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COMPAREIT: A SECURE E-COMMERCE PRICE COMPARISON PLATFORM USING SPRING-BOOT

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ABSTRACT

The rapid expansion of e-commerce platforms has made online shopping more convenient, but it has also increased the difficulty of finding the best product prices across multiple websites. Users often need to visit different platforms manually to compare prices, availability, and sellers, which is time-consuming and inefficient. To address this issue, this project presents **CompareIT**, a secure and intelligent e-commerce price comparison platform that allows users to search for products and compare prices from multiple online marketplaces through a single interface. The system is developed using **React.js and Tailwind CSS** for the frontend and **Spring Boot microservices** for the backend. Real-time product data is fetched using the **Google Shopping API**, enabling accurate price comparison and best-deal identification. Secure user access is ensured through **multi-factor authentication**, including password-based login, OAuth authentication, OTP verification, and JWT-based session management. The platform improves user decision-making by reducing search effort and presenting reliable pricing information. The results demonstrate that CompareIT enhances efficiency, security, and user experience in online shopping. The project concludes that centralized price comparison platforms can significantly save time and money for users and can be further enhanced with AI-based recommendations and advanced analytics in the future.

Keywords: E-Commerce, Price Comparison, Web Application, Spring Boot, React.Js, Secure Authentication, JWT-Security.

1. INTRODUCTION

The rapid growth of digital technologies has significantly transformed the way people shop and interact with online marketplaces. E-commerce platforms such as Amazon, Flipkart, and other online retailers have become an essential part of daily life by offering convenience, variety, and competitive pricing. However, the availability of multiple platforms for the same products has also introduced a major challenge for consumers—identifying the best price, trusted seller, and optimal purchasing option within a short time. Users are often required to visit several websites manually, compare prices, and evaluate product details, which makes the process time-consuming and inefficient.

Recent research in the field of e-commerce systems focuses on improving user experience, automation, and security through centralized platforms and intelligent comparison mechanisms. Studies highlight the importance of real-time data aggregation, scalable system architecture, and secure authentication methods to ensure reliable and trustworthy online shopping environments. Modern web applications increasingly adopt microservice-based architectures, API-driven data integration, and token-based authentication to enhance performance, scalability, and security.

In this context, the **CompareIT** project is proposed as a smart and secure e-commerce price comparison platform that enables users to compare product prices across multiple online marketplaces through a single interface. By integrating modern frontend technologies, secure backend services, and third-party product search APIs, the system aims to reduce manual effort, improve decision-making, and enhance the overall online shopping experience. This project falls under the domain of web-based e-commerce systems and secure information processing, addressing current challenges faced by online consumers.

2. METHODOLOGY

The methodology of this research focuses on the design, development, and analysis of **CompareIT**, an e-commerce price comparison platform that enables users to compare product prices across multiple online marketplaces through a single web application. The proposed system follows a structured full-stack development approach that integrates frontend technologies, backend services, third-party APIs, and secure authentication mechanisms to ensure accuracy, scalability, and reliability. The analysis emphasizes real-time data retrieval, secure user access, and efficient comparison logic to improve the online shopping experience.

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2.1 System Design and Architecture

The system architecture of CompareIT is designed using a client–server model. The frontend is developed using React.js and Tailwind CSS to provide a responsive and interactive user interface. The backend is implemented using Spring Boot microservices, which handle product search requests, comparison logic, authentication, and session management. The Google Shopping API is integrated to fetch real-time product prices and seller information from multiple e-commerce platforms. This modular architecture ensures scalability, fault isolation, and efficient communication between system components.

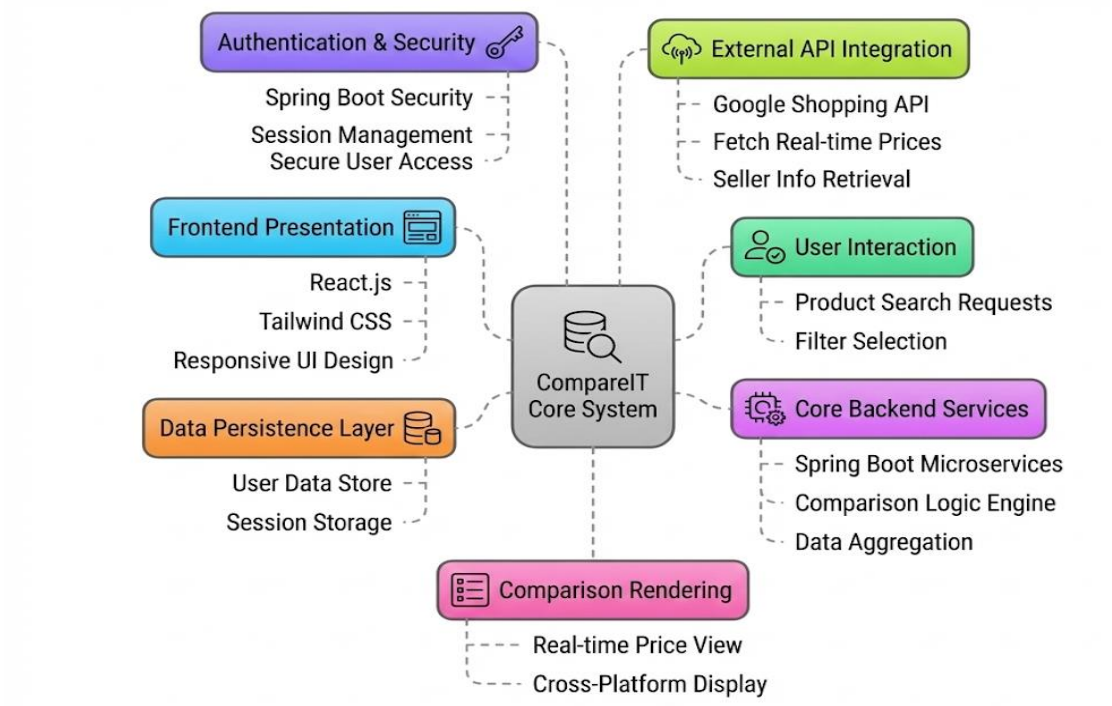

Figure 1: CompareIT System Architecture

2.2 Product Search and Price Comparison Analysis

Product search and price comparison form the core functionality of CompareIT. When a user enters a product query, the backend processes the request and retrieves relevant product data using the Google Shopping API. The retrieved data is analyzed to match similar products, compare prices, and identify the best available deal. The system then displays multiple seller options, allowing users to make informed purchasing decisions. This analysis reduces manual effort and improves accuracy in price comparison.

2.3 Security and Authentication Methodology

Security is implemented using a multi-factor authentication approach. The system supports password-based login, OAuth authentication using Google and GitHub, and OTP verification through email. User sessions are managed using JSON Web Tokens (JWT), ensuring secure and stateless authentication. Platform and IP-based validation are applied to prevent unauthorized access. This methodology enhances data security and protects user information during system interaction.

2.4 Development Tools and API Testing

The development of CompareIT is carried out using Visual Studio Code as the primary integrated development environment. Postman is used to test and validate RESTful APIs developed in the backend. API testing ensures correct request handling, response accuracy, and secure data transmission. This phase helps in identifying errors early and improves system reliability.

2.5 Performance and Result Analysis

The system performance is analyzed based on response time, accuracy of price comparison, and user interaction efficiency. The use of microservices and API-based data retrieval ensures faster responses and better scalability. The results indicate that CompareIT significantly reduces search time and enhances the overall user experience compared to traditional manual price comparison methods.

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3. MODELING AND ANALYSIS

Modeling and analysis play an important role in understanding the structure, behavior, and performance of the proposed **CompareIT** system. This section explains the system modeling techniques used to represent the working of the e-commerce price comparison platform and analyzes how different components interact to achieve efficient price comparison, secure authentication, and reliable performance. The modeling focuses on system architecture, data flow, and functional behavior to ensure clarity and correctness in implementation.

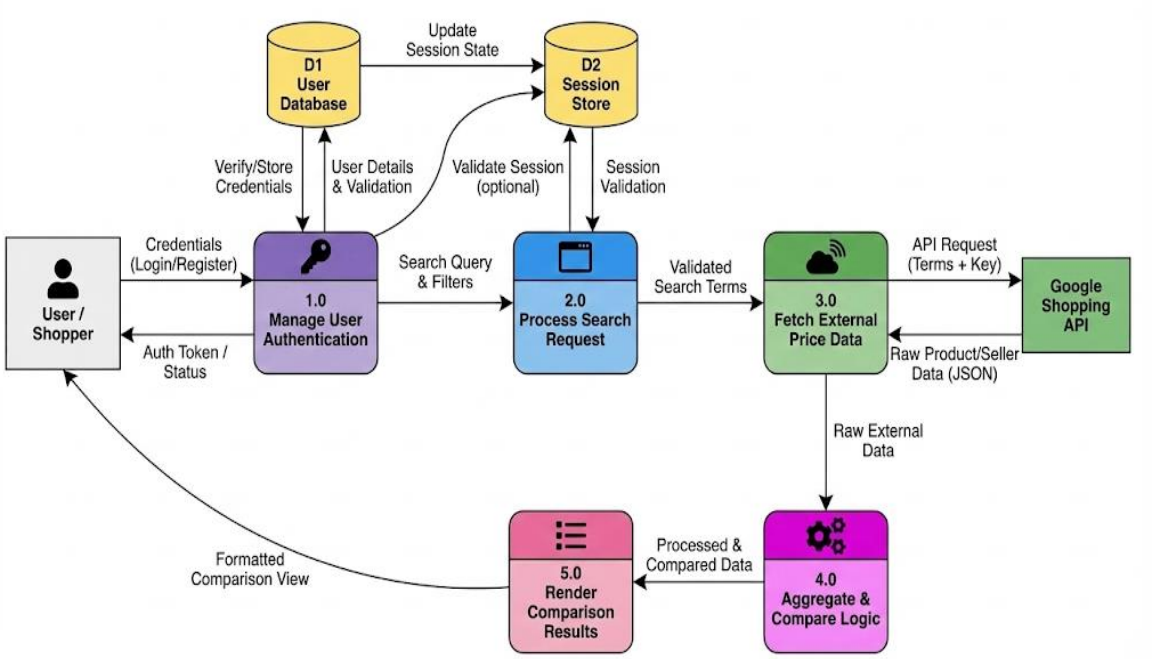

Figure 2: CompareIT Data Flow Diagram (DFD) Level 1

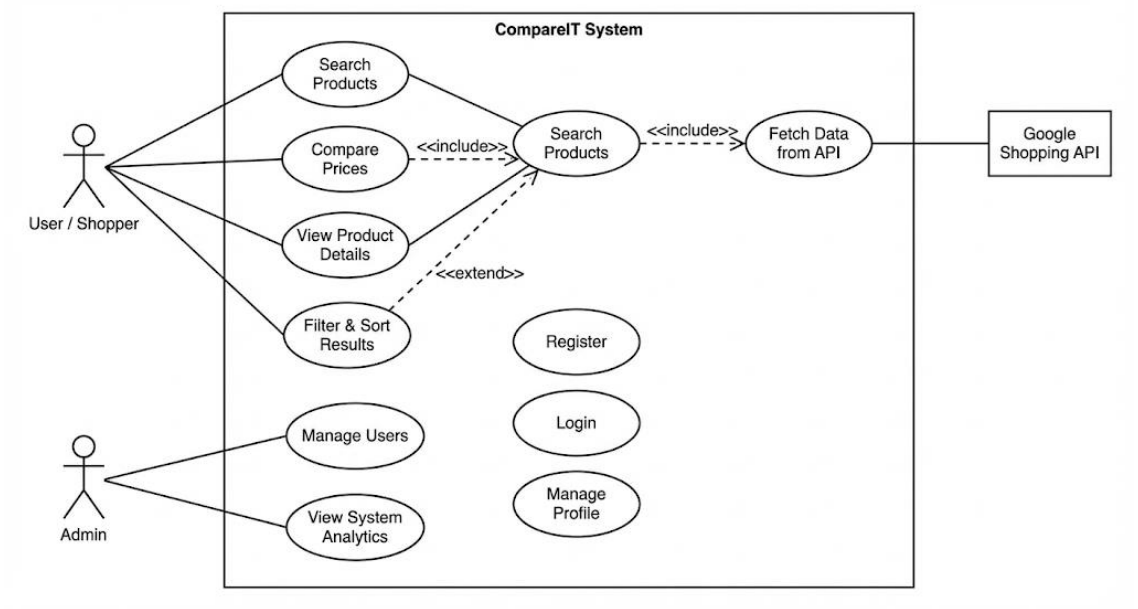

Figure 3: CompareIT Use-case Diagram

4. DEVELOPMENT, TESTING, AND DEPLOYMENT

4.1 Development

The development of the CompareIT platform follows a modular and systematic approach. The frontend is developed using React.js and Tailwind CSS to create a responsive and user-friendly interface that allows users to search and compare products easily. Component-based development is used to improve code reusability and maintainability.

The backend is developed using Spring Boot with a microservices architecture to handle core functionalities such as product search, price comparison, authentication, and session management. The Google Shopping API is integrated to fetch real-time product data from multiple e-commerce platforms. Secure user authentication is implemented using

multi-factor authentication, including password-based login, OAuth authentication, OTP verification, and JWT-based session handling. The entire development process is carried out using Visual Studio Code as the primary integrated development environment.

4.2 Testing

Testing plays a critical role in ensuring the correctness, security, and reliability of the CompareIT system. Unit testing is performed on individual components and backend services to verify their functionality. RESTful APIs developed using Spring Boot are tested using Postman to validate request handling, response accuracy, authentication tokens, and error management.

Integration testing ensures smooth communication between the frontend and backend services. Security testing is conducted to verify authentication flows, JWT validation, and access control mechanisms. Functional testing confirms that key features such as product search, price comparison, and redirection to seller platforms work as expected. The testing process helps identify defects early and ensures stable system performance.

4.3 Deployment

The deployment phase focuses on making the application available for real-world usage. The frontend is deployed on a web hosting platform to ensure fast loading and global accessibility. Backend services are deployed in a scalable environment to handle multiple user requests efficiently.

Continuous Integration and Continuous Deployment (CI/CD) practices are followed to automate build and deployment processes. This ensures that updates and improvements are deployed smoothly with minimal downtime. The deployed system provides reliable access, secure communication, and consistent performance, making CompareIT suitable for academic demonstration as well as real-world e-commerce applications.

5. APPLICATION AND USE CASE

5.1 Application

The **CompareIT** platform is designed to simplify online shopping by providing a centralized system for comparing product prices across multiple e-commerce websites. It can be applied in various real-world scenarios where users need accurate and quick price comparison before making purchase decisions.

The application is useful for individual consumers who want to find the best deals, students and budget-conscious users seeking affordable products, and small businesses that perform price analysis for market research. CompareIT can be used across different product categories such as electronics, fashion, household items, and accessories. The secure authentication mechanism ensures safe user access, making the platform reliable for frequent usage.

The system also serves as a practical example of modern web application development using secure authentication, API integration, and scalable architecture, making it suitable for academic and industrial applications.

5.2 Use Case

The primary use case of the **CompareIT** system involves a user searching for a product and comparing prices from multiple online marketplaces. The typical workflow is as follows:

1. The user registers or logs in to the system using secure authentication.
2. After successful login, the user enters a product name in the search bar.
3. The system sends the request to the backend, which retrieves real-time product data using the Google Shopping API.
4. The platform analyzes and compares prices from different sellers and displays the results in a structured format.
5. The user reviews the comparison results and selects the best available option.
6. The system redirects the user to the original e-commerce platform for final purchase.

Additional use cases include user authentication management, secure session handling, and viewing previously searched products. These use cases demonstrate how CompareIT improves efficiency, reduces manual effort, and enhances the overall online shopping experience.

6. RESULTS AND DISCUSSION

This section presents the results obtained from the implementation and testing of the **CompareIT** e-commerce price comparison platform and discusses their significance. The system was evaluated based on functionality, performance, security, and user experience. The results demonstrate that the proposed platform effectively addresses the challenges of manual price comparison and provides a reliable solution for online shoppers.

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6.1 Functional Results

The functional testing of CompareIT confirms that all major features operate as intended. Users are able to register and log in securely using multi-factor authentication, including password-based login, OAuth authentication, and OTP verification. Product search functionality successfully retrieves real-time product information using the Google Shopping API. The system accurately displays prices from multiple sellers and highlights the best available deals. Redirection to original e-commerce platforms functions correctly without exposing sensitive user data.

6.2 Performance Analysis

Performance testing shows that the system responds efficiently to user requests. The microservice-based backend architecture reduces response time and allows the system to handle multiple concurrent users effectively. API responses tested using Postman indicate consistent and reliable data retrieval. The frontend interface remains responsive across different devices, ensuring smooth interaction and usability.

6.3 Security Evaluation

The security mechanisms implemented in CompareIT provide strong protection against unauthorized access. JWT-based session management ensure secure communication between the frontend and backend. IP and platform-based validation further enhance session security. Testing results indicate that the authentication process effectively prevents invalid access attempts, improving overall system reliability.

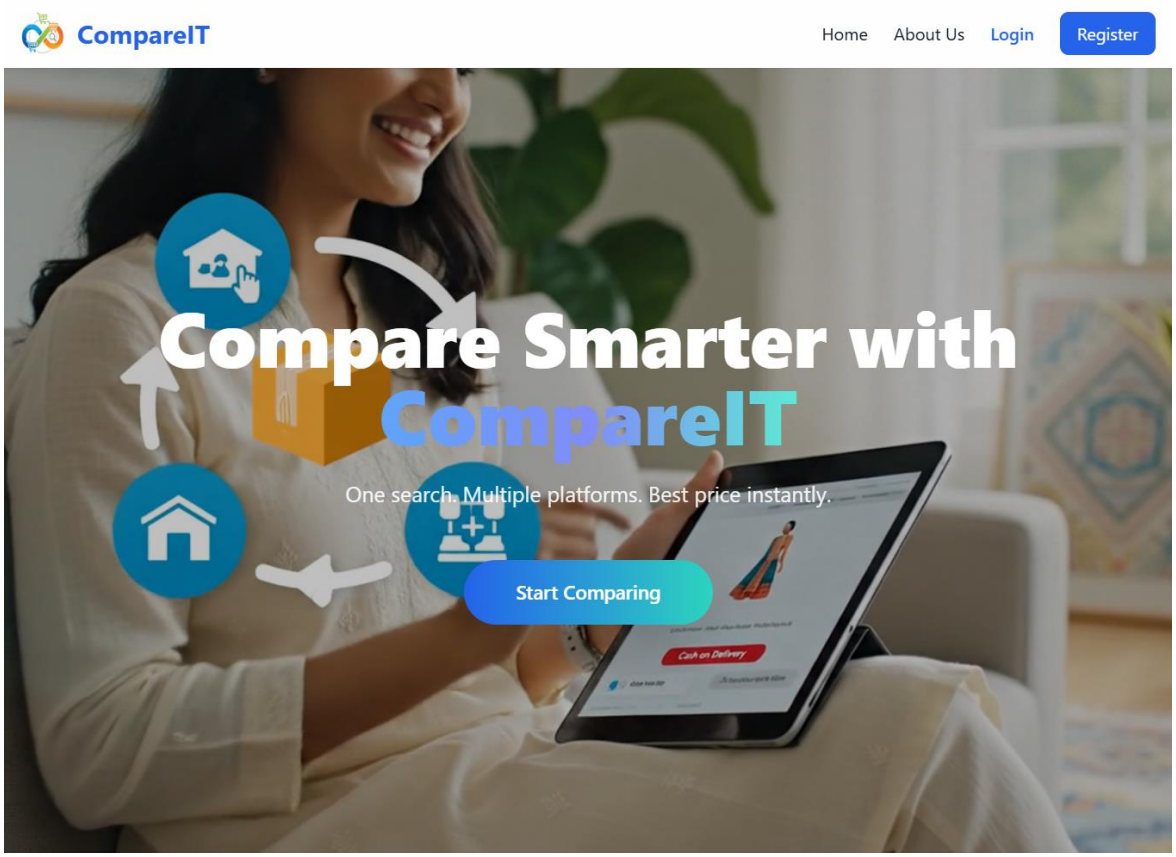

Figure 4: Home Page

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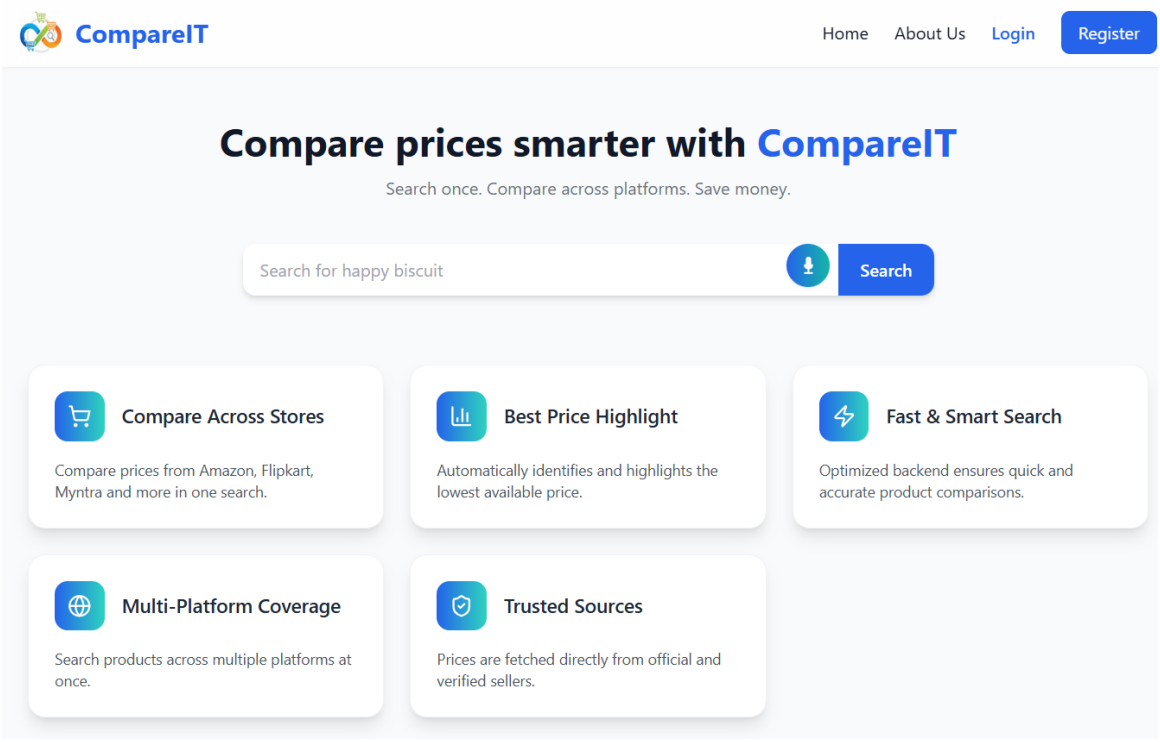

Figure 5: Initial Searching Page

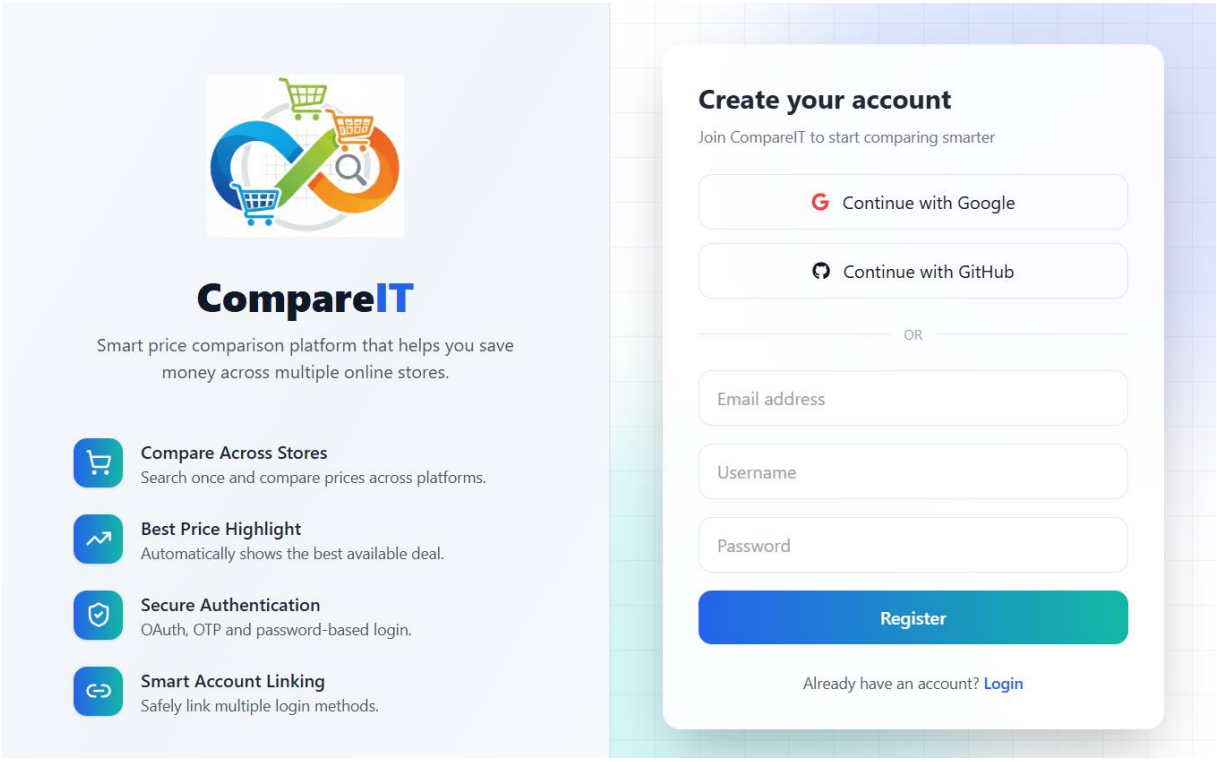

Figure 6: Authentication Page

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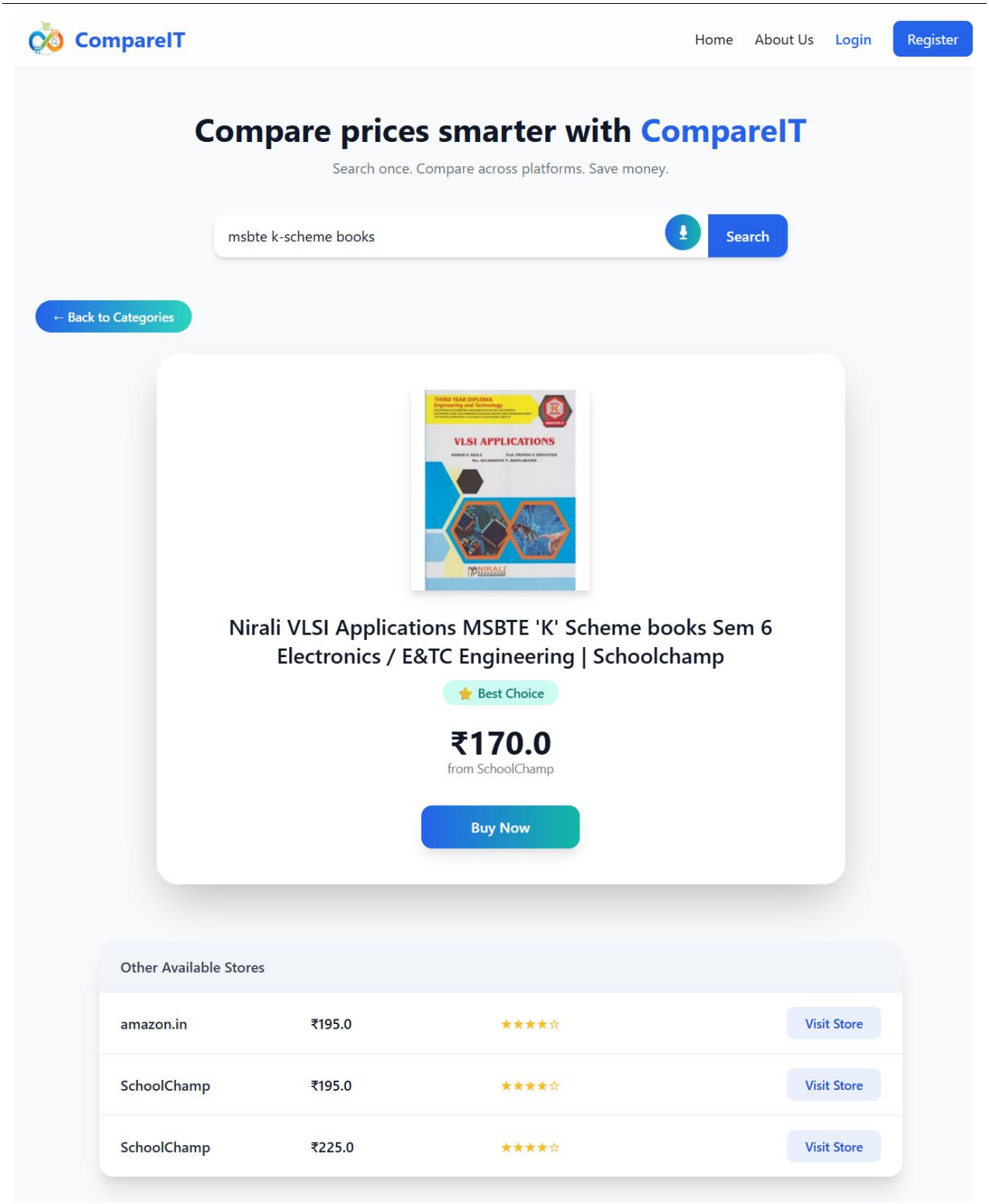

Figure 7: Available Shopping Platforms for Specific product.

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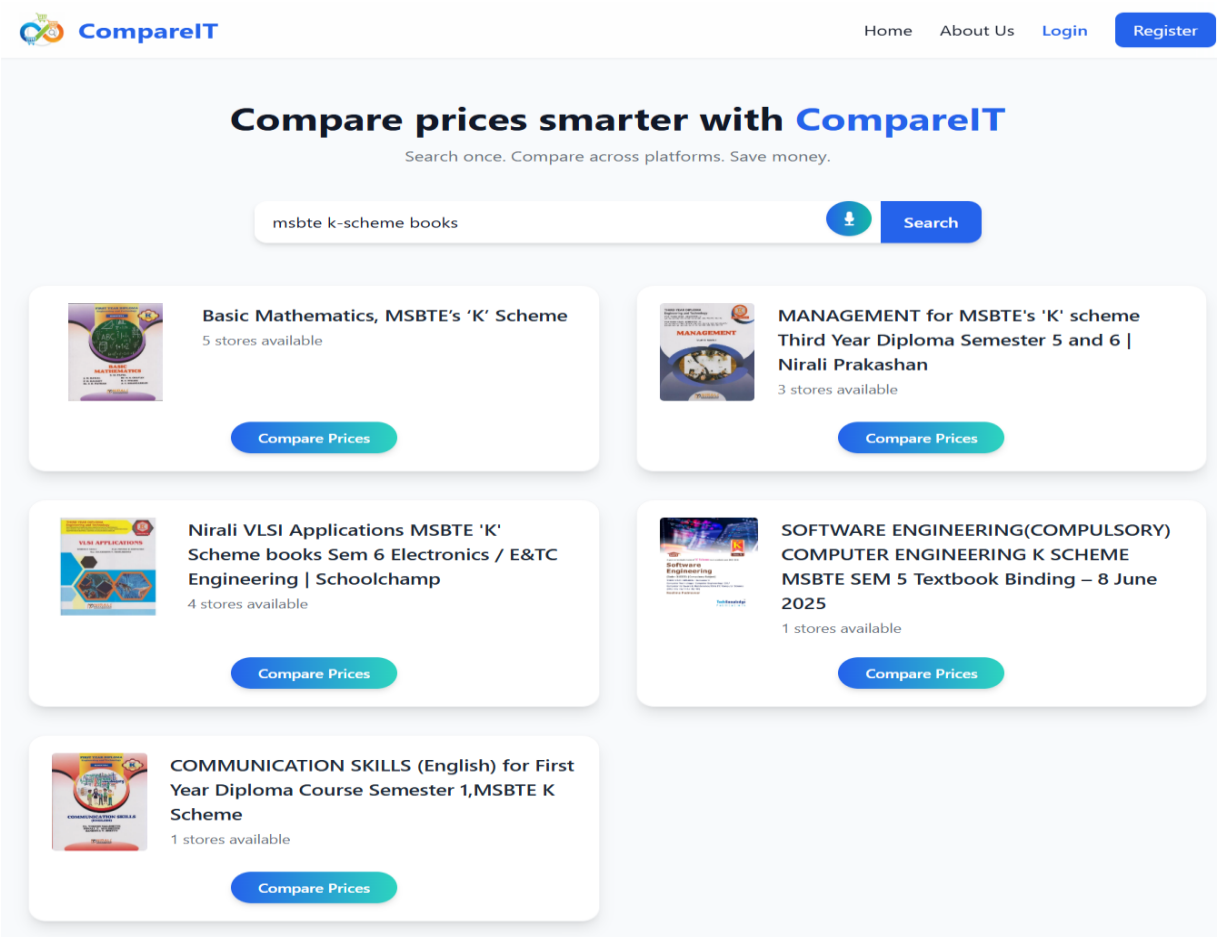

Figure 8: Product Categories Page.

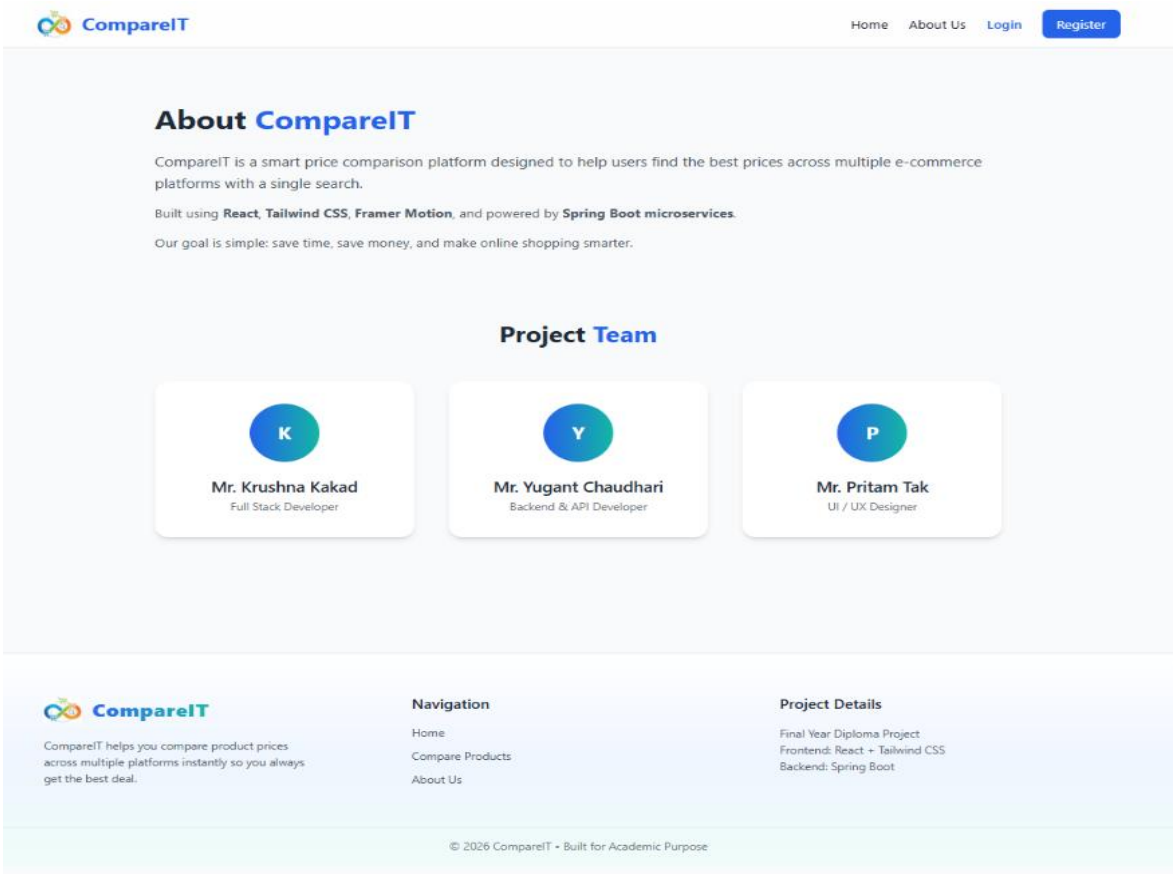

Figure 9: AboutUs Page and Footer.

7. CONCLUSION

The CompareIT project successfully demonstrates the development of a secure and efficient e-commerce price comparison platform that simplifies the online shopping process. The system provides a centralized interface for comparing product prices from multiple online marketplaces, reducing the need for manual searches across different websites. By integrating modern frontend technologies and a scalable backend architecture, the platform delivers a responsive and user-friendly experience.

The use of the Google Shopping API enables real-time retrieval of product prices and seller information, ensuring accurate and reliable comparison results. Strong security mechanisms, including multi-factor authentication, OAuth login, OTP verification, and JWT-based session management, enhance user trust and protect sensitive data. Testing results confirm that the system performs efficiently, handles user requests effectively, and maintains secure communication between system components.

Overall, the project achieves its objectives by improving decision-making, saving user time, and enhancing the efficiency of online price comparison. CompareIT serves as a practical application of modern web technologies and secure system design. With further enhancements such as AI-based recommendations, price trend analysis, and integration with additional e-commerce platforms, the system has the potential to evolve into a comprehensive solution for smart and informed online shopping.

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