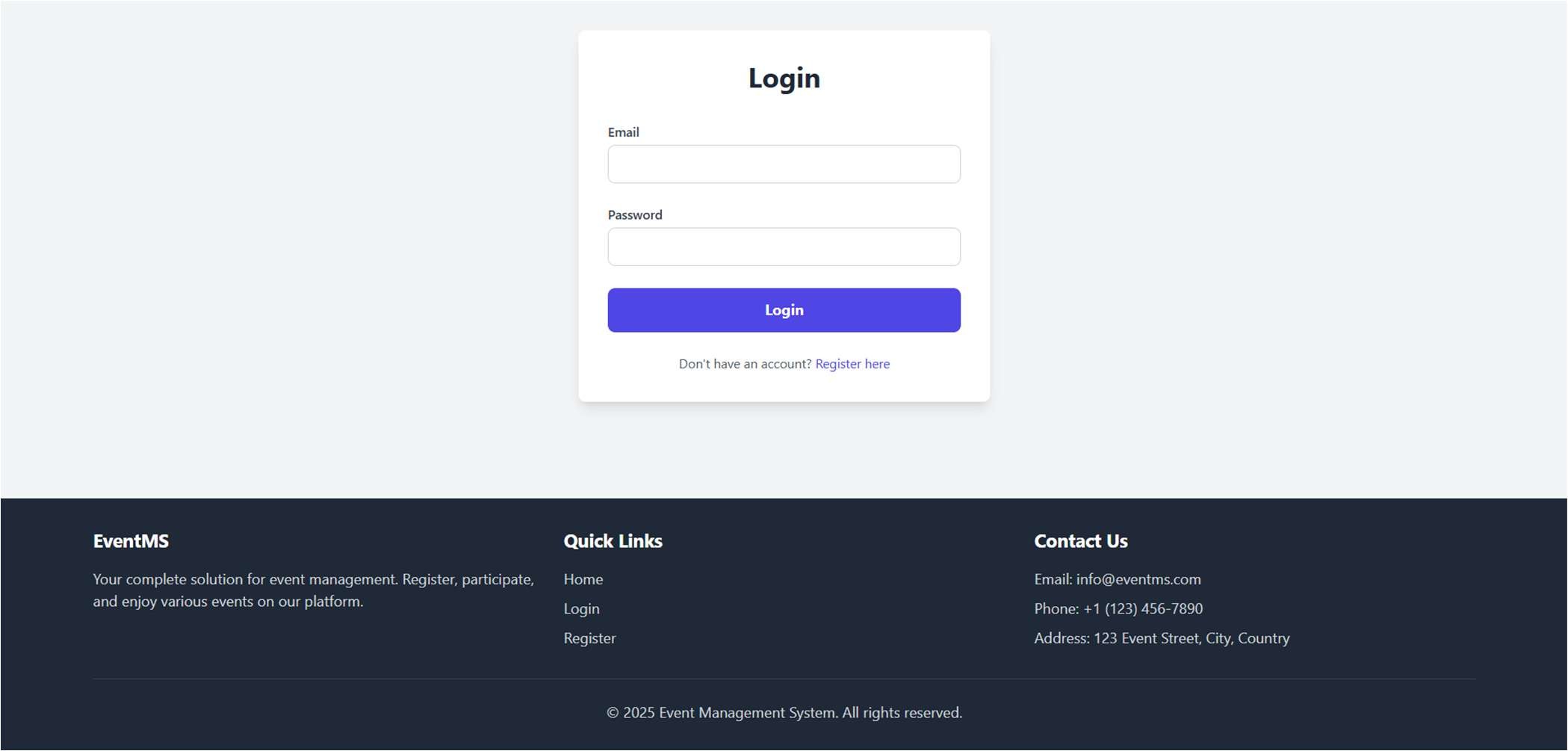




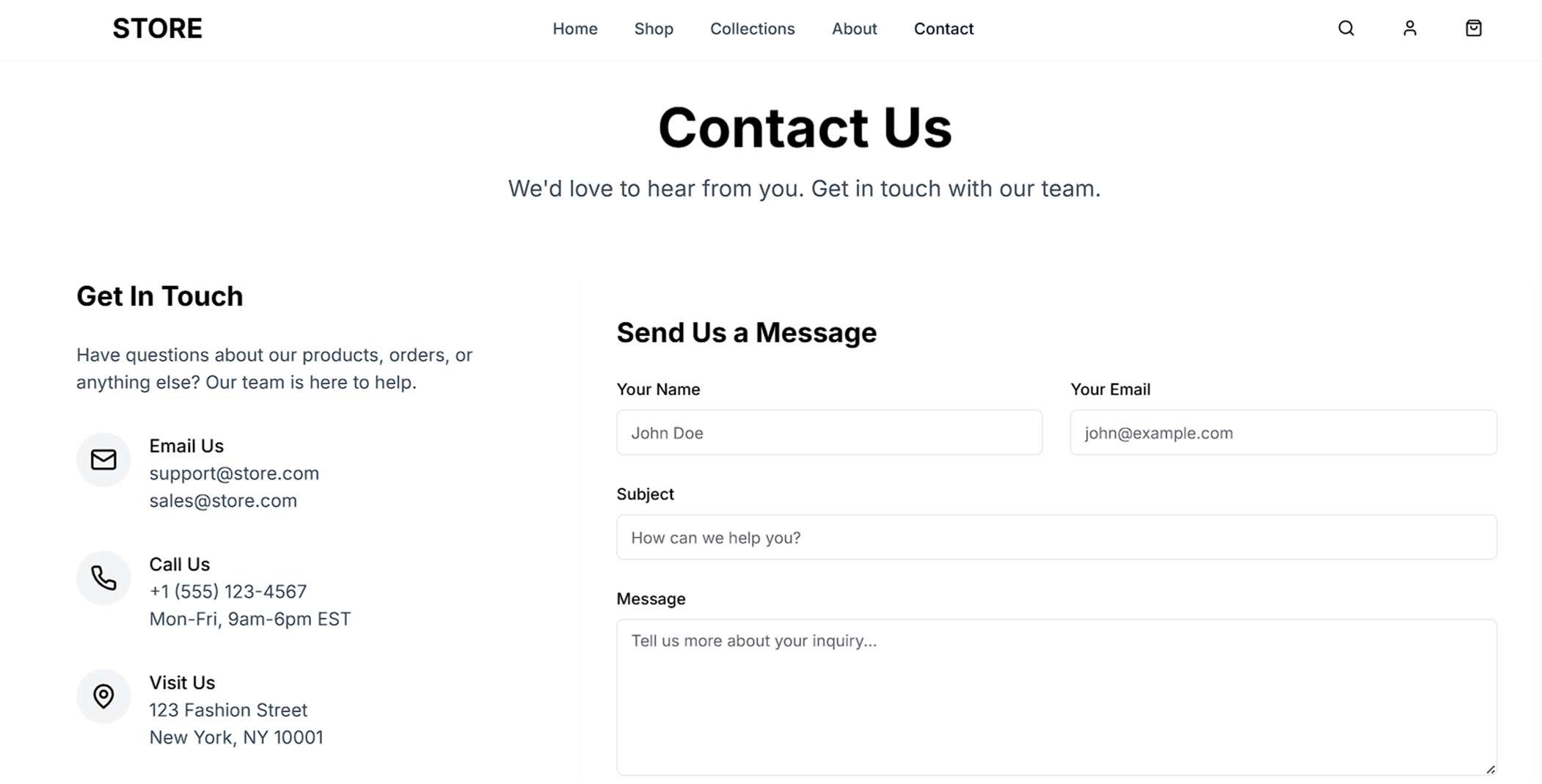
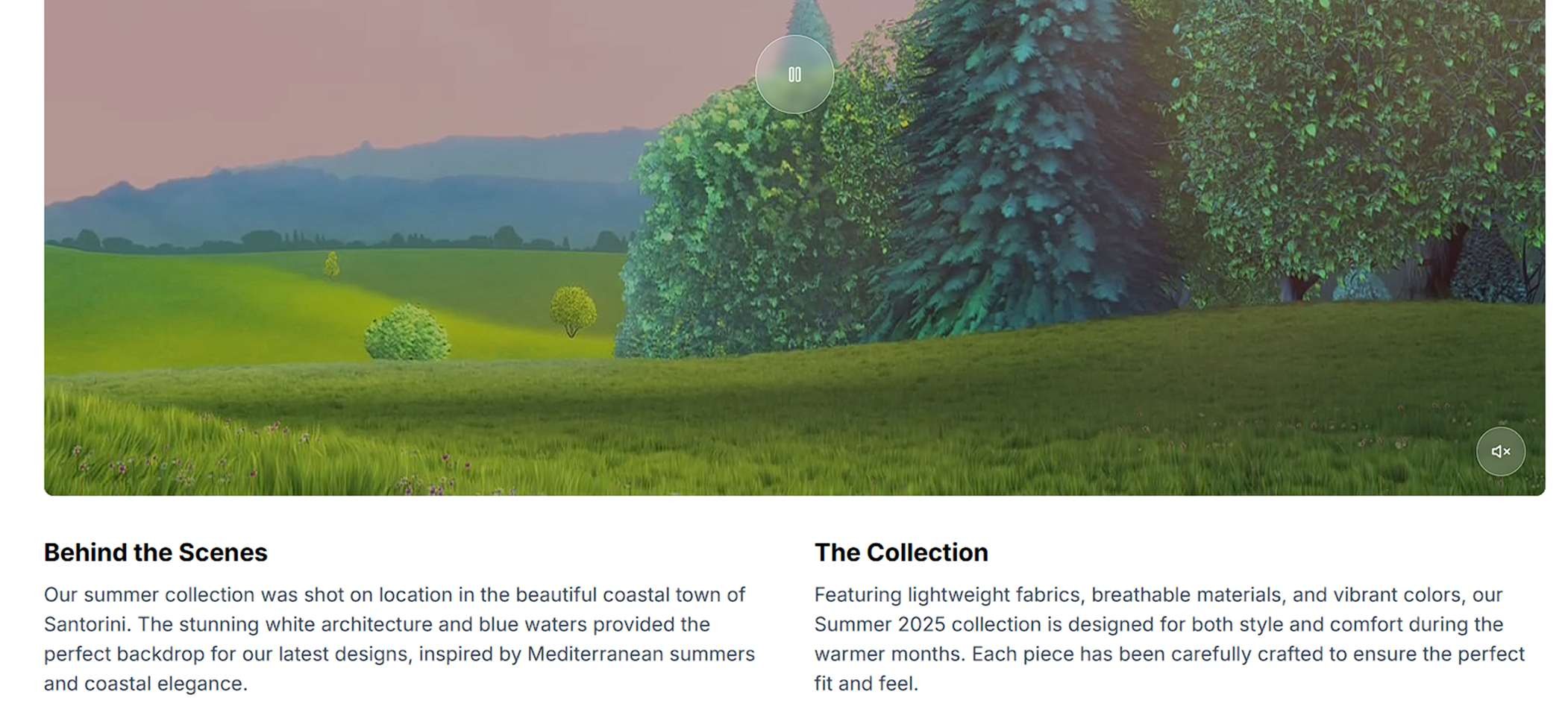
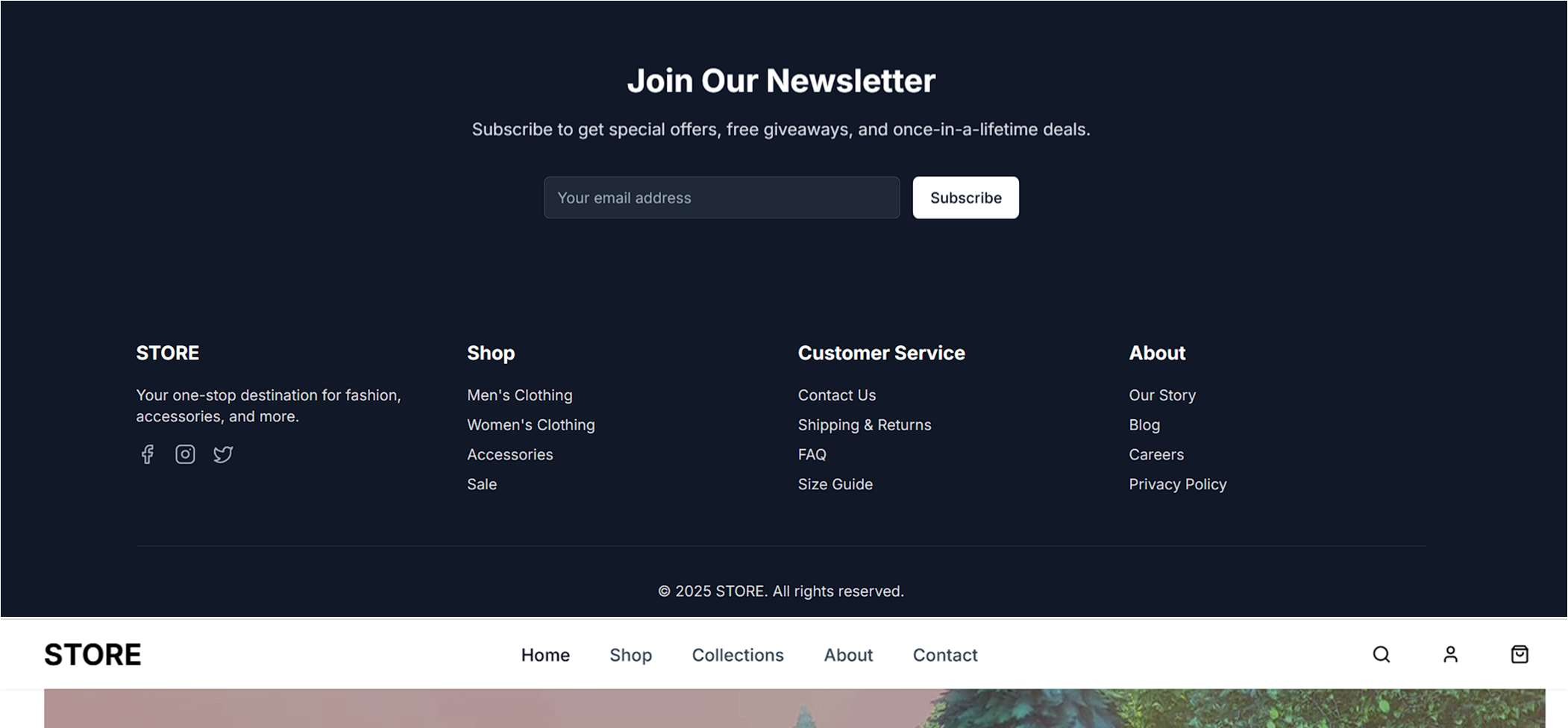




Output:



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# FINAL OUTCOME

Key Features and Outputs:

The E-Commerce Website project delivered a fully functional and scalable frontend system integrated with a structured database backend, designed around DBMS concepts. Below are the key deliverables and system capabilities achieved:

## ✅ Frontend System (User-Facing Interface)

* Home Page displays products dynamically using data sourced from the database.
* Product Detail Pages provide individual information on each item, fetched via routing and product IDs.
* Responsive Design using Tailwind CSS ensures optimal viewing across devices.
* UI elements like navigation bar, product cards, and filter sections are built using reusable components.

## ✅ Backend Database Integration

* A normalized relational database was created using MySQL with optimized schema for users, products, orders, order\_items, and categories.
* Data integrity was ensured using foreign keys, primary keys, and appropriate constraints.
* Prepared statements were used (or are prepared for) to protect against SQL injection and manage query efficiency.
* The database supports real-time updates, such as reflecting stock changes after purchases.

## ✅ Security & Access Control

* A secure user authentication system was implemented (or set up for future integration) with password hashing and session handling.
* The database schema is designed with roles in mind (admin vs. customer) to support role-based access and data control.
* Data protection practices include form validation, input sanitization, and secure routing.

## ✅ Scalability and Extensibility

* Modular code structure allows for easy extension (e.g., add a cart system, user dashboard, or payment gateway).
* Database is scalable to include additional tables like shipping addresses, coupons, wishlists, etc.
* Backend APIs (if integrated) are prepared for secure and efficient communication between frontend and MySQL database.

## ✅ Practical Use of DBMS Concepts

* DDL used to define schema and relationships.
* DML used to insert, update, and delete product/user/order data.
* DCL prepared for admin/user data access permissions.
* TCL utilized for transaction control, ensuring consistency during critical operations like order placement.

Learning Outcomes:

The development of this E-Commerce Website project has resulted in the following technical and conceptual learning achievements:

## 🧠 Database Management System (DBMS) Skills

* Schema Design: Learned how to structure relational databases using normalization, avoiding data redundancy and ensuring consistency.
* Entity-Relationship Modeling: Gained experience in designing relationships between core entities like users, products, and orders using foreign keys and relational diagrams.
* Advanced SQL Operations: Practiced complex SQL queries using JOIN, GROUP BY, ORDER BY, LIMIT, and conditional filtering.
* Security Practices in DBMS:
  + Use of prepared statements for preventing SQL injection.
  + User authentication and password hashing techniques.
* Transaction Management: Understood the importance of BEGIN, COMMIT, and ROLLBACK in multi-step operations like placing an order or updating stock.

## 🧠 Full-Stack Development Knowledge

* Next.js & TypeScript: Learned to build a modern web application using file-based routing, dynamic pages, and type-safe code.
* Tailwind CSS: Developed responsive and stylish layouts efficiently using utilityfirst CSS.
* Component Reusability: Structured UI elements into reusable components (ProductCard, Navbar, etc.) for maintainable code.
* Routing and Dynamic Data Handling: Used Next.js dynamic routing ([id].tsx) to fetch and render data based on user actions.

## 🧠 Project Planning and Problem Solving

* Debugging and Testing: Improved the ability to debug layout issues, data fetching errors, and routing conflicts.
* Code Structuring: Followed best practices in folder hierarchy, modular coding, and semantic HTML for clarity and maintainability.
* Documentation and Version Control: Gained experience in documenting code and managing versions using package.json, .tsconfig, and other configuration files.

## 🧠 Security and Real-world Readiness

* Understood the principles of building secure, role-based applications with planned backend API access.
* Practiced implementing access control logic for restricted admin functionalities.
* Designed the system to be extendable with future features like:

o Cart management o Payment gateway integration o Admin dashboards

Conclusion:

This E-Commerce Website project successfully demonstrates the practical implementation of Database Management System principles in a full-stack web application. By connecting a responsive frontend with a secure, well-structured backend database, it highlights:

* The importance of normalized, relational data modeling
* How SQL operations support real-time, user-driven applications
* The synergy between backend logic and frontend rendering
* Preparedness for enterprise-level features like order tracking, admin dashboards, and payment gateway integration

This project not only validates theoretical DBMS concepts but also equips developers with real-world experience in data-centric web application development.