

SmartBuy

**AQSA SHOAIB
MARIA HASSAN**



Spring 2024

**Department of Computer Science
COMSATS University Islamabad
Attock Campus-Pakistan**



COMSATS University Islamabad Attock Campus
Attock Pakistan

SmartBuy

By

Aqsa Shoaib CIIT/FA20-BSE-027/ ATK

Maria Hassan CIIT/FA20-BSE-049/ATK

Supervisor

Dr. Muhammad Sardaraz

Bachelor of Science in Software Engineering (2020-2024)



COMSATS University Islamabad Attock Campus
Attock Pakistan

SmartBuy

A project presented to
COMSATS University, Islamabad

In partial fulfillment
of the requirement for the degree of

Bachelors of Science in Software Engineering (2020-2024)

By

Aqsa Shoaib CIIT/FA20-BSE-027/ATK

Maria Hassan CIIT/FA20-BSE-049/ATK

DECLARATION

We hereby declare that this software, neither whole nor as a part has been copied out from any source. It is further declared that we have developed this software and accompanied report entirely on the basis of our personal efforts. If any part of this project is proved to be copied out from any source or found to be reproduction of some other, we will stand by the consequences. No Portion of the work presented has been submitted of any application for any other degree or qualification of this or any other university or institute of learning.

Aqsa Shoaib

FA20-BS-027

Maria Hassan

FA20-BS-049

CERTIFICATE OF APPROVAL

It is to certify that the final year project of BS (SE) “**SmartBuy**” is developed by **Aqsa Shoaib (CIIT/FA20-BSE-027)** and **Maria Hassan (CIIT/FA20-BSE-049)** under the supervision of “**Dr.Muhammad Sardaraz**” and that in his opinion; it is fully adequate, in scope and quality for the degree of Bachelors of Science in Software Engineering.

1. External Examiner

Dr. Shariq Hussain
Associate Professor
Dept. of Computer Science
University of Engineering and Technology,
Taxila

2. Supervisor

Dr. Muhammad Sardaraz
Associate Professor
Dept. of Computer Science
Comsats University Islamabad,
Attock Campus

3. Head of the department

Dr. Khalid
Associate Professor HOD(CS)
Dept. of Computer Science
Comsats University Islamabad,
Attock Campus

Executive Summary

In a world where online shopping can often feel overwhelming and impersonal, SmartBuy emerges as a revolutionary solution, reshaping the way we shop online. With its AI-powered capabilities, SmartBuy aims to provide a personalized and comprehensive shopping experience, addressing the challenges of time-consuming searches and biased recommendations.

SmartBuy's mission is clear: to save customers time and effort by offering personalized product recommendations, detailed comparisons without relying on affiliate links. By aggregating data from multiple e-commerce sites, SmartBuy ensures unbiased product comparisons, empowering customers to make informed purchasing decisions.

Through its modules, SmartBuy offers a seamless user experience, from product comparison and personalized recommendations to e-commerce integration and data security. With features like personalized recommendations based on user behavior SmartBuy not only simplifies the shopping process but also enhances customer satisfaction.

By prioritizing user management and engagement, SmartBuy fosters a community-driven approach to online shopping, empowering users to create accounts, share feedback, and participate in referral programs.

In essence, SmartBuy isn't just another shopping assistant it's a game changer. By leveraging AI technology and user-centric design, SmartBuy revolutionizes the online shopping experience, providing a personalized, efficient, and unbiased platform that caters to the individual needs and preferences of each customer. SmartBuy isn't just a software it's a partner in transforming the way we shop online, empowering customers and enhancing their overall shopping experience.

Acknowledgement

All praise is to Almighty Allah who bestowed upon us a minute portion of His boundless knowledge by virtue of which we were able to accomplish this challenging task.

We are greatly indebted to our project supervisor “Dr.Muhammad Sardaraz”. Without their personal supervision, advice and valuable guidance, completion of this project would have been doubtful. We are grateful to them for their encouragement and continual help during this work.

And we are also thankful to our parents and family who have been a constant source of encouragement for us and brought us with the values of honesty & hard work.

Aqsa Shoaib

Maria Hassan

Table of Contents

1	Introduction.....	14
1.1	Vision Statement.....	14
1.2	Related System Analysis/Literature Review.....	15
1.3	Project Deliverables.....	15
1.4	System Limitations/Constraints.....	16
1.5	Tools and Technologies.....	17
1.6	Relevance to Course Modules.....	17
2	Problem Definition.....	20
2.1	Problem Statement.....	20
2.2	Problem Solution.....	20
2.3	Objectives of the Proposed System.....	21
2.4	Scope.....	21
2.5	Modules.....	22
2.5.1	Module 1: Product Comparison and Search.....	22
2.5.2	E-commerce Integration.....	22
2.5.3	Module 5: User Management and Engagement.....	22
3	Requirement Analysis.....	24
3.1	User classes and characteristics.....	24
3.2	Requirement Identifying Technique.....	26
3.2.1	Use case (use case diagram + detail use case).....	26
	Detail Use Cases.....	27
3.3	Event- response table.....	39
3.4	Storyboarding.....	41
3.5	Functional Requirements.....	45
3.5.1	FR-1 Description.....	45
3.5.2	FR-2 Description.....	45
3.5.3	FR-3 Description.....	46
3.5.4	FR-4 Description.....	46
3.5.5	FR-5 Description.....	47
3.6	Non-Functional Requirements.....	48
3.6.1	System Reliability.....	48
3.6.2	User-Friendly Interface.....	48
3.6.3	Data Accuracy.....	48
3.6.4	Legal and Ethical Compliance.....	48
3.7	External Interface Requirements.....	48
3.7.1	User Interfaces Requirements.....	48
3.7.2	Software interfaces.....	49
3.7.3	Hardware interfaces.....	50
3.7.4	Communications interfaces.....	51
4.	Design and Architecture.....	53
4.1	Architectural Design.....	53
4.2	Design Models.....	54
4.2.1	Activity Diagram.....	54

4.2.2	Sequence Diagram	56
4.2.3	Class Diagram	57
4.2.4	State Transition Diagram	58
4.2.5	Data Flow Diagram	59
5.2	External APIs/SDKs	64
6	Testing and Evaluation	68
6.1	Unit Testing.....	68
6.2	Functional Testing.....	71
6.3	Integration Testing	74
7.	Conclusion and Future Work	80
7.1	Conclusion	80
7.2	Future Work	80

List of Figures

Figure 1: Comparison Table.....	3
Figure 2: Context diagram.....	12
Figure 3: Use Case Diagram.....	16
Figure 4: Home Screen.....	35
Figure 5: Search Results.....	35
Figure 6: Product Page	36
Figure 7: Login Page	36
Figure 8: Sign Up	37
Figure 9: Box and Line diagram	48
Figure 10: Activity diagram	50
Figure 11: Class diagram.....	51
Figure 12: Sequence diagram	52
Figure 13: State diagram	53
Figure 14: Level-0 Data Flow Diagram	54
Figure 15: Level-1 Data Flow Diagram	55
Figure 16: Home Screen.....	64
Figure 17: Search Page.....	65

List of Tables

Table 1: Tool & Technologies.....	5
Table 2: User Classes & Description.....	13
Table 3: Use Case 1.....	17
Table 4: Use Case 2.....	19
Table 5: Use Case 3.....	21
Table 6: Use Case 4.....	22
Table 7: Use Case 5.....	24
Table 8: Use Case 6.....	26
Table 9: Use Case 7.....	27
Table 10: Use Case 8.....	29
Table 11: Use Case 9.....	30
Table 12: Use Case 10.....	32
Table 13: Use Case 11.....	34
Table 14: Use Case 12.....	39
Table 15: External APIs/SDKs.....	62
Table 16: Unit Testing.....	68
Table 17: Functional Testing.....	69
Table 18: Business Rule Testing	70
Table 19: Integration Testing	71

Abstract

SmartBuy is an innovative online platform designed to enhance the shopping experience by providing users with comprehensive product discovery, comparison, and recommendation capabilities. In today's vast and dynamic e-commerce landscape, finding the perfect product can be challenging due to the multitude of options available across various online stores. SmartBuy addresses this challenge by offering a centralized hub where users can effortlessly explore a wide array of products sourced from different e-commerce platforms. Key features of SmartBuy include seamless product comparison, in-depth analysis of product attributes and reviews, and personalized product recommendations tailored to individual user preferences. By leveraging advanced algorithms and machine learning techniques, SmartBuy delivers intelligent recommendations that align with each user's unique tastes, needs, and budgetary considerations. Through SmartBuy, users can easily compare products side by side, evaluate their features, prices, and specifications, and make well-informed purchasing decisions. The platform goes beyond surface-level comparisons by providing insights into product quality, performance, and customer satisfaction, helping users find the best possible products that meet their specific requirements. In summary, SmartBuy revolutionizes the online shopping experience by simplifying product discovery, facilitating informed decision-making, and offering personalized recommendations, ultimately empowering users to navigate the digital marketplace with confidence and ease.

Chapter No 1

INTRODUCTION

1 Introduction

SmartBuy is an AI-powered shopping assistant designed to provide best product recommendations and insights from multiple ecommerce stores. The purpose of this proposal is to outline the features of the system and its benefits. The current shopping experience can be overwhelming due to the vast amount of product options available. SmartBuy seeks to resolve these challenges by providing a comprehensive and personalized product comparison platform without relying on biased affiliate links. The system aggregates product data from multiple e-commerce sites via web scraping and uses natural language processing to provide detailed comparisons and highlight key features and differences between products. SmartBuy recommend best product based on the ratings and reviews. The main objectives of SmartBuy are to improve the shopping experience, save customer's time and effort. The significance of SmartBuy is that it provides an informed shopping experience without relying on biased affiliate links, which helps customers, make informed purchasing decisions, leading to a more satisfying shopping experience.

1.1 Vision Statement

Making online shopping easier and smarter, SmartBuy helps you find the best products from different online stores. Seamlessly searching across multiple e-commerce platforms, SmartBuy enables users to compare selected products with similar offerings, meticulously analyzing reviews and ratings. Through intelligent algorithms, SmartBuy recommends the optimal product, ensuring users make informed decisions tailored to their preferences. With SmartBuy, navigating the expansive online marketplace is effortless, empowering users to discover the perfect product with ease and assurance. Unlike existing systems, our product provides a comprehensive and unbiased shopping experience that is tailored to the needs and preferences of each individual customer.

Here is how:

- ✓ **In-Depth Analysis:** SmartBuy goes beyond surface-level comparisons by delving into the details of each product. The platform meticulously analyzes reviews, ratings, and feedback from verified customers, offering valuable insights into the quality and performance of the products.
- ✓ **Intelligent Recommendations:** Leveraging advanced algorithms and machine learning techniques, SmartBuy delivers product recommendations tailored to each user's preferences. By

understanding user behavior, purchase history, and demographic data, SmartBuy suggests the optimal products that align with individual tastes and requirements.

- ✓ **Efficiency and Convenience:** Navigating the vast and often overwhelming online marketplace becomes effortless with SmartBuy. Users can quickly find what they are looking for without the need to visit multiple websites or sift through countless product listings manually. This efficiency saves time and streamlines the shopping process.

1.2 Related System Analysis/Literature Review

SmartBuy revolutionizes online shopping with its comprehensive platform that seamlessly aggregates products from various online stores. By leveraging advanced AI algorithms, SmartBuy empowers users to compare products effortlessly, analyze reviews and ratings meticulously, and receive personalized recommendations tailored to their preferences. Unlike existing systems, SmartBuy ensures a transparent and unbiased shopping experience, prioritizing user satisfaction and informed decision-making.

Table 1 Related System Analysis with proposed project solution

Functionality	Shop Savvy	Wire cutter	SmartBuy
Comparison	✓	✓	✓
Search Product of own choice	✗	✗	✓
Filtering	✗	✗	✓
AI Analysis	✗	✗	✓
Comprehensive	✗	✗	✓
Unbiased	✗	✗	✓

1.3 Project Deliverables

1. **Proposal:** Fully functional SmartBuy platform with all modules implemented according to specifications outlined in the proposal.
2. **User-friendly interface** for seamless navigation and interaction with the SmartBuy platform.

3. **Data Scraping and Aggregation:** Develop scripts or modules for scraping product data from different online stores and scrapping it into smartbuy through oxylabs ecommerce scraper api. Ensure data integrity, accuracy, and timely updates.
4. **Comprehensive product comparison and search functionality** allowing users to search, filter, and compare products based on various criteria such as price, quality, features, and customer reviews.
5. **Semantic Analysis :** Semantic analysis utilizing machine learning algorithms to analyze on products reviews to figure out which product has most positive reviews
6. **Recommendation system** utilizing machine learning algorithms to analyze products similar to the selected product, providing tailored product recommendations based on comparison.
7. **User management and engagement features** allowing users to create accounts, access personalized recommendations, engage with ratings and reviews, share socially, and participate in referral programs.
8. **Continuous monitoring and improvement** of the SmartBuy platform based on user feedback and behavior analysis to enhance the overall shopping experience.
9. **Documentation** including user manuals, technical guides, and system documentation to facilitate platform usage and maintenance.

1.4 System Limitations/Constraints

LI-1: The app's ability to analyze and compare products will depend on the availability and quality of data from various e-commerce sites. The app may not be able to analyze or compare certain products if they are not available on these sites or if the data is incomplete or inaccurate.

LI-2: The accuracy of product recommendations will depend on the quality of user data and the effectiveness of the app's machine learning algorithms. If users provide incomplete or inaccurate data, or if the algorithms are not effective in identifying user preferences, the recommendations may not be accurate or useful.

LI-3: The app's price tracking system may be limited by the frequency and reliability of price updates from various e-commerce sites. If the sites do not provide timely or accurate updates, the app may not be able to provide notifications to users in a timely or accurate manner.

LI-4: The app may face legal and ethical constraints in the collection and use of user data, particularly with regards to privacy and data security. The app will need to comply with relevant laws and regulations, as well as establish robust data security and privacy measures to protect user data.

LI-5: The app may face competition from other product comparison platforms and services, which may limit its ability to attract and retain users. The app will need to establish a strong value proposition and user experience to compete effectively in the market.

1.5 Tools and Technologies

Table 2 Tools and Technologies for Proposed Project

<i>Tools And Technologies</i>	Tools	Version	Rationale
	MS Visual Studio	2015	IDE
	Mongo db.	2019	DBMS
	Technology	Version	Rationale
	Next JS	14.2.2	Full-Stack Development
	Node JS	20.11.1	Full-Stack Development
	Tailwind CSS	3.4.3	Front-end Development

1.6 Relevance to Course Modules

The SmartBuy Web App is related to several courses studied during a BSE program, including Software Engineering, Artificial intelligence/Machine learning and database management system.

- **Software Design and Architecture:** Topics in this course such as system scalability, modularity, and maintainability are relevant to designing the SmartBuy platform

- **Data Mining and Machine Learning:** The techniques for extracting insights from large datasets and building predictive models are relevant for developing the recommendation engine in SmartBuy.
- **Database Systems:** Database course concepts such as data modeling, querying, and database design is crucial for implementing the backend infrastructure of SmartBuy, including data aggregation, storage, and retrieval

Chapter No 2
PROBLEM DEFINITION

2 Problem Definition

Online shopping can be overwhelming with so many choices. SmartBuy wants to make it easier by helping you compare products without using biased links. It looks at products from different e-commerce websites, highlights what's important, and gives you personalized suggestions. The goal is to save you time and effort, and help you make better decisions when shopping online.

2.1 Problem Statement

Online shopping is often impersonal and frustrating for customers who face difficulties navigating multiple e-commerce sites. Customers struggle to find the best deals and products amidst the overwhelming options available. Biased affiliate links and irrelevant product recommendations exacerbate the frustration, leading to a lack of trust in the recommendations provided. Consumers often feel their individual needs and preferences are not adequately addressed in the current online shopping landscape. The abundance of choices and the complexity of navigating multiple platforms contribute to the dissatisfaction experienced by customers. Existing online shopping experiences fail to provide a personalized and tailored approach that meets the unique needs of each individual shopper. Customers are left feeling overwhelmed and disillusioned by the lack of transparency and bias in the recommendations they receive. Navigating the digital marketplace becomes a tedious and time-consuming task, deterring customers from enjoying a seamless shopping experience. The current online shopping landscape falls short in providing customers with the convenience, efficiency, and personalized service they desire. There is a clear need for a solution that addresses the impersonal nature of online shopping and empowers customers to find the best deals and products that truly meet their needs and preferences.

2.2 Problem Solution

SmartBuy is a groundbreaking platform that endeavors to revolutionize the online shopping experience by addressing the inherent challenges faced by consumers. Leveraging cutting-edge machine learning algorithms, SmartBuy meticulously analyzes products across various dimensions including price, quality, features, and customer reviews. This in depth analysis

enables SmartBuy to provide personalized product recommendations tailored to each user's unique behavior and preferences, ensuring a more relevant and satisfying shopping experience. These advanced technologies and features, SmartBuy aims to significantly increase customer satisfaction and provide a more informed and personalized shopping experience. The platform's overarching goal is to transform the online shopping landscape, making it more transparent, convenient, and tailored to the needs of individual consumers.

2.3 Objectives of the Proposed System

BO-1: Develop and implement machine-learning algorithms to analyze products based on various factors such as price, quality, features, and customer reviews.

BO-2: Sentiment analysis on product reviews and product recommendation based on similarity of product to offer relevant product suggestions for comparison.

BO-3: Increase customer satisfaction by providing a more informed and personalized shopping experience.

BO-4: Revolutionize the online shopping experience by addressing common frustrations and challenges faced by customers.

BO-5: Attract and retain customers by offering a comprehensive and convenient online shopping platform that provides personalized recommendations and insights.

2.4 Scope

The scope of the proposed project is to provide a comprehensive and personalized product recommendation system to customers based on their behavior and preferences. The system will analyze user data and purchasing history to recommend products that are tailored to their needs, resulting in an estimated increase in user engagement by 20%. The project will also develop an AI- powered product comparison engine that will compare products based on various factors such as price, quality, features, and customer reviews. This comparison engine will enable

customers to make informed purchasing decisions, and improve their overall shopping experience. The comparison based on price will help customers save money.

2.5 Modules

2.5.1 Module 1: Product Comparison and Search

FE-1: Allow users to search for products based on various criteria such as price, quality, features, and customer reviews.

FE-2: Allow users to filter search results by different criteria such as brand, category, price range, and availability.

FE-3: Display detailed information for each product including images, descriptions, specifications, and reviews.

FE-4: Allow users to compare multiple products side by side based on selected criteria.

FE-5: Implement an algorithm to calculate a score for each product based on the selected criteria.

2.5.2 E-commerce Integration

FE-1: SmartBuy utilizes web scraping techniques to collect product data from various e-commerce websites in real-time. Oxylabs, a service provider, assists in scraping product data from multiple online retailers, ensuring a continuous feed of updated product information.

FE-2: The product listings are updated in real-time, ensuring that users have access to the latest information and pricing from the integrated e-commerce websites.

legal and ethical standards in data aggregation and analysis.

2.5.3 Module 5: User Management and Engagement

FE-1: Allow users to create accounts and login to access personalized recommendations and shopping features.

FE-2: Implement user engagement features such as ratings and reviews, social sharing, and referrals.

Chapter No 3
REQUIREMENT ANALYSIS

3 Requirement Analysis

The requirement analysis for SmartBuy entails a thorough examination of the platform's functionalities and features to ensure it meets the needs of modern online shoppers. SmartBuy must offer a seamless and intuitive user experience, empowering users to easily navigate through a vast array of products. It should incorporate advanced algorithms for personalized product recommendations, leveraging user behavior and preferences to enhance shopping efficiency. Key requirements include comprehensive product comparison tools, expert insights on trends, and a robust price tracking system. Additionally, SmartBuy must prioritize security and privacy measures to safeguard user data and comply with regulatory standards. Continuous monitoring and improvement, along with comprehensive documentation and training, are essential for ensuring the platform's ongoing success and user satisfaction.

3.1 User classes and characteristics

Table 3.1 User Classes and Characteristics

User class	Description
General Users	<p>Characteristics: These users are typical shoppers who visit the SmartBuy platform to discover and purchase products online.</p> <p>Behavior: They browse through product listings, compare different options, read reviews, and make purchase decisions based on their preferences and needs.</p> <p>Interaction: General users interact with the platform by searching for products, filtering results, viewing product details, and adding items to their cart for purchase</p>

Registered Users:	<p>Characteristics: These users have created accounts on the SmartBuy platform, allowing them to access additional features and personalize their shopping experience.</p> <p>Behavior: Registered users can save their preferences, track order history, receive personalized recommendations, and participate in loyalty programs or rewards programs.</p> <p>Interaction: They interact with the platform by logging in to their accounts, managing their profiles, updating preferences, and accessing exclusive features such as saved searches and personalized recommendations.</p>
Retailers	<p>Retailer are multiple ecommerce-websites which sells their own products. SmartBuy will Interact with E-commerce sites to fetch their products on the smartbuy platform.</p> <p>Retailers aim to expand their reach and boost sales by utilizing platforms like SmartBuy.</p>

3.2 Requirement Identifying Technique

3.2.1 Use case (use case diagram + detail use case)



Figure 1 Use Case Diagram 1

Detail Use Cases

➤ Sign Up/Login

Table 3.2. 1 Use Case 1 Description

Use Case ID:	UC-1
Use Case Name	Sign Up/Login
Actors	User
Description	The "Sign Up/Login" use case involves a user accessing the SmartBuy platform either to create a new account (sign up) or to log into an existing account. This use case enables users to authenticate themselves and access personalized features and preferences within the SmartBuy system.
Trigger	The user expresses an intent to access the SmartBuy platform, either to create a new account or to log into an existing one.
Preconditions	None
Post conditions	The user is successfully logged into the SmartBuy system (for both sign up and login scenarios).
Normal Flow	<ol style="list-style-type: none">1. Sign Up:<ol style="list-style-type: none">a. The user accesses the sign-up page on the SmartBuy platform.b. The user provides the required information, including username, email, password, etc.c. The system validates the provided information and creates a new user account.d. The system logs the user into the SmartBuy platform automatically.2. Login:<ol style="list-style-type: none">a. The user accesses the login page on the SmartBuy platform.b. The user enters their credentials (username/email and password).c. The system validates the user's credentials.d. If the credentials are valid, the system logs the user into the SmartBuy platform.
Alternative Flows	None
Exceptions	Invalid Credentials: If the user enters incorrect credentials during login, the system displays an error message and prompts the user to re-enter the correct credentials.
Business Rules	Users must provide valid credentials to access the SmartBuy platform.

Assumptions	User-provided information during sign-up is accurate and valid. - User credentials are stored securely in the system.
--------------------	---

➤ **Receive Personalized Recommendations**

Table 3.2. 2 Use Case 2 Description

Use Case ID:	UC-2
Use Case Name	Receive Personalized Recommendations
Actors	User
Description	The "Receive Personalized Recommendations" use case involves the SmartBuy system analyzing user behavior and preferences to provide tailored product recommendations. This use case enables users to receive personalized suggestions based on their past interactions, browsing history, purchase patterns, and preferences, enhancing their shopping experience.
Trigger	The user expresses an intent to explore product recommendations on the SmartBuy platform.
Preconditions	The user must be logged into their account on the SmartBuy platform.
Postconditions	The user receives personalized product recommendations based on their preferences and behavior.
Normal Flow	<ol style="list-style-type: none"> 1. The user navigates to the recommendations section of the SmartBuy platform. 2. The SmartBuy system analyzes the user's browsing history, past purchases, saved preferences, and other relevant data. 3. Based on the analysis, the system generates personalized product recommendations tailored to the user's interests and preferences. 4. The system displays the recommended products to the user, along with relevant details such as images, descriptions, prices, etc. 5. The user reviews the recommendations and can choose to explore the suggested products further or make a purchase.
Alternative Flows	None
Exceptions	No Recommendations Available: If the system cannot generate personalized recommendations for the user due to insufficient data or other reasons, a message indicating the unavailability of recommendations is displayed to the user.
Business Rules	Recommendations are based on user behavior and preferences collected and analyzed by the SmartBuy system.
Assumptions	The user has provided sufficient data and information to enable the SmartBuy system to generate personalized recommendations. - The SmartBuy system utilizes advanced algorithms and data analysis techniques to generate accurate and relevant recommendations.

➤ Product Search

Table 3.2. 3 Use Case 3 Description

Use Case ID:	UC-3
Use Case Name	Product Search
Actors	Primary Actor: User, Secondary Actor: SmartBuy System
Description	The "Product Search" use case involves users searching for products on the SmartBuy platform based on various criteria such as price, quality, features, and customer reviews. This use case enables users to find specific products or browse through available options to meet their requirements.
Trigger	The user expresses an intent to search for products on the SmartBuy platform.
Preconditions	The user must be logged into their account on the SmartBuy platform.
Post conditions	The user receives search results based on the entered search criteria.
Normal Flow	<ol style="list-style-type: none"> 1. The user navigates to the search bar or product search section of the SmartBuy platform. 2. The user enters search criteria such as keywords, price range, brand, category, etc., into the search bar or selects filters from available options. 3. The SmartBuy system processes the search query and retrieves relevant product listings from its database. 4. The system displays the search results to the user, including products that match the entered criteria. 5. The user can browse through the search results, view product details, and select items of interest for further exploration or purchase.
Alternative Flows	None
Exceptions	No Results Found: If the system cannot find any products matching the entered search criteria, a message indicating the absence of search results is displayed to the user.
Business Rules	Search results are based on the user's entered criteria and the availability of matching products in the SmartBuy database.
Assumptions	The user provides accurate and relevant search criteria to find desired products effectively. The SmartBuy system utilizes efficient algorithms to process search queries and retrieve

	relevant product listings.
--	----------------------------

➤ Filter Search Results

Table 3.2. 4 Use Case 4 Description

Use Case ID:	UC-4
Use Case Name	Filter Search Results
Actors	Primary Actor: User, Secondary Actor: SmartBuy System
Description	The "Filter Search Results" use case involves users refining their product search results on the SmartBuy platform by applying various filters to narrow down the options based on specific criteria such as brand, category, price range, and availability. This use case allows users to find products that closely match their preferences and requirements.
Trigger	The user expresses an intent to refine their search results by applying filters on the SmartBuy platform.
Preconditions	The user must have performed a product search on the SmartBuy platform.
Postconditions	The user receives refined search results based on the applied filters.
Normal Flow	<ol style="list-style-type: none"> 1. After performing a product search, the user views the initial search results displayed on the SmartBuy platform. 2. The user selects the option to filter the search results, either through a sidebar menu or filter options provided on the search results page. 3. The SmartBuy system presents various filter criteria such as brand, category, price range, availability, etc., to the user. 4. The user selects desired filter options to narrow down the search results according to their preferences. 5. The system applies the selected filters to the existing search results and updates the product listings accordingly. 6. The user reviews the refined search results and can further adjust or remove filters as needed.
Alternative Flows	None
Exceptions	No Results Found: If applying certain filters results in an empty set of search results, a message indicating the absence of matching products is displayed to the user.

Business Rules	Filters are applied based on the user's selected criteria and the availability of matching products in the SmartBuy database.
Assumptions	The user provides accurate and relevant filter criteria to refine the search results effectively. The SmartBuy system efficiently processes filter selections and updates the search results in real-time.

➤ View Product Details

Table 3.2. 5 Use Case 5 Description

Use Case ID:	UC-5
Use Case Name	View Product Details
Actors	User
Description	The "View Product Details" use case involves users accessing comprehensive information about a specific product listed on the SmartBuy platform. This use case allows users to view detailed descriptions, specifications, images, and customer reviews of a particular product to make informed purchasing decisions.
Trigger	The user expresses an intent to explore detailed information about a specific product listed on the SmartBuy platform.
Preconditions	The user must have performed a product search on the SmartBuy platform. - The user must have selected a product from the search results to view its details.
Postconditions	The user receives detailed information about the selected product, including descriptions, specifications, images, and customer reviews.
Normal Flow	<ol style="list-style-type: none"> 1. After performing a product search, the user views the search results displayed on the SmartBuy platform. 2. The user selects a specific product from the search results to view its details. 3. The SmartBuy system retrieves and displays comprehensive information about the selected product, including descriptions, specifications, images, and customer reviews. 4. The user reviews the detailed product information to evaluate its suitability and make an informed purchasing decision.
Alternative Flows	None

Exceptions	Product Not Found: If the selected product is not available or cannot be retrieved from the database, a message indicating the unavailability of product details is displayed to the user.
Business Rules	Product details are retrieved and displayed based on the availability and accuracy of information stored in the SmartBuy database.
Assumptions	The user provides accurate product identifiers or selects products listed in the search results to view their details. - The SmartBuy system efficiently retrieves and displays product details without significant delays.

➤ Compare Products

Table 3.2. 6 Use Case 6 Description

Use Case ID:	UC-6
Use Case Name	Compare Products
Actors	Primary Actor: User, Secondary Actor: SmartBuy System
Description	The "Compare Products" use case enables users to compare multiple products side by side based on selected criteria. This functionality allows users to make informed purchasing decisions by evaluating the features, specifications, prices, and other attributes of different products simultaneously.
Trigger	The user expresses an intent to compare multiple products listed on the SmartBuy platform.
Preconditions	The user must have performed a product search on the SmartBuy platform. - The user must have selected multiple products from the search results to compare.
Postconditions	The user receives a side-by-side comparison of the selected products, highlighting their respective attributes and differences.
Normal Flow	<ol style="list-style-type: none"> 1. After performing a product search, the user views the search results displayed on the SmartBuy platform. 2. The user selects multiple products from the search results to compare. 3. The SmartBuy system retrieves and displays detailed information about the selected products. 4. The user reviews the selected products and initiates the comparison process. 5. The SmartBuy system generates a side-by-side comparison of the selected products, highlighting their features, specifications, prices, and other relevant attributes. 6. The user evaluates the comparison results to make an informed decision.
Alternative Flows	None

Exceptions	Product Comparison Error: If there is an error in retrieving or processing product data for comparison, a message indicating the issue is displayed to the user.
Business Rules	Product comparison functionality is dependent on the availability and accuracy of product data stored in the SmartBuy database.
Assumptions	The user selects multiple products with the intention of comparing their features and attributes. - The SmartBuy system efficiently retrieves and processes product data for comparison without significant delays.

➤ Integrate with E-commerce Platforms

Table 3.2. 8 Use Case 9 Description

Use Case ID:	UC-9
Use Case Name	Integrate with E-commerce Platforms
Actors	Primary Actor: SmartBuy System, Secondary Actor: Oxylab Webscrapper
Description	The "Integrate with E-commerce Platforms" use case involves the admin integrating the SmartBuy platform with various e-commerce websites to aggregate product listings and enable seamless shopping experiences for users. Through this functionality, the SmartBuy system collaborates with external e-commerce platforms to access their product data and display it within the SmartBuy ecosystem.
Trigger	The admin initiates the integration process with specific e-commerce platforms to expand the product offerings available on the SmartBuy platform.
Preconditions	The admin must have appropriate permissions and access rights to manage integrations with external e-commerce platforms. The e-commerce platforms intended for integration must be compatible with the SmartBuy system and support data exchange protocols.
Postconditions	The SmartBuy system successfully establishes connections with the selected e-commerce platforms, enabling the retrieval and display of product listings within the SmartBuy interface.
Normal Flow	<ol style="list-style-type: none"> 1. The admin accesses the administration panel or settings dashboard within the SmartBuy platform. 2. Within the settings or integration section, the admin selects the option to "Integrate with E-commerce Platforms." 3. The admin enters the necessary credentials or API keys required for accessing the data from the desired e-commerce platforms.

	<p>4. The SmartBuy system validates the provided credentials and establishes connections with the e-commerce platforms' APIs.</p> <p>5. Upon successful integration, the SmartBuy system begins fetching product data from the integrated e-commerce platforms and displaying it within the SmartBuy interface.</p>
Alternative Flows	Integration Error: If there is an error during the integration process (e.g., invalid credentials, API limitations, connectivity issues), the system may display an error message to the admin and prompt them to retry the integration or troubleshoot the issue.
Exceptions	Integration Rejection: If an e-commerce platform denies access or restricts API usage for the SmartBuy system, the integration process may fail, and the admin would need to explore alternative integration options or seek assistance from the e-commerce platform's support team.
Business Rules	The SmartBuy platform must adhere to the terms of service and API usage policies specified by the integrated e-commerce platforms to maintain compliance and avoid service disruptions.
Assumptions	The e-commerce platforms selected for integration are willing to collaborate and share product data with the SmartBuy system through their APIs or data feeds. The admin possesses the necessary technical knowledge and expertise to configure integration settings and troubleshoot any integration-related issues that may arise.

➤ Set Up Product Catalogs

Table 3.2. 7 Use Case 10 Description

Use Case ID:	UC-10
Use Case Name	Set Up Product Catalogs
Actors	SmartBuy System
Description	The "Set Up Product Catalogs" use case involves the admin configuring and organizing product catalogs within the SmartBuy platform. This functionality enables the admin to establish and manage the structure of product categories, subcategories, and listings to provide users with a well-organized and easily navigable shopping experience.
Trigger	The admin initiates the setup of product catalogs to populate the SmartBuy platform with relevant product listings and categories.
Preconditions	The admin must have appropriate permissions and access rights to manage product catalogs within the SmartBuy system. The SmartBuy platform must be operational and accessible for the admin to configure product catalogs.

Postconditions	The product catalogs are successfully configured and made available within the SmartBuy platform for users to browse and explore.
Normal Flow	<ol style="list-style-type: none"> 1. The admin accesses the administration panel or backend dashboard of the SmartBuy platform. 2. Within the settings or catalog management section, the admin selects the option to "Set Up Product Catalogs." 3. The admin creates or defines product categories and subcategories based on the types of products available on the platform (e.g., electronics, clothing, home goods). 4. For each category and subcategory, the admin specifies relevant attributes and metadata (e.g., name, description, image) to facilitate product organization and navigation. 5. The admin assigns products to the appropriate categories and subcategories within the product catalog structure. 6. Once the catalog setup is complete, the SmartBuy platform updates its database with the configured product catalogs, making them accessible to users.
Alternative Flows	Catalog Error: If there is an error during the catalog setup process (e.g., duplicate categories, invalid metadata), the system may display an error message to the admin and prompt them to correct the issues before proceeding.
Exceptions	Catalog Rejection: If the configured product catalogs do not meet the platform's standards or guidelines, the system may reject the setup changes and notify the admin to revise the configurations accordingly.
Business Rules	Product categories and subcategories must be logically organized and intuitively labeled to facilitate user navigation and product discovery.
Assumptions	<p>The admin possesses the necessary knowledge of the product inventory and user preferences to create relevant and effective product catalog structures.</p> <p>The SmartBuy platform provides sufficient flexibility and customization options to accommodate various types of products and catalog configurations.</p>

➤ **Real-Time Data Feed**

Table 3.2. 8 Use Case 13 Description

Use Case ID:	UC-13
Use Case Name	Real-Time Data Feed
Actors	SmartBuy System , Oxylab Webscrapper
Description	The "Real-Time Data Feed" use case involves the SmartBuy system receiving and processing real-time product data feeds from various e-commerce websites through web scraping techniques. This functionality ensures that the product listings and information displayed on the SmartBuy platform are continuously updated and reflect the latest data from the integrated e-commerce sources.
Trigger	The SmartBuy system initiates the process to fetch real-time product data feeds from e-commerce websites based on predefined intervals or triggers (e.g., scheduled updates, user search queries).
Preconditions	The SmartBuy system must be connected to the internet and have access to the web scraping tools or services required to fetch real-time data feeds from e-commerce websites. - The SmartBuy system must have established connections or integrations with the target e-commerce websites to retrieve product data feeds securely and reliably.
Postconditions	The SmartBuy platform successfully receives and processes real-time product data feeds, updating the product catalog and listings with the latest information from the integrated e-commerce sources.
Normal Flow	<ol style="list-style-type: none"> 1. The SmartBuy system initiates the process to fetch real-time product data feeds from the integrated e-commerce websites. 2. The SmartBuy system sends requests to the target e-commerce websites' servers to retrieve product data feeds using web scraping techniques. 3. The e-commerce websites' servers respond to the requests by providing the real-time product data feeds in the specified format (e.g., JSON, XML). 4. The SmartBuy system receives the real-time product data feeds and processes the information to extract relevant product details, including images, descriptions, prices, and availability. 5. The SmartBuy platform updates its product catalog and listings with the newly fetched data, ensuring that users have access to the latest product information when browsing and searching on the platform.

Alternative Flows	Data Retrieval Error: If there is an error during the retrieval of real-time product data feeds (e.g., server unavailability, connection timeout), the SmartBuy system may attempt to retry the data fetching process or notify system administrators for further investigation and resolution.
Exceptions	Rate Limiting or Access Restrictions: Some e-commerce websites may impose rate limits or access restrictions on web scraping activities, requiring the SmartBuy system to adhere to these limitations to avoid disruptions or penalties.
Business Rules	Real-time product data feeds should be fetched and processed in compliance with the terms of service and usage policies of the target e-commerce websites, respecting any access restrictions or limitations imposed by the website owners.
Assumptions	The SmartBuy system employs robust web scraping techniques and protocols to fetch real-time product data feeds securely and efficiently, minimizing the risk of data errors or discrepancies. - The availability and reliability of real-time product data feeds depend on the responsiveness and stability of the target e-commerce websites' servers and APIs, which may vary based on factors such as network congestion, server load, and maintenance schedules.

➤ Product Listing

Table 3.2. 9 Use Case 14 Description

Use Case ID:	UC-14
Use Case Name	Product Listing
Actors	SmartBuy System
Description	The "Product Listing" use case involves displaying a collection of products available for sale or viewing within a platform or marketplace. Users can explore and browse through various products offered by sellers or vendors.
Trigger	Users express an intent to view available products within the platform or marketplace.
Preconditions	None
Postconditions	Users are presented with a list of products available for sale or viewing.
Normal Flow	1. Users access the product listing feature within the platform or marketplace. 2. The system retrieves product data and displays a structured list of available products. 3. Users browse through the product listings, viewing essential details such as product name, description, price, images, and availability.
Alternative	None

Flows	
Exceptions	None
Business Rules	The product listing must be up-to-date and reflect the latest inventory and pricing information. - Products should be presented in a visually appealing and user-friendly manner.
Assumptions	Users have access to a stable internet connection to view the product listings. - The platform or marketplace has a sufficient number of products to populate the listing.

➤ Data Scraping and Parsing

Table 3.2. 10 Use Case 15 Description

Use Case ID:	UC-15
Use Case Name	Data Scraping and Parsing
Actors	SmartBuy System, Oxylabs Webscraper
Description	The "Data Scraping and Parsing" use case involves the SmartBuy system utilizing web scraping techniques to collect product data from various e-commerce websites in real-time. Oxylabs, a web scraping service provider, assists in scraping product data from multiple online retailers, ensuring a continuous feed of updated product information. Subsequently, the system parses the scraped data to extract relevant product details and integrate them into the SmartBuy platform.
Trigger	The SmartBuy system initiates the process to fetch real-time product data feeds from e-commerce websites based on predefined intervals or triggers (e.g., scheduled updates, user search queries).
Preconditions	- The SmartBuy system must be connected to the internet and have access to the web scraping tools or services provided by Oxylabs. - The SmartBuy system must have established connections or integrations with the target e-commerce websites to retrieve product data feeds securely and reliably.
Post conditions	The SmartBuy platform successfully receives and processes real-time product data feeds, updating the product catalog and listings with the latest information from the integrated e-commerce sources.
Normal Flow	1. The SmartBuy system initiates the process to fetch real-time product data feeds from the integrated e-commerce websites. 2. The SmartBuy system sends requests to the target e-commerce websites' servers to

	<p>retrieve product data feeds using web scraping techniques.</p> <p>3. The e-commerce websites' servers respond to the requests by providing the real-time product data feeds in the specified format (e.g., JSON, XML).</p> <p>4. The SmartBuy system receives the real-time product data feeds and parses the information to extract relevant product details, including images, descriptions, prices, and availability.</p>
Alternative Flows	Data Retrieval Error: If there is an error during the retrieval of real-time product data feeds (e.g., server unavailability, connection timeout), the SmartBuy system may attempt to retry the data fetching process or notify system administrators for further investigation and resolution.
Exceptions	Rate Limiting or Access Restrictions: Some e-commerce websites may impose rate limits or access restrictions on web scraping activities, requiring the SmartBuy system to adhere to these limitations to avoid disruptions or penalties.
Business Rules	Real-time product data feeds should be fetched and processed in compliance with the terms of service and usage policies of the target e-commerce websites, respecting any access restrictions or limitations imposed by the website owners.
Assumptions	<p>The SmartBuy system employs robust web scraping techniques and protocols to fetch real-time product data feeds securely and efficiently, minimizing the risk of data errors or discrepancies.</p> <p>- The availability and reliability of real-time product data feeds depend on the responsiveness and stability of the target e-commerce websites' servers and APIs, which may vary based on factors such as network congestion, server load, and maintenance schedules.</p>

3.3 Event- response table

Table 3.2. 11 Event response table for SmartBuy

Event	System State	Response
User initiates product search	Idle state	Retrieve search query from user
Search query received	Processing	Fetch relevant product data from e-commerce websites

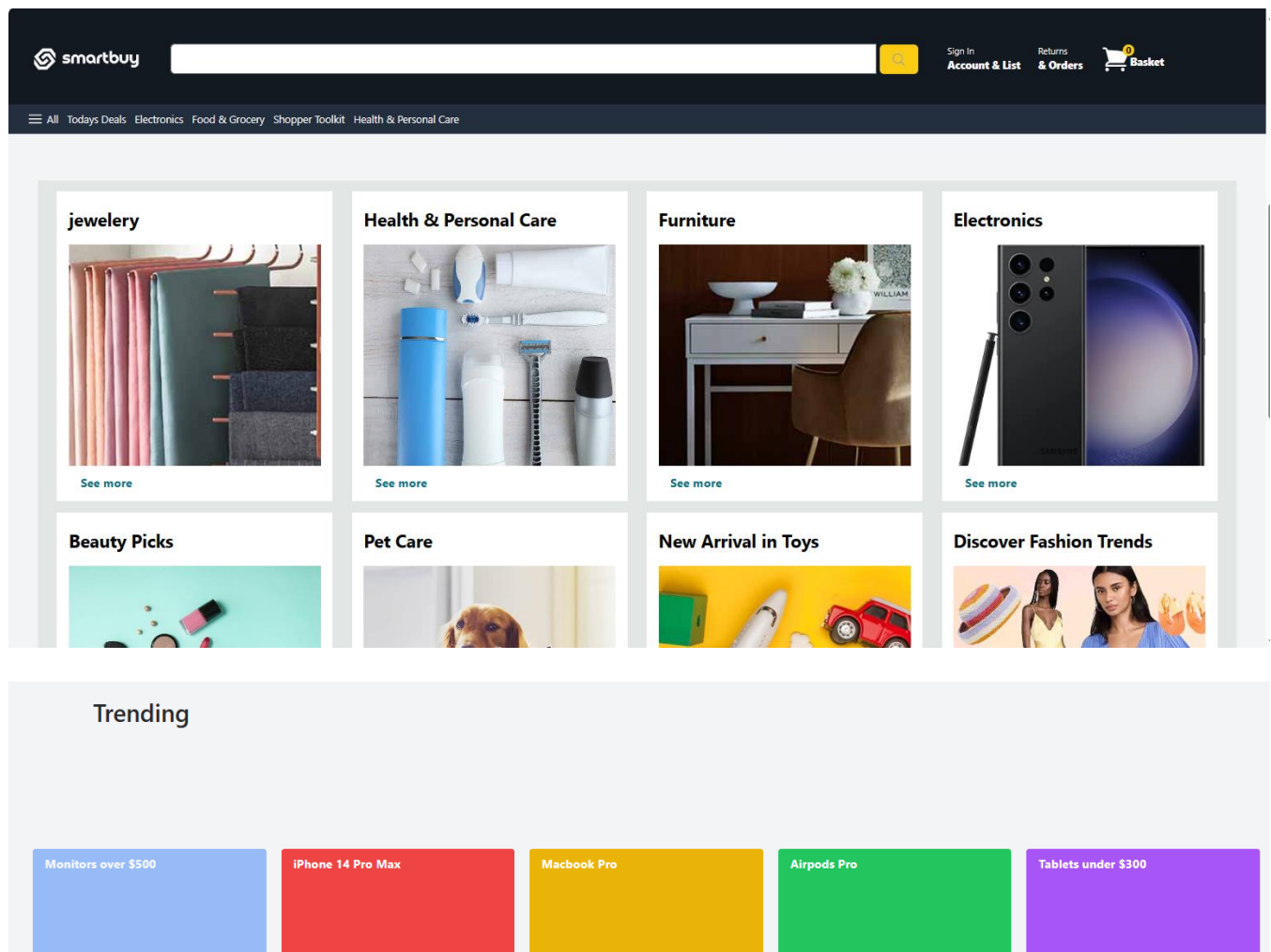
Product data retrieved	Processing	Display search results to the user
User selects products for comparison	Displaying search results	Add selected products to comparison list
Comparison list updated	Processing	Retrieve detailed information for selected products
Detailed information retrieved	Processing	Display side-by-side comparison of selected products
User requests personalized recommendations	Idle state	Analyze user behavior and preferences
User profile analyzed	Processing	Generate personalized product recommendations
Personalized recommendations generated	Processing	Display recommended products to the user
User logs in to the platform	Idle state	Authenticate user credentials
User credentials authenticated	Processing	Grant access to user account
User account accessed	Processing	Display personalized recommendations and saved preferences
User engages with social sharing feature	Idle state	Initiate social sharing process
Social sharing process initiated	Processing	Share selected products on user's social media platform
Products successfully shared	Processing	Provide confirmation message to the user
User submits feedback on product	Idle state	Capture user feedback
User feedback captured	Processing	Analyze feedback for product improvement
Feedback analyzed	Processing	Implement necessary changes to enhance product quality
User clicks on product link	Idle state	Redirect user to the external website for purchasing
User redirected to external	Processing	Open the product page on the external

website		website
User navigates external website	Processing	Allow user to explore and interact with the product page
User completes purchase on external website	Processing	Wait for user to return to SmartBuy platform
User returns to SmartBuy platform	Processing	Display confirmation message and update user's purchase history

3.4 Storyboarding

➤ Home Screen

Figure 2 Home Screen 1



➤ Search Results Page:

Figure 3 Search Results Page 1

The screenshot shows the SmartBuy website's search results for 'watch'. The header includes the SmartBuy logo, a search bar with 'watch' entered, and links for 'Sign In', 'Account & List', 'Returns & Orders', and a 'Basket' icon. A navigation bar below the header lists categories: 'All', 'Todays Deals', 'Electronics', 'Food & Grocery', 'Shopper Toolkit', and 'Health & Personal Care'.

On the left side, there are filters for 'Price (\$)' with 'Min' and 'Max' input fields and a 'Go' button. Below this is a 'Category' filter with checkboxes for 'Men', 'Women', 'Electronics', 'Beauty', and 'Clothes'. Further down is a 'Ratings' filter with checkboxes for star ratings from 1 to 5.


The main content area is titled 'Shop On SmartBuy Search Results for Page 1' and 'Showing results for "watch"'. It features a grid of 12 product listings, each with a product name, price, and a link to the product page. The products are:

- Freestyle Shark Mini Leash Watch Maverick: \$65.00 USD, Freestyle
- Swatch x Omega Bioceramic Moonswatch Mission to Moonphase Snoopy: \$422.00 USD, StockX
- Wristwatche Original Men's Stainless Steel Leather Fashion Sports: \$22.49 USD, eBay - khadirmart
- Men's Watch Elroy Minimalist Casual Business: \$56.00 USD, Gentleman Rules
- Folio Large Men's Watch, Black Dial and Band Battery, Model FMDMSG002: \$8.00 USD, eBay
- Patek Philippe Nautilus: \$95,000.00 USD, Platinum Times Company
- Ciga Design Mechanical Watch Series U Blue Planet - Gilding Version: \$1,899.00 USD, CIGA Design Official Store
- Samsung Galaxy Watch6 Classic Golf Edition 43mm 47mm Smartwatch: \$446.96 USD, eBay - etradekorea
- Stiwee Watches Watch Men Birthday Gifts for Mom Fashion Stainless Steel with ...: (Price not visible)
- Apple Watch Series 3 GPS - 38mm - Sport Band - Aluminum Case, Size: One size, Silver: (Price not visible)
- Samsung Galaxy Watch4, 40mm - Black: (Price not visible)
- Samsung Galaxy Watch6 (Bluetooth 40mm): (Price not visible)

This section is a placeholder for the second search results page. It features the same header and navigation bar as the first page. The main content area is mostly blank, with some faint, light gray rectangular shapes indicating where product listings would appear. The footer of this section is also blank.

➤ Product Page

Figure 4 Product page 1






[Sign In](#) [Account & List](#) [Ret](#)

[All](#) [Todays Deals](#) [Electronics](#) [Food & Grocery](#) [Shopper Toolkit](#) [Health & Personal Care](#)

Freestyle Shark Mini Leash Watch Maverick

★★★★★



Product Details


71.66 USD
(65 USD 6.66 USD tax) [+ 5 more prices](#)

Free delivery by Wed, Oct 230-day returns

Water resistant 100M/330 FT. Original shark fin night vision backlight. Time/day/date digital display. 2 alarms. Heat time strap with Velcro double closure.

Product Highlights

- 30mm Case Width
- Small Wrist Fit
- 100M Water Resistance
- Velcro Band Velcro Leash
- Night Vision
- 30mm Case Width
- Small Wrist Fit
- 100M Water Resistance
- Velcro Band Velcro Leash
- Night Vision



[All](#) [Todays Deals](#) [Electronics](#) [Food & Grocery](#) [Shopper Toolkit](#) [Health & Personal Care](#)

- Velcro Band Velcro Leash
- Night Vision
- Backlight Night Vision
- Backlight Alarm(s)
- Dual Time Military Time
- Hydro Pushers

Reviews (4.7)

Top Review

Kathryn C Says: Freestyle Watch Shark Leash White Dolphin

★★★★★

"Because it said required I had to rate it so I gave it 3 stars. It is a Christmas gift so hasn't been opened yetSo can't evaluate un

Specifications

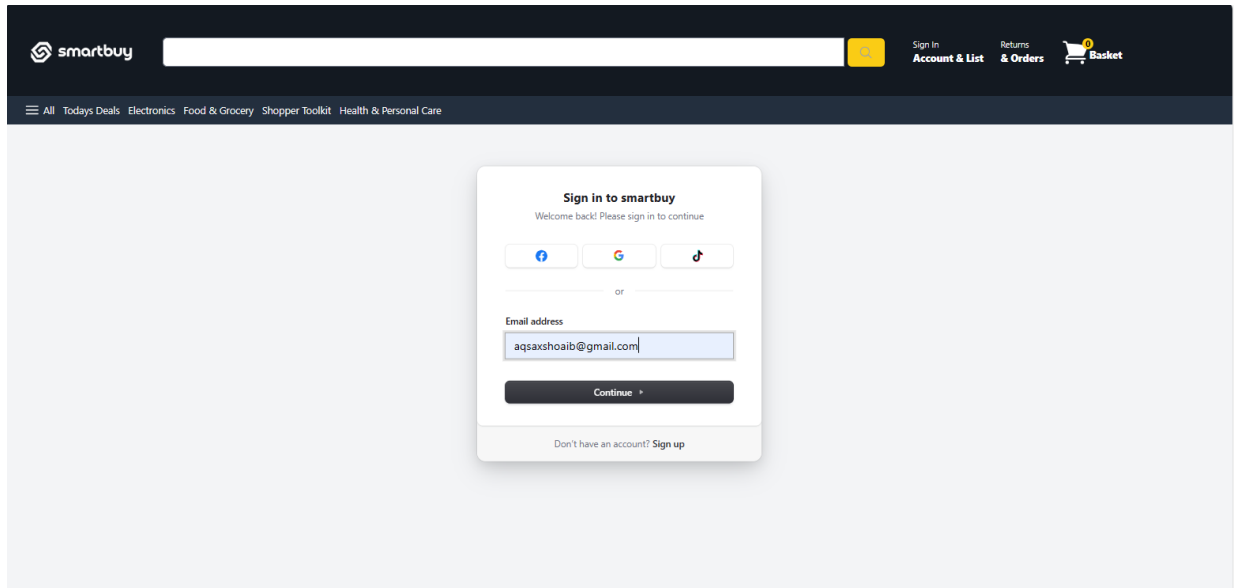
Details

Is Discontinued By Manufacturer

No

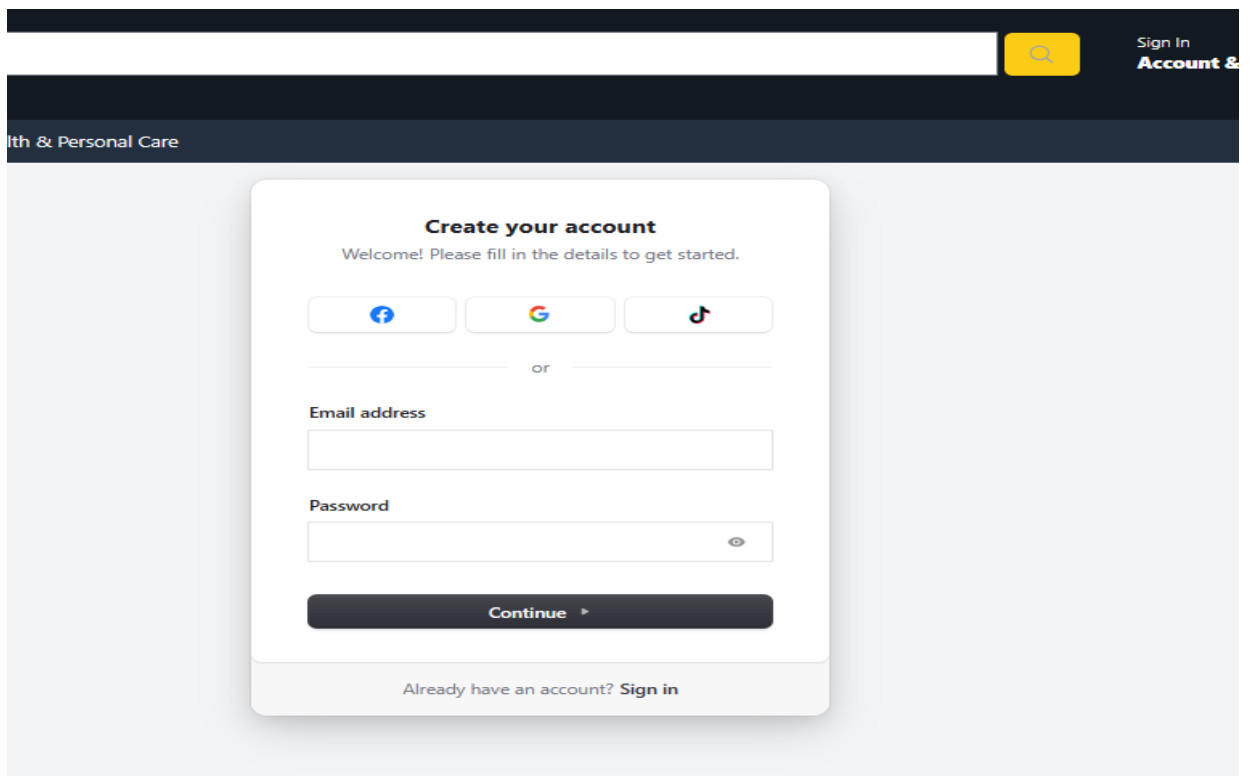
➤ Login/Sign-Up

Figure 5 login page 1



The image shows the login page of the Smartbuy website. At the top, there is a dark navigation bar with the Smartbuy logo on the left, a search bar in the center, and links for 'Sign In Account & List', 'Returns & Orders', and a shopping basket icon on the right. Below the navigation bar, a horizontal menu lists various product categories: 'All', 'Today's Deals', 'Electronics', 'Food & Grocery', 'Shopper Toolkit', and 'Health & Personal Care'. The main content area is light gray and features a central white login card. The card is titled 'Sign in to smartbuy' and includes the text 'Welcome back! Please sign in to continue'. It offers three social login options: Facebook, Google, and TikTok. Below these, there is a link 'or' and a text input field for 'Email address' containing the email 'aqsaxshoib@gmail.com'. A dark 'Continue' button is positioned below the email field. At the bottom of the card, there is a link that says 'Don't have an account? Sign up'.

Figure 6 Sign up page 1



The image shows the sign-up page of the Smartbuy website. The layout is similar to the login page, with the same dark navigation bar and horizontal menu. The main content area is light gray and features a central white sign-up card. The card is titled 'Create your account' and includes the text 'Welcome! Please fill in the details to get started.' It offers three social sign-up options: Facebook, Google, and TikTok. Below these, there is a link 'or' and two text input fields: 'Email address' and 'Password'. The password field has a small eye icon to toggle visibility. A dark 'Continue' button is positioned below the password field. At the bottom of the card, there is a link that says 'Already have an account? Sign in'.

3.5 Functional Requirements

3.5.1 FR-1 Description

Table 3.3. 1 Description Of FR-1

Identifier	FR-1
Title	Product Search and Comparison
Requirement	Users can search for products and compare them based on various attributes.
Source	User Perspective
Rationale	Facilitate informed decisions
Business Rule (if required)	none
Dependencies	none
Priority	high

3.5.2 FR-2 Description

Table 3.3. 2 Description of FR-2

Identifier	FR-2
Title	Personalized Recommendations
Requirement	The system provides personalized product recommendations based on user behavior and preferences.
Source	User Perspective

Rationale	Enhance user experience
Business Rule (if required)	none
Dependencies	FR-1
Priority	high

3.5.3 FR-3 Description

Table 3.3. 3 Description of FR-3

Identifier	FR-3
Title	E-commerce Integration
Requirement	SmartBuy integrates with various e-commerce sites to gather product data and price information.
Source	Buisness Requirement Document
Rationale	Ensure comprehensive data
Business Rule (if required)	none
Dependencies	none
Priority	high

3.5.4 FR-4 Description

Table 3.3. 4 Description of FR-4

Identifier	FR-4
Title	Price Tracking
Requirement	The system shall track and notify users of price changes for selected

	products across various e-commerce platforms.
Source	Development Team
Rationale	Empowers users to make cost-effective decisions and capitalize on discounts or promotions.
Business Rule (if required)	Users must opt-in for notifications.
Dependencies	External APIs
Priority	Medium

3.5.5 FR-5 Description

Table 3.3. 5 Description of FR-5

Identifier	FR-5
Title	User Management and Engagement
Requirement	Users can create accounts, manage their profiles, and engage with the system through reviews and ratings.
Source	Admin
Rationale	Enhance user engagement
Business Rule (if required)	none
Dependencies	none
Priority	medium

3.6 Non-Functional Requirements

3.6.1 System Reliability

SmartBuy should be reliable, operating smoothly without erratic behavior or frequent crashes. Reliable performance is essential for maintaining a dependable service.

3.6.2 User-Friendly Interface

The user interface should be designed to be intuitive and easy to navigate. A user-friendly interface reduces the learning curve and enhances the overall user experience.

3.6.3 Data Accuracy

The system must ensure that product information is accurate and up-to-date. Inaccurate or outdated data may erode user trust and satisfaction.

3.6.4 Legal and Ethical Compliance

The platform must adhere to legal and ethical constraints regarding data collection and competition. Complying with these standards is crucial for maintaining the legality and ethical standing of the platform.

3.7 External Interface Requirements

3.7.1 User Interfaces Requirements

- i. **Intuitive Search Interface:** A user-friendly search interface that allows users to easily input search queries and navigate through search results.
- ii. **Product Comparison Interface:** A clear and organized interface for comparing multiple products side by side, highlighting key features, prices, and other relevant information.

- iii. **Personalized Recommendation Interface:** An interface that presents personalized product recommendations to users based on their behavior and preferences, with options for users to provide feedback on recommendations.
- iv. **User Account Management Interface:** An interface for users to create accounts, log in securely, manage their profiles, and access personalized recommendations and saved preferences.
- v. **External Website Integration Interface:** A smooth transition interface that seamlessly redirects users to external websites when they click on product links for purchasing, ensuring a seamless shopping experience across platforms.
- vi. **Responsive Design:** User interfaces should be responsive and accessible across various devices and screen sizes, including desktops, laptops, tablets, and smartphones, to ensure a consistent user experience.

3.7.2 Software interfaces

- i. **SI-1.1:** The SmartBuy system shall connect to external e-commerce websites to retrieve product data and prices for real-time comparison.
- ii. **SI-1.2:** SmartBuy shall employ machine learning libraries to implement recommendation algorithms for personalized product recommendations.
- iii. **SI-1.3:** The SmartBuy system shall interact with user databases to securely store and manage user profiles and preferences.
- iv. **SI-1.4:** SmartBuy shall utilize web scraping and data gathering tools to collect product information from e-commerce sites that do not offer APIs.

- v. **SI-1.6:** SmartBuy shall utilize next.js 13.4.0 frameworks and tailwind.css for developing its user interface and ensuring responsiveness across various devices.
- vi. **SI-1.7:** The system shall access privacy and security libraries to implement encryption and data protection measures in compliance with privacy regulations.
- vii. **SI-1.8:** SmartBuy will connect to social media platforms to enable users to share their shopping experiences and engage with the system through social media integration.

3.7.3 Hardware interfaces

- i. **Smartphones:** The user interface of SmartBuy is designed to be responsive and accessible on various smartphones, including Android devices.
- ii. **Tablets:** SmartBuy's user interface is optimized for tablets, ensuring a consistent and user-friendly experience on these devices.
- iii. **Desktop Computers:** Users can access SmartBuy via web browsers on desktop computers, making the platform versatile for different computing environments.
- iv. **Touchscreen Interactions:** Users on smartphones and tablets interact with the SmartBuy system through touchscreen controls, including tapping, swiping, and pinching for zooming and navigation.
- v. **Mouse and Keyboard Inputs:** Users on desktop computers interact with the system using mouse clicks and keyboard inputs.
- vi. **HTTPS:** SmartBuy employs the HTTPS (Hypertext Transfer Protocol Secure) protocol for secure data transmission between the user's device and the system server. This ensures data privacy and protection during interactions.

- vii. **E-commerce Web scraper APIs:** SmartBuy communicates with external e-commerce websites and services using E-commerce Web Scraper API 's .This standard communication protocol enables data retrieval, updates, and transactions with external sources.

3.7.4 Communications interfaces

- i. **CI-1:** SmartBuy shall utilize web browsers as the primary user interface for accessing the system. The system shall be compatible with commonly used web browsers, including Google Chrome, Mozilla Firefox, Apple Safari, and Microsoft Edge.
- ii. **CI-2:** SmartBuy shall use network protocols, including HTTPS (Hypertext Transfer Protocol Secure), to secure data transmission between the user's device and the system server. All data transfers shall be encrypted to ensure user data privacy and security.
- iii. **CI-3:** SmartBuy shall employ electronic forms for user registration, login, and profile management. These forms will capture and validate user information, preferences, and feedback, ensuring a smooth and secure user experience.

Chapter No 4
DESIGN AND ARCHITECTURE

4. Design and Architecture

4.1 Architectural Design

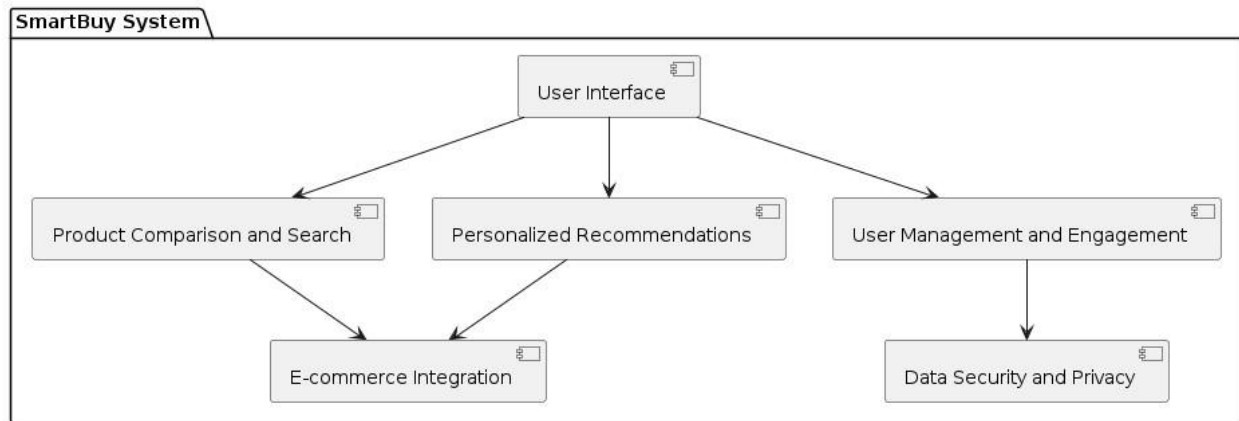


Figure 7 Architecture Design 1

Box and line Diagram

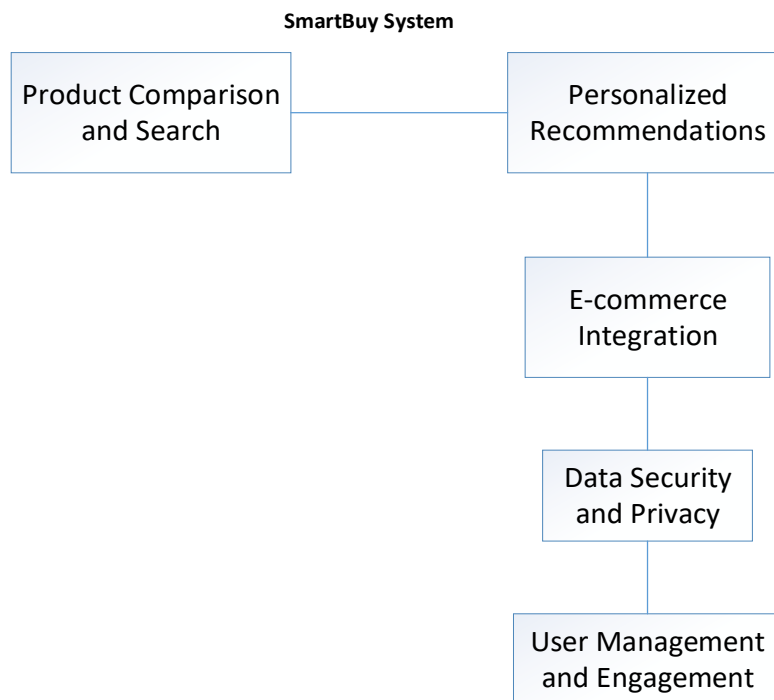


Figure 8 Box and line Diagram 1

4.2 Design Models

4.2.1 Activity Diagram

Description:

The activity diagram illustrates the user journey within the SmartBuy system. It begins with the user searching for products, followed by a series of conditional steps based on user input and system responses.

1. If the user enters search criteria, the system retrieves search results. If results are found, they are displayed to the user.
2. If the user selects a product for comparison, the system allows comparison, prompting the user to select comparison criteria if necessary. Otherwise, the user continues browsing products.
3. If the user desires personalized recommendations, the system analyzes user behavior and preferences, providing tailored product suggestions.
4. Users have the option to save favorite products, with the system facilitating this action if chosen.
5. Additionally, users may choose to create an account, enabling enhanced features and functionality within the system.

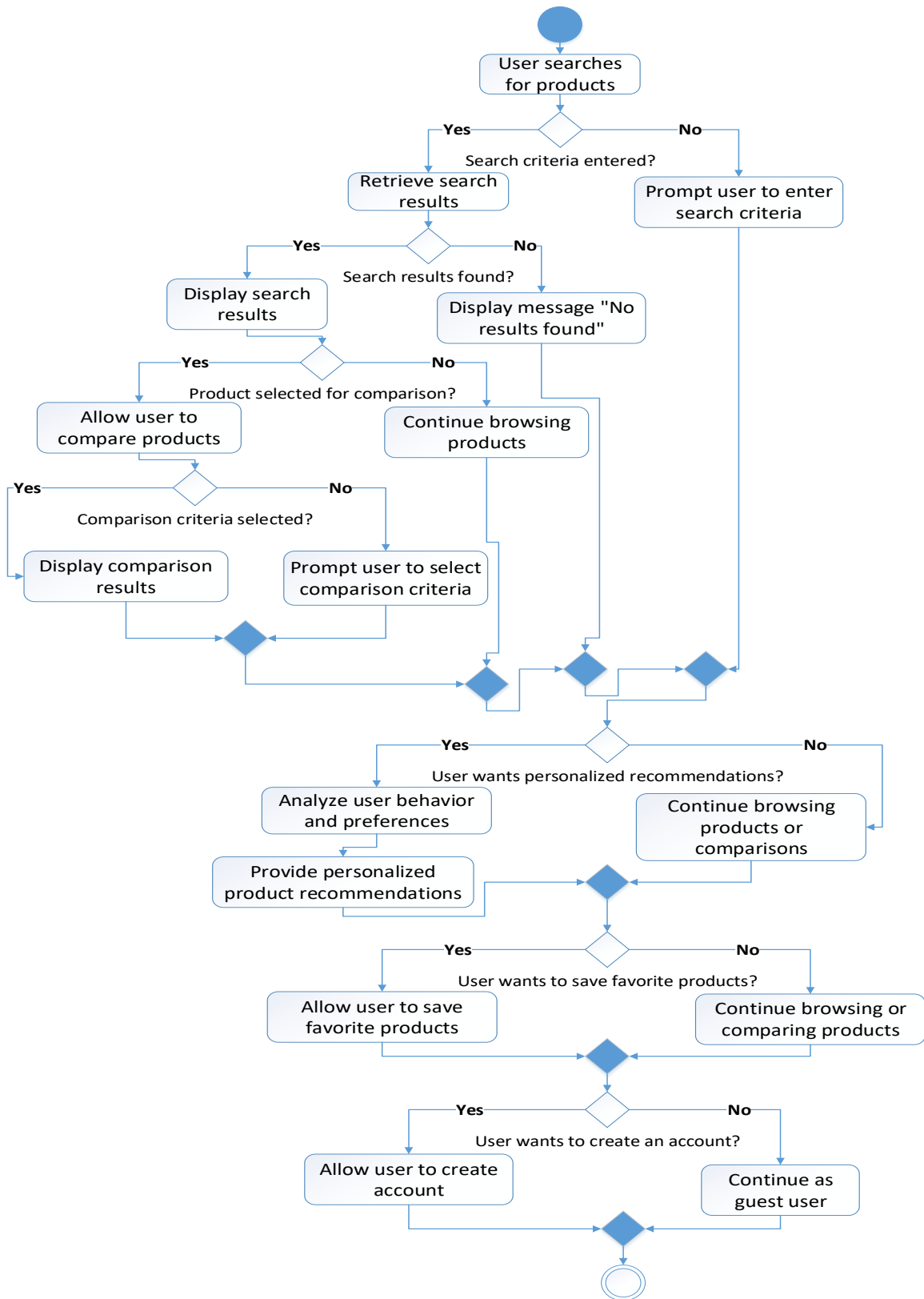
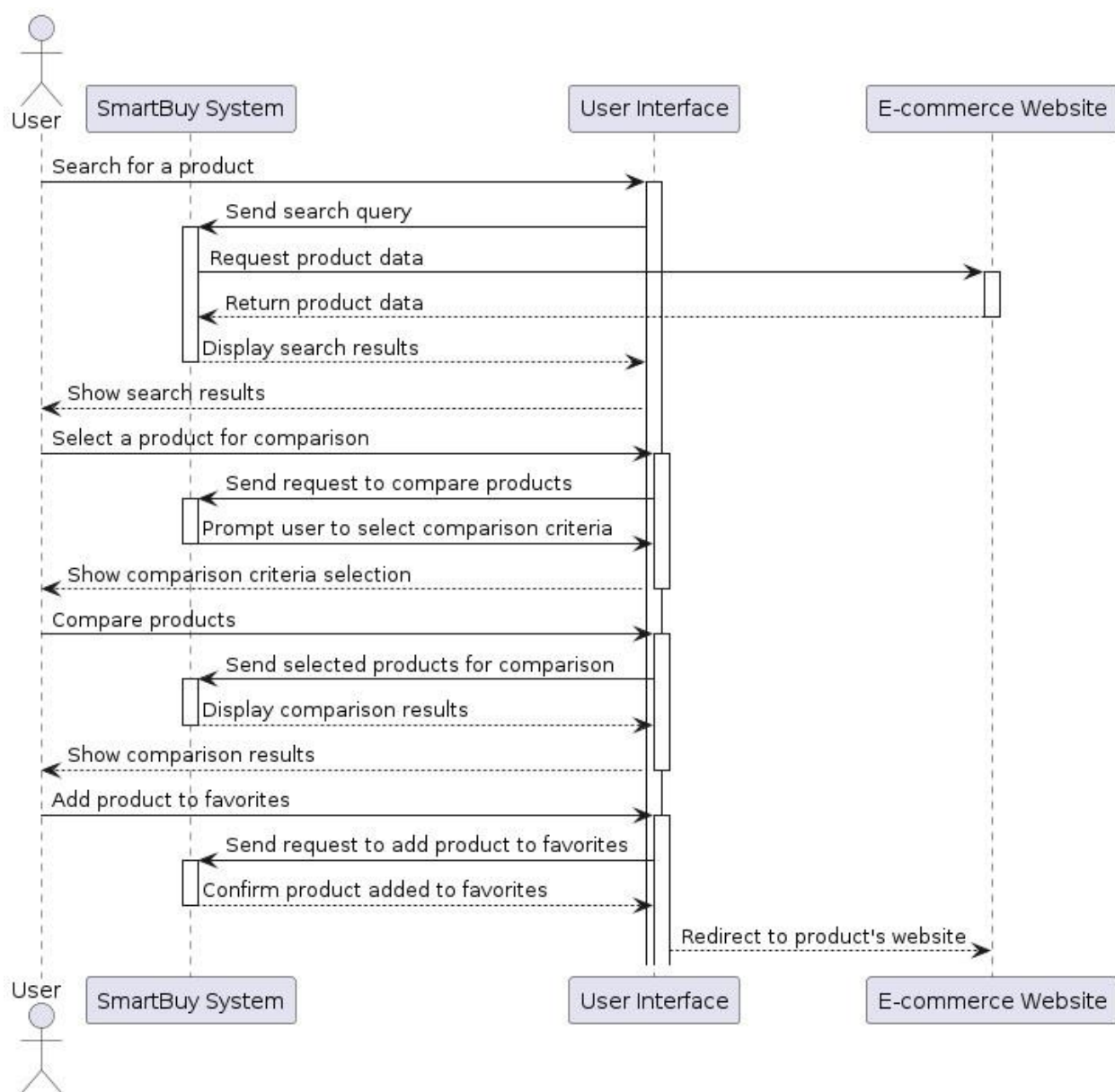


Figure 9 Activity Diagram 1

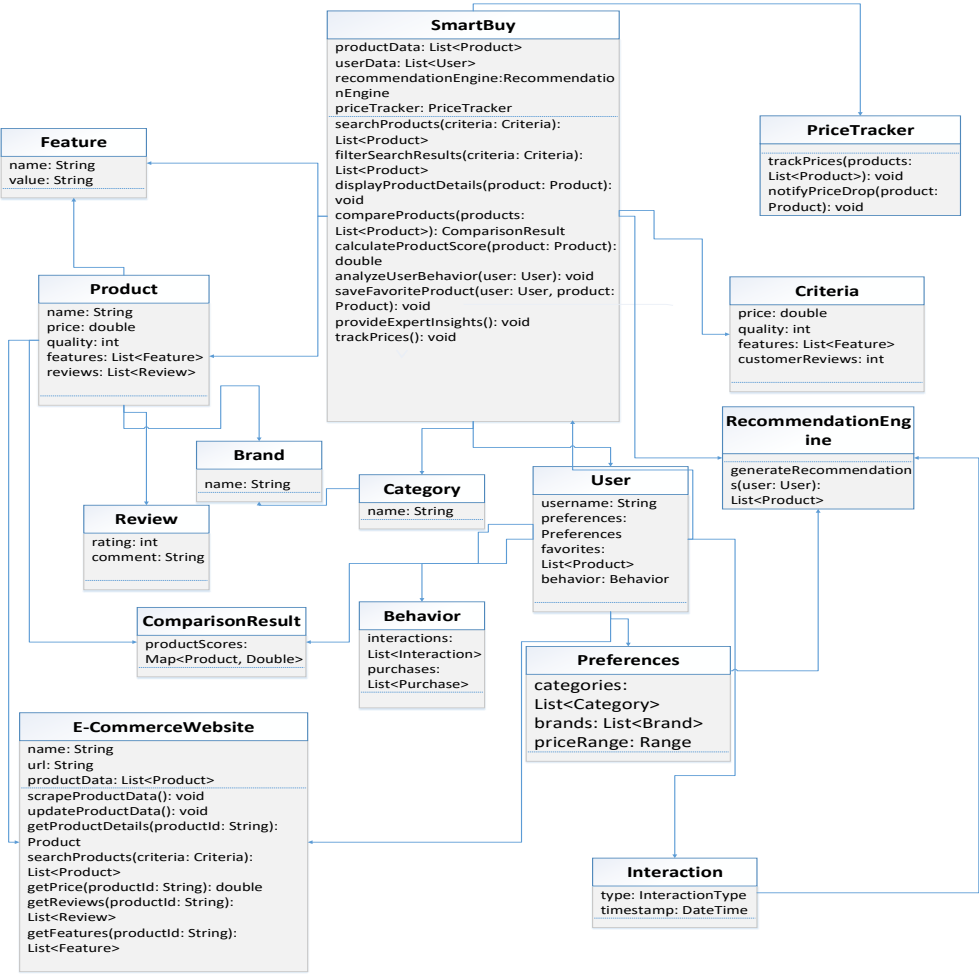
4.2.2 Sequence Diagram

Description

This sequence diagram illustrates the interaction between the user, the SmartBuy system, the user interface, and the e-commerce website. It starts with the user searching for a product, then proceeds to select a product for comparison, compare products, and finally add a product to favorites. Each step involves communication between the user, the user interface, SmartBuy system, and the e-commerce website, ensuring a seamless experience for the user.



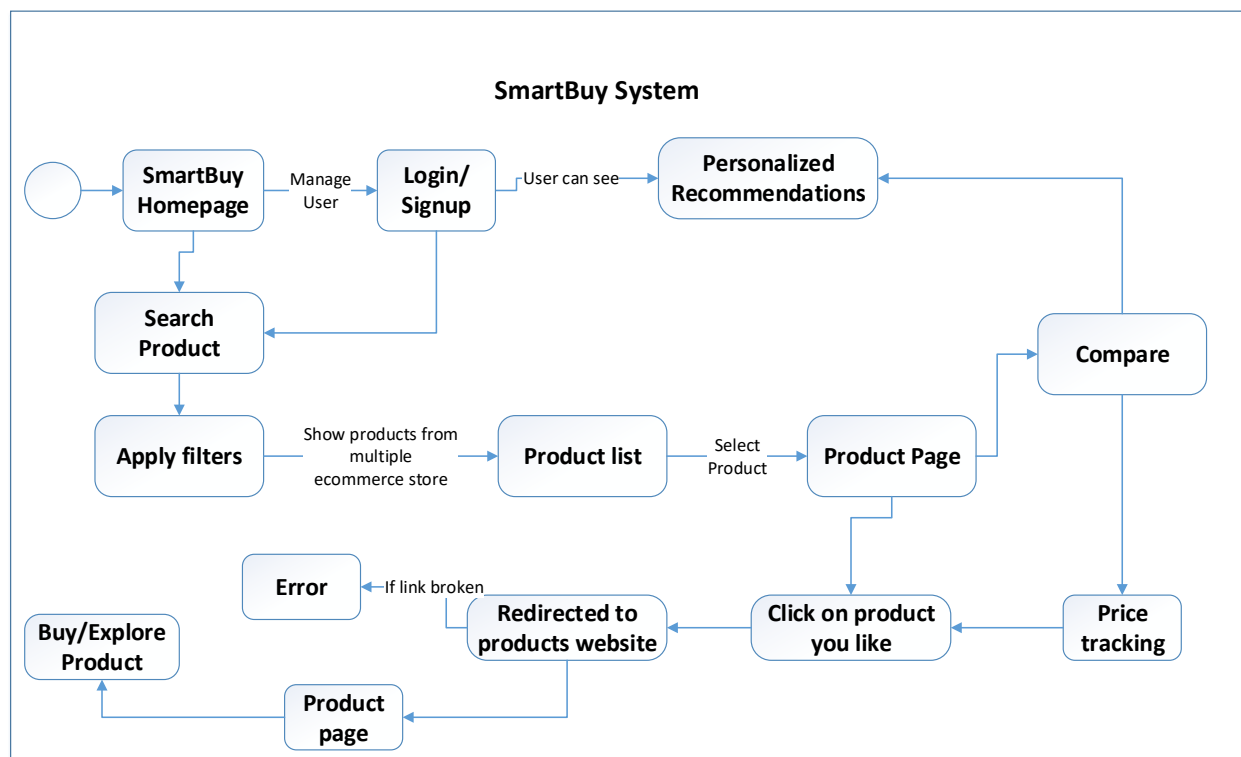
4.2.3 Class Diagram



4.2.4 State Transition Diagram

Description

The state diagram illustrates the various states and transitions within the SmartBuy system. It encompasses states such as "Idle," "Searching," "Comparing," "Analyzing," "Updating," and "Engaging." Each state represents a specific phase of the system's operation, such as user interaction, data processing, or system maintenance. Transitions between states occur based on user inputs, system events, or external triggers. For instance, the system transitions from the "Idle" state to the "Searching" state when a user initiates a product search, and it transitions to the "Comparing" state when the user selects products for comparison. The diagram helps visualize the flow of activities within the system and how it responds to various inputs and events to fulfill its objectives of providing personalized recommendations, product comparisons, and user engagement.



4.2.5 Data Flow Diagram

Figure 16: Level-0 Data Flow Diagram

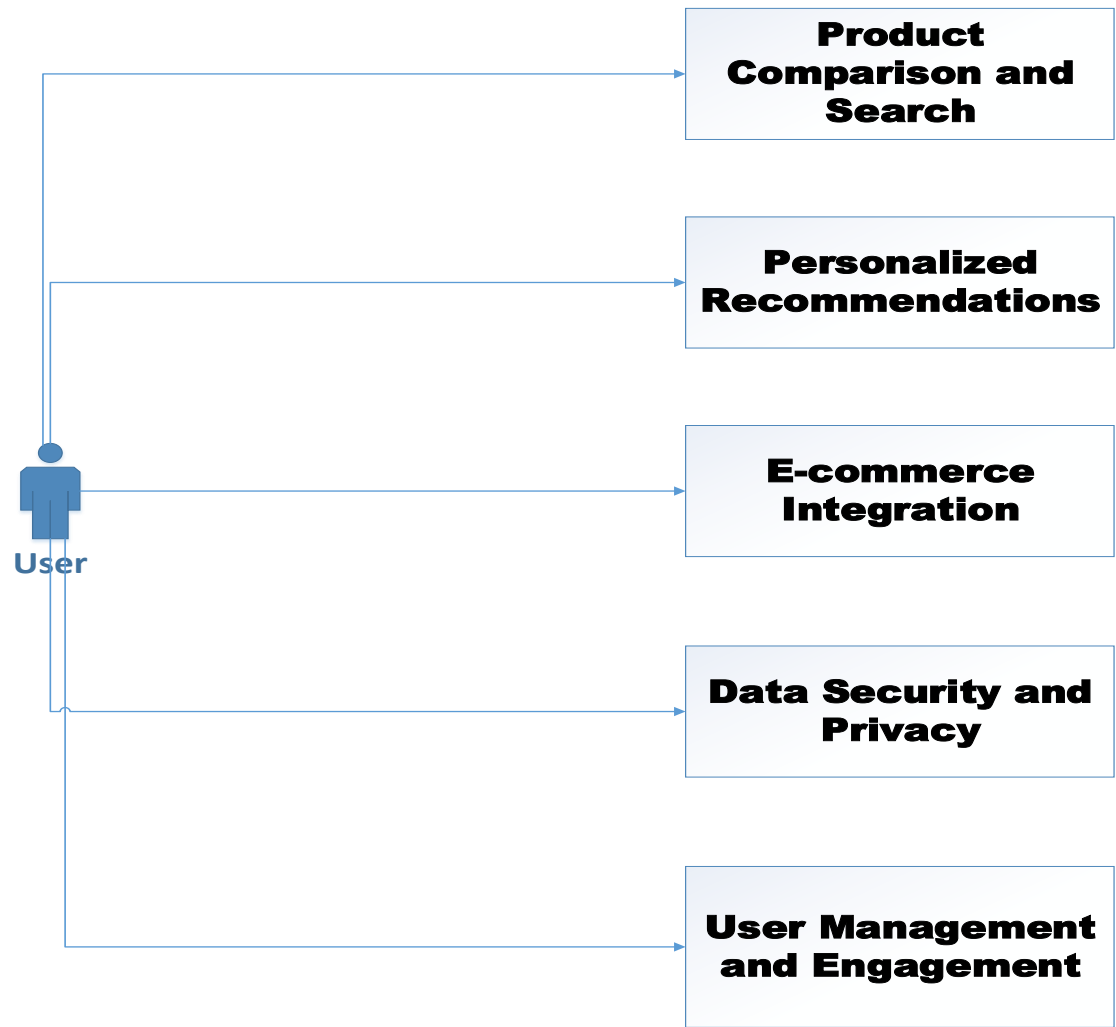
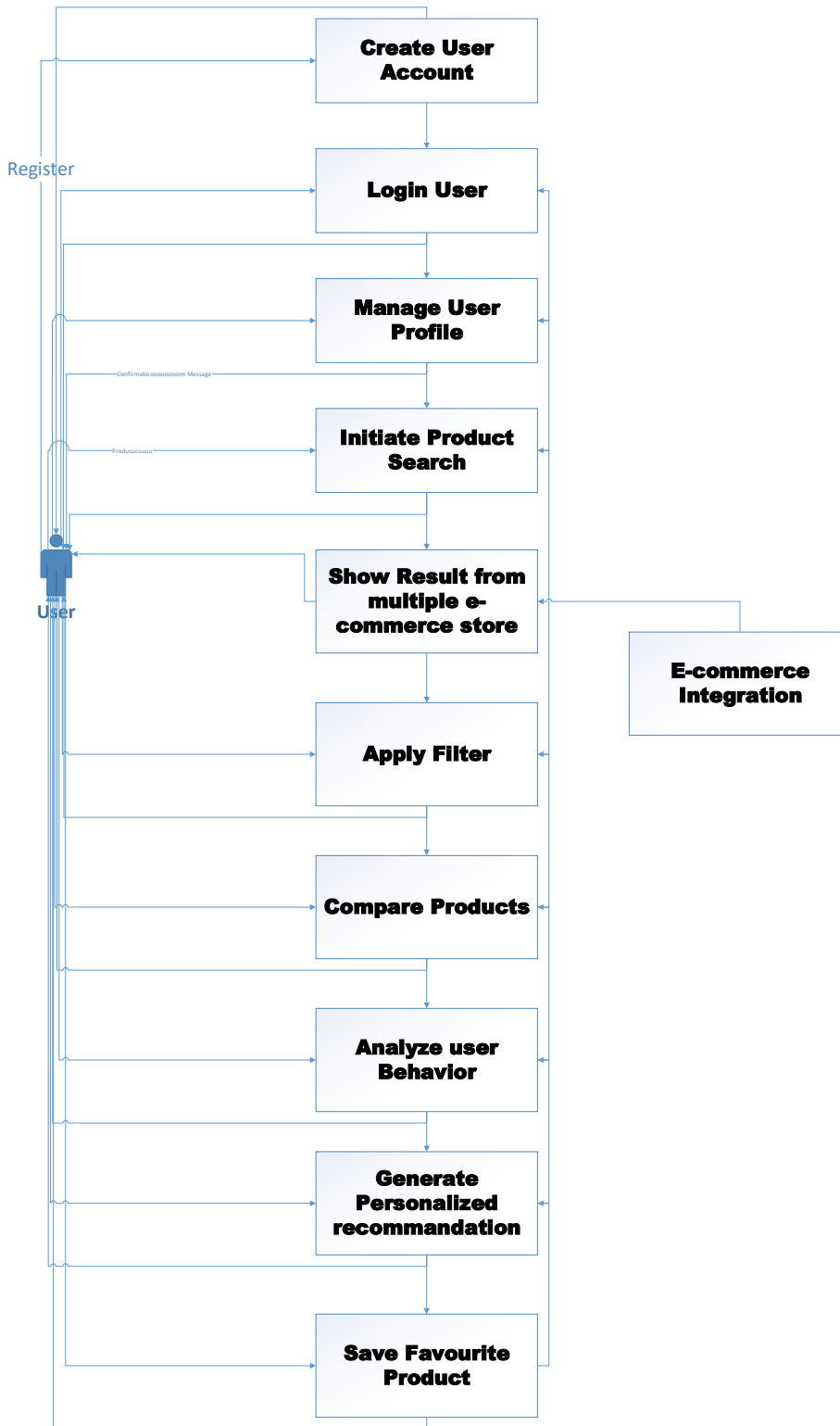


Figure 16: Level-1 Data Flow Diagram



Chapter No 5

IMPLEMENTATION

5. Implementation

5.1 API End-Points

➤ Api/earch

```
6. import { NextResponse } from "next/server";
7. import { PageResult, SearchParams } from "@/typings";
8.
9. export async function POST(request: Request) {
10.   const { searchTerm, pages, ...params } = await request.json();
11.   const searchParams: SearchParams = params;
12.   if (!searchTerm) {
13.     return NextResponse.json(
14.       new Response("Missing search term" , {
15.         status: 400,
16.
17.       })
18.     );
19.   }
20.
21.   const filters: any = [];
22.   Object.entries(searchParams).forEach(([key, value]) => {
23.     if (value) {
24.       if (key === "maxPrice") {
25.         if (value === "1000+") return;
26.       }
27.
28.       filters.push({
29.         key,
30.         value: key === "sort_by" ? value : Number(value),
31.       });
32.     }
33.   });
34.
35.   const response = await
36.     fetch('https://realtime.oxylabs.io/v1/queries',{
37.       method: "POST",
38.       headers: {
39.         "Content-Type": "application/json",
40.         Authorization: `Basic ${Buffer.from(
41.           process.env.OXYLABS_USERNAME + ':' +
42.           process.env.OXYLABS_PASSWORD
```

```

42.         ).toString("base64"))}`,
43.     },
44.     cache: "no-store",
45.     body: JSON.stringify({
46.         source: "websites_search",
47.         domain: "com",
48.         query: searchTerm,
49.         pages: Number(pages) || 1,
50.         parse: true,
51.         context: filters,
52.     }),
53. });
54. });
55.
56. const data = await response.json();
57. console.log(data)
58.
59. const pageResults: PageResult[] = data.results;
60.
61. return NextResponse.json(pageResults, { status: 200 });
62. }

```

➤ **Api/product/[id] route.ts**

```

63.import { ProductData } from "@/typings";
64.import { NextResponse } from "next/server";
65.
66.type Props = {
67.    params: {
68.        id: string;
69.    };
70.};
71.
72.export async function GET(request: Request, { params: { id } }: Props) {
73.    if (!id) {
74.        return NextResponse.json(
75.            { message: "Missing product ID" },
76.            { status: 400 }
77.        );
78.    }
79.
80.    const response = await fetch("https://realtime.oxylabs.io/v1/queries",
81.        {
82.            method: "post",

```

```

82.         body: JSON.stringify({
83.             source: "google_shopping_product",
84.             domain: "com",
85.             query: id,
86.             parse: true,
87.         }),
88.         headers: {
89.             "Content-Type": "application/json",
90.             Authorization:
91.                 "Basic " +
92.                 Buffer.from(
93.                     `${process.env.OXYLABS_USERNAME}:${process.env.OXYLABS_PASSWORD}`
94.                 ).toString("base64"),
95.         },
96.         cache: "no-store",
97.     });
98.
99.     const data = await response.json();
100.     console.log(data);
101.
102.     if (data.results.length === 0) {
103.         return new Response("No product found", {
104.             status: 404,
105.         });
106.     }
107.
108.     const productData: ProductData = data.results[0];
109.
110.     return NextResponse.json(productData, { status: 200 });
111. }

```

5.2 External APIs/SDKs

Table 4 Details of APIs used in the project

Name of API and version	Description of API	Purpose of usage	List down the API endpoint/function/class in which it is used

Oxylabs	E-commerce Scraper API	E-commerce Websites Integration	https://realtime.oxylabs.io/v1/queries
---------	---------------------------	------------------------------------	---

5.3. User Interface

The user interface of SmartBuy is designed to be intuitive, user-friendly, and visually appealing, providing a seamless and engaging shopping experience. The interface features a clean layout with easy navigation, allowing users to browse through product listings, compare items, and access personalized recommendations effortlessly. Key elements include search bars, filters, and sorting options to help users refine their product searches according to their preferences. Product listings are presented with clear images, concise descriptions, and relevant information such as prices, ratings, and reviews, enabling users to make informed decisions. Additionally, interactive features such as product comparison tools and price tracking functionalities enhance user interaction and satisfaction. Overall, the user interface of SmartBuy aims to streamline the online shopping process and optimize usability for a diverse range of users.

5.3 Deployment

Deploying SmartBuy on Vercel ensures seamless accessibility and scalability of the platform. Leveraging Vercel's robust infrastructure, SmartBuy achieves high performance and reliability, delivering a smooth user experience across devices. With effortless deployment processes and automatic scaling capabilities, Vercel streamlines the management of SmartBuy, allowing for efficient updates and optimizations to meet evolving user needs.

Chapter No 6
TESTING AND EVALUATION

6 Testing and Evaluation

6.1 Unit Testing

Unit Testing 1: Login as User with valid and invalid credentials

Testing Objective: To verify that the login functionality of the SmartBuy system works correctly by allowing users to authenticate with valid credentials and handling invalid credentials appropriately.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Result
1	email field validates a proper email address	Email: abc@gmail.com	Validates email address and moves cursor to next textbox	Pass
2	email field displays error message for invalid email format	Email: abc.gmail.com	Highlights field and displays error message	Pass
3	Login with valid email and wrong password	Email: abc@gmail.com Password: abc345	Error message displayed, login failed	Pass
4	Login with invalid email and valid password	Email: abc.gmail.com Password: abc123	Error message displayed, login failed	Pass
5	Login with both invalid email and password	Email: anaya.gmail.com Password: ab345	Error message displayed, login failed	pass

Unit Testing 2: Search Products

Testing Objective: To ensure that the search functionality of the SmartBuy system works as expected by allowing users to search for products based on various criteria and returning accurate search results.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Result
1	search bar accepts valid search query	Search Query: "smartphone"	Displays search results for smartphones	Pass
2	search bar accepts empty search query	Search Query: ""	Displays all available products	Pass
3	search bar accepts special characters in search query	Search Query: "smartphone&\$%"	Displays search results with special characters	Pass
4	search results are displayed properly	Search Query: "laptop"	Displays search results for laptops	Pass
5	search results are limited to relevant products	Search Query: "banana"	Displays no search results for irrelevant query	Pass

Unit Testing 3: Product Comparison

Testing Objective: To verify that the product comparison functionality of the SmartBuy system functions correctly by allowing users to compare multiple products based on various attributes such as price, quality, features, and customer reviews.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Result
1	Validate product comparison with multiple products	Selected products	Products are displayed side by side	Pass
2	Verify comparison based on price, quality, features, and customer reviews	Selected products with different attributes	Products are compared based on selected attributes	Pass
3	Check handling of products with missing attributes	Products with missing attributes	System displays message indicating missing attributes and proceeds with comparison	Pass
4	Ensure clear and comprehensive comparison results display	View comparison results	Comparison table presents attributes and values clearly	Pass
5	Test removal of products from comparison list	Remove one or more products from comparison	Removed products are no longer displayed in comparison table	Pass

Unit Testing 4: Filter Search Result

Testing Objective: To ensure that the filter functionality of the SmartBuy system works correctly by allowing users to filter search results based on various criteria and returning accurate filtered results.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Result
1	filters work with valid criteria	Selected Criteria: Brand - Apple, Price Range - \$500-\$1000	Displays search results for Apple products within the specified price range	Pass
2	filters work with invalid criteria	Selected Criteria: Brand - XYZ, Price Range - \$500-\$1000	Displays no search results for non-existent brand XYZ within the specified price range	Pass
3	filters work with empty criteria	Selected Criteria: Brand - None, Price Range - None	Displays all available products without applying any filters	Pass
4	filters reset properly	Apply filters and then reset	Clears all filters and displays all available products	Pass
5	multiple filters work simultaneously	Selected Criteria: Brand - Samsung, Category - Electronics	Displays search results for Samsung products in the Electronics category	Pass

Unit Testing 5: View Product Details

Testing Objective: To ensure that the product detail viewing functionality of the SmartBuy system works correctly by allowing users to view detailed information about products.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Result
1	product details are displayed properly	Selected Product: Smartphone	Displays detailed information about the selected smartphone	Pass
2	product details include images	Selected Product: Laptop	Displays images of the selected laptop along with other details	Pass
3	product details include descriptions	Selected Product: Tablet	Displays detailed description of the selected tablet	Pass
4	product details include specifications	Selected Product: Camera	Displays technical specifications of the selected camera	Pass
5	product details include	Selected Product:	Displays customer reviews and ratings for the	Pass

	customer reviews	Headphones	selected headphones	
--	------------------	------------	---------------------	--

6.2 Functional Testing

Functional Testing 1: Login with different roles (Admin, User)

Objective: To ensure that the correct page with the correct navigation bar is loaded.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Actual Result	Result
1	Login as an 'Admin' member.	Username: admin@example.com Password: abc123	Main page for the Admin is loaded with the Admin navigation bar.	Logged in and redirected to admin main page.	Pass
2	Login as a 'User' member.	Username: user@example.com Password: acbs456	Main page for the User is loaded with the User navigation bar.	Logged in and redirected to user main page.	Pass

Functional Testing 2: Search Products Functionality

Objective: To verify that the search functionality of SmartBuy returns accurate search results based on user queries.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Actual Result	Result
1	Search for a valid product keyword ("smartphone").	Keyword: "smartphone"	Displays search results for smartphones.	Search results displayed for smartphones.	Pass
2	Search for an empty keyword.	Keyword: ""	Displays all available products.	All available products displayed.	Pass
3	Search for a keyword with special characters ("smartphone&%%").	Keyword: "smartphone&%%"	Displays search results with special characters.	Search results displayed with special characters.	Pass
4	Search for a valid product keyword ("laptop").	Keyword: "laptop"	Displays search results for laptops.	Search results displayed for laptops.	Pass
5	Search for an irrelevant	Keyword: "banana"	Displays no search	No search results	Pass

	keyword ("banana").		results for irrelevant query.	displayed for irrelevant query.	
--	---------------------	--	-------------------------------	---------------------------------	--

Functional Testing 3: Product Comparison

Objective: To ensure that the product comparison functionality of SmartBuy allows users to compare products effectively.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Actual Result	Result
1	Add two valid products to the comparison list.	Products: Product A, Product B	Products are added to the comparison list.	Products added to the comparison list.	Pass
2	Add an invalid product to the comparison list.	Product: Invalid Product	Error message displayed, indicating invalid product.	Error message displayed for invalid product.	Pass
3	Compare features of two products in the comparison list.	Products: Product A, Product B	Features of both products are displayed side by side.	Features of both products displayed side by side.	Pass
4	Remove a product from the comparison list.	Product: Product A	Product A is removed from the comparison list.	Product A successfully removed from comparison list.	Pass
5	Attempt to compare less than two products.	Products: Product A	Error message displayed, indicating minimum two products required.	Error message displayed for less than two products.	Pass

Functional Testing 4: View Product Details

Objective: To ensure that users can view the details of products effectively.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Actual Result	Result
1	View details of a valid product.	Product: Product A	Detailed information about Product A is displayed.	Detailed information about Product A displayed.	Pass
2	View details of an	Product:	Error message displayed,	Error message displayed	Pass

	invalid product.	Invalid Product	indicating invalid product.	for invalid product.	
3	View product images.	Product: Product A	Images of Product A are displayed.	Images of Product A displayed.	Pass
4	View product description and specifications.	Product: Product A	Description and specifications of Product A are displayed.	Description and specifications of Product A displayed.	Pass
5	View product reviews and ratings.	Product: Product A	Reviews and ratings of Product A are displayed.	Reviews and ratings of Product A displayed.	Pass

Functional Testing 4: Filter Search Results

Objective: To ensure that users can filter search results effectively based on various criteria.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Actual Result	Result
1	Filter search results by brand.	Brand: Samsung	Search results are filtered to display products only from the brand Samsung.	Search results filtered to display Samsung products.	Pass
2	Filter search results by category.	Category: Electronics	Search results are filtered to display products only from the Electronics category.	Search results filtered to display Electronics products.	Pass
3	Filter search results by price range.	Price Range: \$500 - \$1000	Search results are filtered to display products within the specified price range.	Search results filtered to display products in price range.	Pass
4	Filter search results by availability.	Availability: In Stock	Search results are filtered to display only products that are currently in stock.	Search results filtered to display in-stock products.	Pass
5	Filter search results by rating.	Rating: 4 stars	Search results are filtered to display only products with a rating of 4 stars.	Search results filtered to display products with 4-star rating.	Pass
6	Filter search results by features.	Features: Waterproof	Search results are filtered to display only products with the feature "Waterproof".	Search results filtered to display waterproof products.	Pass

7	Filter search results by multiple criteria simultaneously.	Brand: Apple, Category: Electronics	Search results are filtered to display products from Apple within Electronics category.	Search results filtered correctly based on multiple criteria.	Pass
8	Filter search results with no matching criteria.	Brand: Sony, Price Range: \$2000 - \$3000	Search results display no products as there are no products matching both criteria.	No products displayed matching the specified criteria.	Pass

6.3 Integration Testing

Integration Testing 1: Product Comparison and Search

Testing Objective: To ensure that the product comparison and search functionalities integrate correctly with the database and user interface.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Actual Result	Result
1	Search for a product using valid search query.	Search Query: "smartphone"	Display search results containing smartphones.	Search results show relevant smartphone products.	Pass
2	Search for a product using an empty search query.	Search Query: ""	Display all available products.	All products are displayed in the search results.	Pass
3	Search for a product using special characters in the search query.	Search Query: "smartphone&\$%"	Display search results with special characters included.	Search results include products with special characters.	Pass
4	Search for a product with a specific name that exists in the database.	Search Query: "laptop"	Display search results containing laptops.	Search results show relevant laptop products.	Pass
5	Search for a product with a name that does not exist in the database.	Search Query: "banana"	Display no search results.	No products are displayed for the query "banana".	Pass
6	Search for a product and verify that the results are displayed correctly.	Search Query: "headphones"	Display search results containing headphones.	Search results show relevant headphone products.	Pass
7	Search for a product	Search Query:	Display search results	Search results show	Pass

	using multiple words in the search query.	"wireless earphones"	containing wireless earphones.	relevant wireless earphone products.	
8	Search for a product with a misspelled word in the search query.	Search Query: "iphon"	Display search results containing products similar to "iPhone".	Search results show relevant products similar to "iPhone".	Pass
9	Compare two products with valid product IDs.	Product IDs: "1234", "5678"	Display a comparison between the two selected products.	Comparison table shows attributes and values of both products.	Pass
10	Compare two products with one invalid product ID.	Product IDs: "1234", "9999"	Display an error message for the invalid product ID.	Error message indicates that one product ID is invalid.	Pass
11	Compare two products with both invalid product IDs.	Product IDs: "9999", "8888"	Display an error message for both invalid product IDs.	Error message indicates that both product IDs are invalid.	Pass
12	Compare two products with valid but non-existent product IDs.	Product IDs: "9999", "8888"	Display an error message for non-existent product IDs.	Error message indicates that both products do not exist.	Pass
13	Compare two products and ensure that the comparison table is displayed.	Product IDs: "1234", "5678"	Display a comparison table with attributes of both products.	Comparison table shows attributes and values of both products.	Pass

Integration Testing 2: E-commerce Integration

Testing Objective: To ensure that the e-commerce integration feature of SmartBuy works seamlessly with external platforms and provides accurate product data.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Actual Result	Result
1	Fetch product data from multiple e-commerce websites.	E-commerce Platforms: Amazon, eBay, Walmart	Retrieve product listings and details from specified e-commerce platforms.	Product data from Amazon, eBay, and Walmart is successfully fetched.	Pass
2	Verify real-time updates for product	Update Interval: Every 5 minutes	Ensure that product listings are updated in	Product listings are refreshed every 5	Pass

	listings.		real-time as per the specified interval.	minutes as expected.	
3	Test if product data is aggregated accurately.	Product Categories: Electronics, Clothing, Home Appliances	Validate that product data is aggregated correctly across different categories.	Product data is accurately aggregated for all specified categories.	Pass
4	Ensure consistent data formatting across platforms.	Data Format: JSON, XML	Verify that product data is uniformly formatted across all integrated platforms.	Product data is consistently formatted in JSON and XML formats.	Pass
5	Check for completeness and correctness of product information.	Product Attributes: Name, Price, Description, Availability	Ensure that all essential product attributes are present and accurate.	Product information includes all required attributes and is accurate.	Pass
6	Test product search functionality using integrated data.	Search Query: "Smartphone"	Verify that users can search for products using data fetched from e-commerce sites.	Product search returns relevant results based on integrated data.	Pass
7	Verify seamless redirection to retailer websites for purchase.	Click on Product Link	Ensure that users are redirected to the respective retailer's website for purchase.	Users are redirected to the correct retailer websites without errors.	Pass
8	Test for error handling in case of unavailability or errors from sources.	Source Unavailability: Amazon API Error	Ensure that appropriate error messages are displayed and handled gracefully.	Error messages are displayed and users are guided appropriately.	Pass

Integration Testing 3: Data Security and Privacy

Testing Objective: To ensure that the data security and privacy measures implemented in SmartBuy are functioning correctly and adhering to established standards.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Actual Result	Result
-----	-----------------------	---------------------	-----------------	---------------	--------

1	Encrypt user credentials during transmission.	Username: user@example.com, Password: *****	User credentials are encrypted using secure protocols during transmission.	User credentials are encrypted using SSL/TLS during transmission.	Pass
2	Verify access controls for sensitive user data.	User Role: Admin	Admins have access to sensitive user data, while regular users do not.	Admins can access and manage sensitive data, while users cannot.	Pass
3	Test compliance with data protection regulations.	Legal Standards: GDPR, CCPA	Ensure that SmartBuy complies with GDPR and CCPA regulations regarding data privacy.	SmartBuy's data handling practices adhere to GDPR and CCPA guidelines.	Pass
4	Check for encryption of stored user data.	Stored Data: User profiles, Purchase History	User data is stored securely with encryption to prevent unauthorized access.	User profiles and purchase history are encrypted in the database.	Pass
5	Validate user consent mechanisms for data usage.	Data Usage: Personalized Recommendations	Users are prompted to provide consent before their data is used for personalized recommendations.	Users are asked for consent before data is used for recommendations.	Pass
6	Test security protocols for external data exchanges.	Third-party APIs: Payment Gateways, E-commerce Platforms	Ensure that data exchanged with external APIs is encrypted and authenticated.	Data exchanged with third-party APIs is encrypted and authenticated.	Pass
7	Verify logging and monitoring mechanisms for data breaches.	Security Logs: Access Logs, Error Logs	SmartBuy maintains logs for access and error events to detect and respond to data breaches.	Access and error logs are maintained and monitored for security events.	Pass
8	Test user account authentication and authorization.	User Credentials: Username, Password	Users can authenticate securely and are only granted access to authorized resources.	User authentication is secure, and access is restricted appropriately.	Pass

Integration Testing 4: User Management and Engagement

Testing Objective: To ensure that the user management and engagement features of SmartBuy are functioning correctly and providing users with the expected functionality and experience.

No.	Test Case/Test Script	Attribute and Value	Expected Result	Actual Result	Result
1	Test user registration functionality.	New User Details: Username, Email, Password	New users can successfully register on SmartBuy platform.	New users can register with valid credentials.	Pass
2	Validate user login functionality.	User Credentials: Username, Password	Registered users can log in securely to their accounts.	Registered users can log in with correct credentials.	Pass
3	Check user account management features.	User Profile: Name, Email, Preferences	Users can update their profiles and manage preferences easily.	Users can update profiles and preferences as expected.	Pass
4	Test user engagement features such as ratings and reviews.	Product Rating: 5 stars, Review Text	Users can rate and review products, and their feedback is visible to others.	Users can rate and review products, and feedback is displayed.	Pass
5	Validate social sharing functionality.	Share Product: Social Media Platforms	Users can share product links on social media platforms seamlessly.	Product links can be shared on social media platforms.	Pass
6	Test referral program functionality.	Referral Link: Invite Friends via Email/SMS	Users can invite friends to join SmartBuy through referral links.	Users can invite friends through referral links.	Pass
7	Check user engagement analytics and tracking features.	Engagement Metrics: Clicks, Views, Conversions	SmartBuy tracks user engagement metrics to analyze platform usage.	User engagement metrics are tracked and available for analysis.	Pass
8	Verify user notification system for personalized	Notification Preferences: Email, Push	Users receive relevant notifications based on their preferences (e.g., sale alerts,	Users receive notifications based on their preferences.	Pass

	updates and alerts.	Notifications	personalized recommendations).		
--	---------------------	---------------	--------------------------------	--	--

Chapter 07

Conclusion and Future Work

7. Conclusion and Future Work

7.1 Conclusion

The SmartBuy system revolutionizes the online shopping experience by providing a comprehensive and personalized platform for users. By aggregating product data from multiple e-commerce sites using oxylabs ecommerce scrapper Api, SmartBuy offers various features such as comparing products, giving personalized recommendations aimed at enhancing user satisfaction and convenience. SmartBuy sets a new standard for online shopping platforms by offering a seamless, informed, and personalized experience that enhances user satisfaction, saves time and effort, and ultimately revolutionizes the way people shop online.

7.2 Future Work

- In our future smartbuy system, we're making shopping easier and more personalized. Here's how:
- **Expert Insights on Products and Trends:** Our system will keep an eye on what's hot in the market using fancy technology. It will gather info from different places like reviews, social media, and industry reports. With this info, customers can learn all about the products they're interested in, helping them make smart choices.
- **Algorithm for Product Scoring:** We're creating a cool algorithm that gives each product a score based on important stuff like quality, features, and price. It'll also take into account what customers like. This way, customers can quickly find the best products that match their needs.
- **Personalized Pricing Options:** Our system will get to know customers like a friend. By looking at what they've bought before and how they shop, it'll suggest special deals just for them. This way, shopping becomes more fun and rewarding for everyone.

Chapter 08

REFERENCES

8. References

- i. Chen, Y., Pavlov, P. A., & Zhang, X. (2020). Personalized product recommendation: A neural attention-based approach. *Information Systems Research*, 31(4), 1149-1167.
- ii. Zhou, T., Ye, Q., & Wang, D. (2019). How do online product reviews affect purchasing behavior? A meta-analysis. *Journal of Retailing*, 95(2), 205-217.
- iii. General Data Protection Regulation (GDPR) (2021). Retrieved from <https://gdpr-info.eu/>
- iv. Price Tracking Tools (2021). Retrieved from <https://www.techradar.com/news/the-best-pricetracking-tools-to-help-you-save-money-when-you-shop-online>
- v. How AI is Transforming the Future of Online Shopping (2021). Retrieved from <https://emerj.com/ai-sector-overviews/ai-transforming-future-online-shopping>