E-COMMERCE MANAGEMENT SYSTEM: UKM E-BOOK JUNCTION

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In the digital age, the demand for academic resources among students at UKM's FTSM College has significantly increased. However, challenges such as scattered availability, high costs, and the lack of a dedicated platform tailored to their academic needs persist. To address these issues, this project introduces UKM BookJunction, an innovative e-commerce management system designed to streamline book purchasing, trading and management for FTSM students. This system will allow UKM's FTSM students to facilitate their online book purchase operations and help them manage system information in a timely and secure manner, recommending different types of books needed for different years.

The system was developed using the Iterative and Incremental Development model, which allowed for continuous improvement and adaptation throughout the development process. The platform leverages a modern and scalable architecture, combining Spring Boot as the primary framework for back-end development, integrated with Spring MVC for model-view-controller separation and MyBatis Plus for efficient database operations. The back end is supported by MySQL for secure and reliable data storage. On the front-end, Vue.js and Element-UI were utilized to deliver a responsive and user-friendly interface. Comprehensive testing, including black-box testing, white-box testing, and user acceptance testing (UAT), validated the system's functionality and reliability. Testing results showed high success rates for core features and positive user feedback on usability and performance.

By addressing key challenges in book management, UKM BookJunction enhances accessibility, affordability, and convenience for students, creating a centralized solution tailored to their academic needs.

Nowadays, with the development of internet technology and related applications, e-commerce is a growing market that requires efficient and powerful platforms to help handle user behaviors and automatically and intelligently solve problems. The E-commerce Management System is of significant importance in the context of the rapidly evolving Internet Economics and E-commerce industry nowadays. According to Statista(2024), global E-commerce sales are projected to reach 5.4 trillion U.S. dollars by 2022, highlighting the substantial market potential and demand for robust E-commerce platforms. Efficient management of E-commerce operations is crucial for businesses to stay competitive and meet customer expectations. A study by BigCommerce(2016) reveals that 51% of Americans prefer to shop online, emphasizing the need for seamless, user-friendly platforms. A well-designed management system can enhance user experience, streamline operations, and ultimately lead to higher conversion rates and customer satisfaction. A report by Akamai Technologies(2017) highlights that a one-second delay in website loading time can result in a 7% reduction in conversion rates, underscoring the importance of real-time responsiveness.

In this project, an e-commerce management system called UKM BookJunction was developed. This e-commerce system allowed UKM's FTSM students to conveniently conduct online book purchase operations and helped them manage system information in a timely and secure manner, recommending different types of books required for different grades. The system was designed to streamline processes, including inventory management, order processing, user authentication, and real-time interaction.

In the digital age, there had been a surge in demand for teaching materials and learning materials among students, especially those in UKM's FTSM academy. However, the fragmented nature of books, high costs, and lack of dedicated academic

platforms posed challenges to students. Therefore, it was crucial to develop a book trading system to address these issues. Such a system improved accessibility, affordability, and convenience for students by providing a centralized platform for purchasing and exchanging books. Customizing the system to the unique needs of FTSM academies also fostered a sense of community, potentially expanded the book market, and provided educators with valuable insights to improve their teaching methods.

This project uses object-oriented programming methods, integrates Spring MVC design patterns, and adopts an iterative incremental development process to ensure the reliability and robustness of the system. The project is a client-server-based system with internal functions for performing data validation, modification, and encryption. The system is a real-time platform designed to handle the complexity of modern e-commerce and provide a powerful and scalable solution for e-commerce activities.

For this project, the Iterative and Incremental Development model was identified as the most suitable approach. This model combines elements of iterative design and the incremental build process, enabling flexibility and adaptability throughout the development lifecycle. By integrating the strengths of both the Waterfall and Incremental models, it supports continuous improvement, accommodates changing requirements, and facilitates early user feedback.

The iterative nature of the model ensures that each development cycle refines the system, while the incremental approach allows the system to be built in manageable sections. This combination enhances the project's ability to adapt to evolving needs and ensures that the final product is well-aligned with user expectations. Ultimately, the Iterative and Incremental Development model contributed to the creation of a successful and well-refined E-commerce Management System.

PLANNING

The planning phase for the UKM BookJunction project involved identifying the key requirements of FTSM students and defining the core functionalities necessary for an efficient e-commerce book management system. The primary objective was to

streamline the process of book searching, purchasing, and order management while enhancing user experience through real-time communication and personalized recommendations.

To achieve this, extensive research was conducted to analyze user needs and expectations regarding book accessibility, pricing, and availability. The system's scope was defined to ensure it meets academic demands by aligning book classifications with different study programs and academic levels. Additionally, the integration of secure authentication and payment mechanisms was outlined to ensure data security and user trust.

The Iterative and Incremental Development Model was selected to facilitate continuous improvements based on user feedback. The system architecture, including front-end, back-end, and database design, was planned to ensure scalability and efficiency. Throughout the planning phase, input from potential users and stakeholders was gathered to refine system features and guarantee that the platform effectively addresses student needs.

DESIGN

The design phase of the UKM BookJunction platform focused on structuring the system architecture, user interface, and database to ensure seamless book management, user interaction, and secure transactions. The Model-View-Controller (MVC) architecture was adopted, utilizing Spring Boot for backend logic, Vue.js with Element-UI for the frontend, and MySQL for efficient data storage and retrieval.

The system was designed with key functional modules, including user registration and authentication, book search and filtering, shopping cart management, order processing, and secure payment integration. The recommendation system was structured to provide personalized book suggestions based on user interactions and academic needs.

The admin module was also designed to facilitate book classification, user management, and order tracking, ensuring smooth operation of the platform. A responsive and intuitive user interface was developed to enhance user experience,

ensuring accessibility across different devices. Throughout the design phase, stakeholder feedback was incorporated to refine system features and improve usability, ensuring that the platform effectively serves its intended purpose for FTSM students.

CODING

The development of the UKM BookJunction platform followed an iterative and incremental approach, ensuring that each module was implemented, tested, and refined before moving on to the next. The system was divided into core functional components, including user registration and authentication, book search and recommendations, shopping cart management, order processing, and payment integration.

Each feature was developed in isolated iterations, starting with backend implementation using Spring Boot and MyBatis Plus, followed by frontend development with Vue.js and Element-UI. The MySQL database schema was structured to efficiently store and retrieve book information, user data, and transaction records. Real-time features, such as WebSocket-based notifications, were integrated to enhance user experience. Regular testing was conducted throughout development to validate system performance and security.

RELEASE

Once the system development was completed, UKM BookJunction was deployed into the working environment. The system was hosted on a secure server, with proper database configurations to handle transactions and user interactions efficiently. Initial user feedback was gathered from FTSM students, allowing for refinements and performance optimizations.

ACCEPTANCE TESTING

Comprehensive user acceptance testing was conducted to evaluate system usability, performance, and functionality. The testing process involved two primary phases.The first one is initial testing,it is selected test users were provided with an operation manual, guiding them through key platform functionalities, including book browsing, order placement, and checkout. Their interactions were monitored, and feedback was recorded based on test cases.The second one is experience feedback it is after completing a series of tasks on the platform, users were asked to complete a feedback questionnaire, assessing their satisfaction with navigation, search efficiency, and transaction security.

The collected test results were analyzed to identify issues and areas for improvement. Based on user feedback, several optimizations were made, including refining the recommendation system, improving the checkout flow, and enhancing the search filtering options. These iterative refinements ensured that UKM BookJunction met its intended purpose of providing a seamless book purchasing experience for FTSM students.

The UKM BookJunction platform has been fully developed, and all related documentation has been completed. The system was built using Spring Boot for backend development, with MyBatis Plus managing database interactions. The Vue.js framework, along with Element-UI, was used to create a responsive and user-friendly interface. The platform operates on a MySQL 8.0 database, ensuring secure and efficient data storage.

The development environment utilized IntelliJ IDEA as the primary Integrated Development Environment (IDE), while Maven was employed for dependency management. The system integrates real-time features using WebSocket, allowing for instant updates on order status and book availability. Secure payment processing was incorporated through external payment gateways, ensuring encrypted transactions and user data protection.

Throughout the development process, discussions and decisions were made regarding system architecture, security implementation, and performance optimizations. The iterative approach allowed for continuous refinements based on feedback from FTSM

students, ensuring that the platform effectively meets their needs for book purchasing and management.

After entering the web page, the user will see the login as shown in Figure 1. If this is the first time the user is using UKM BookJunction, he needs to click the Register button to register his account and then come back here to log in. If the user already has an account, he can log in by clicking the "Login" button.

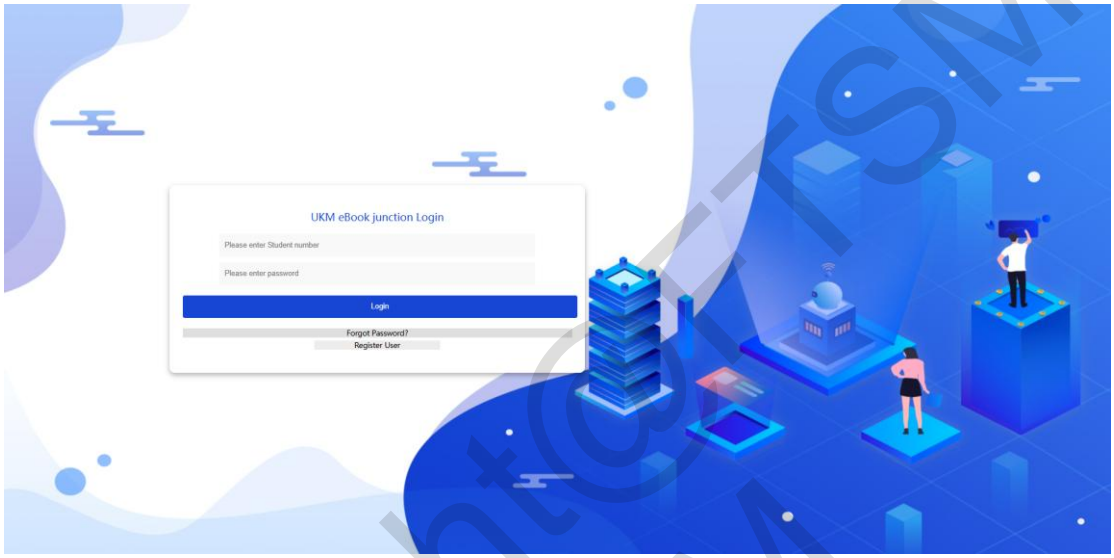


Figure 1 Login Page

When you click the Register button, you will enter the registration page as shown in Figure 2. The user must enter a student ID number that starts with a letter and is followed by six numbers as the account number. The password must be longer than 3 characters and contain uppercase and lowercase letters and numbers. After completing the registration information, click the Register button. A prompt will pop up on the page to inform the user whether the registration is successful.

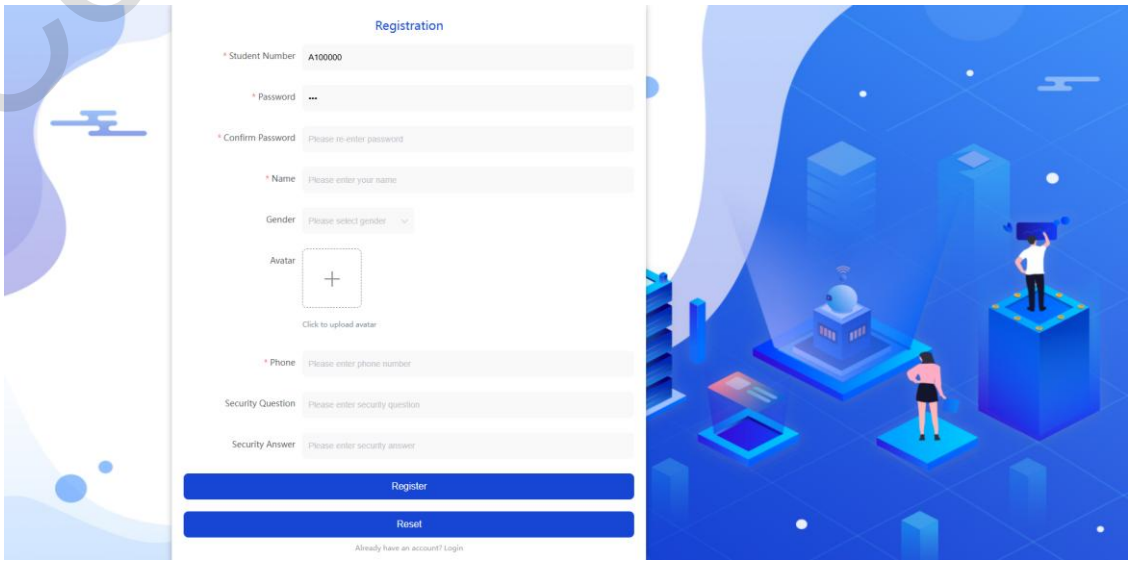


Figure 2 Registration Page

When the user clicks the login button, he enters the main page shown in Figure 3, which contains relevant book recommendations

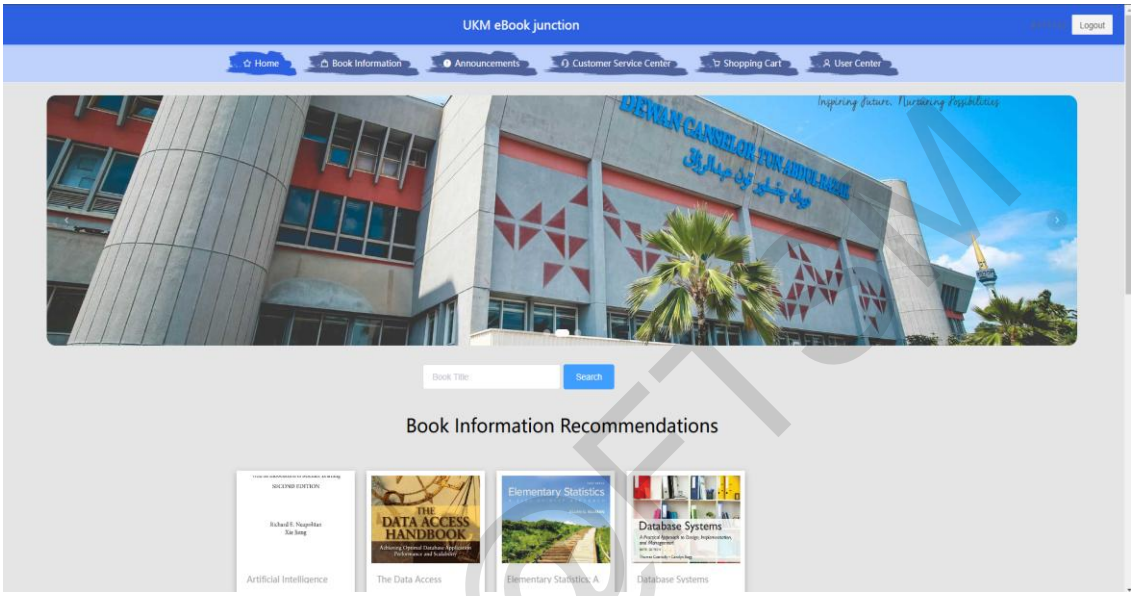


Figure 3 Home Page

When users click on book information, they will be redirected to the book information page, where books of various majors, semesters and subjects are classified. A search function is also added to help users find the books they need more quickly.

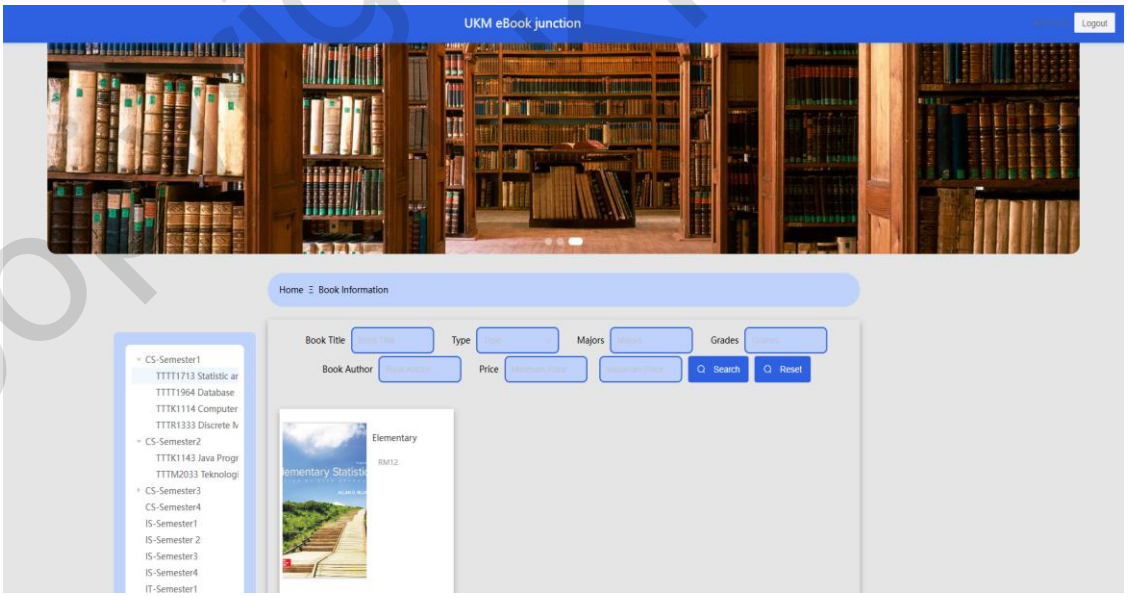


Figure 4 Book screening function

When the user clicks on a specific book, he can view the relevant information of the book.

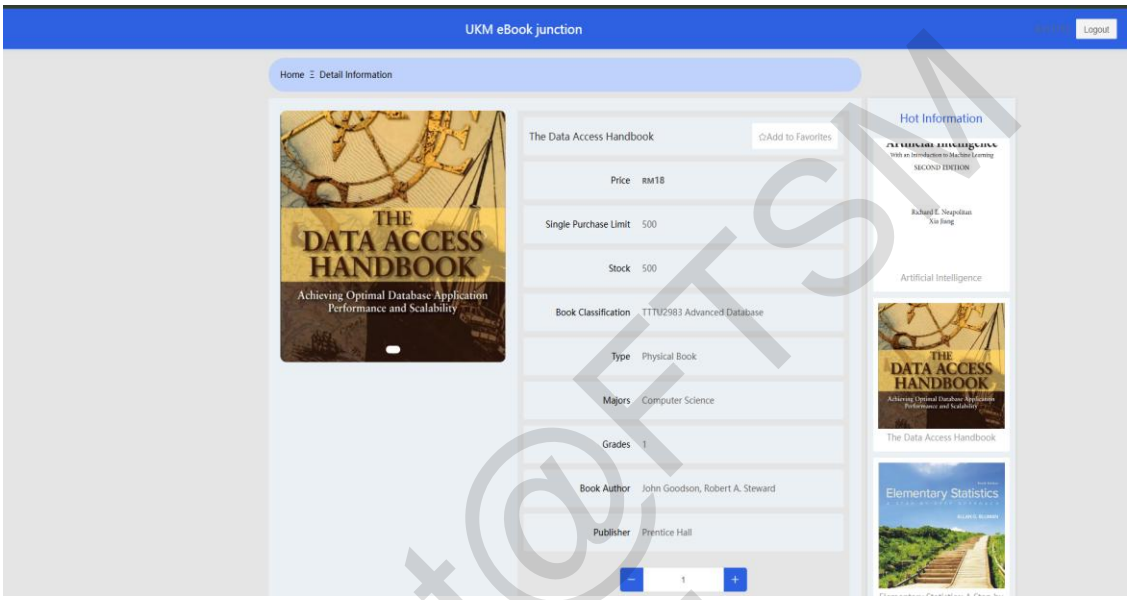


Figure 5 Book Detial

As shown in Figure 6 shows the announcement page of the system. At the top of the page, there is a search box for announcements, allowing users to quickly search for specific announcements by entering relevant keywords in the title.

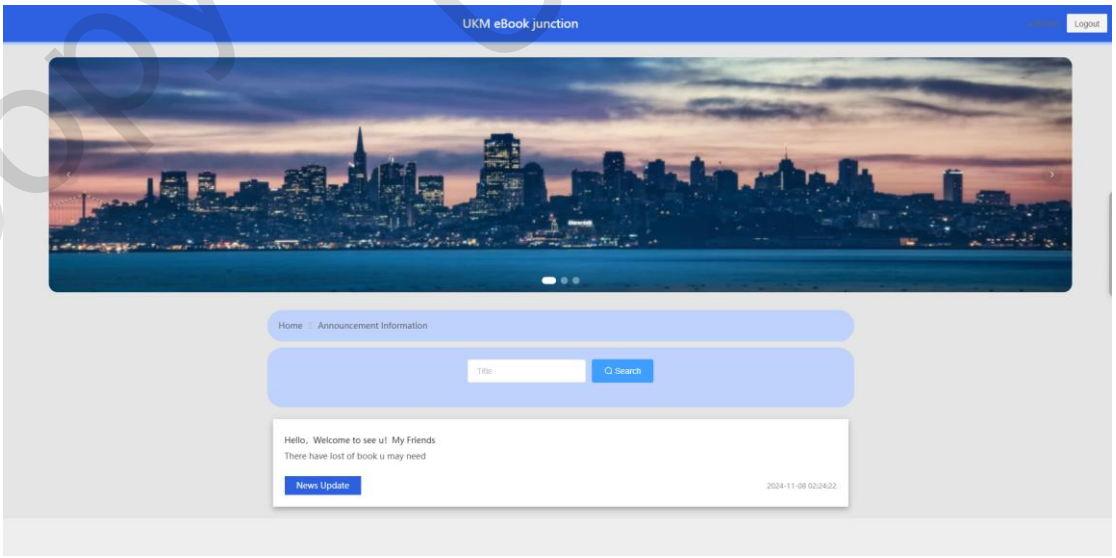


Figure 6 Announcement Page

Figure 7 illustrates the customer service chatbox within the system. When users need to communicate with customer support, they can click the "Customer Service Center" button to open the chatbox. Inside the chatbox, the intelligent virtual assistant will automatically send a welcome message.

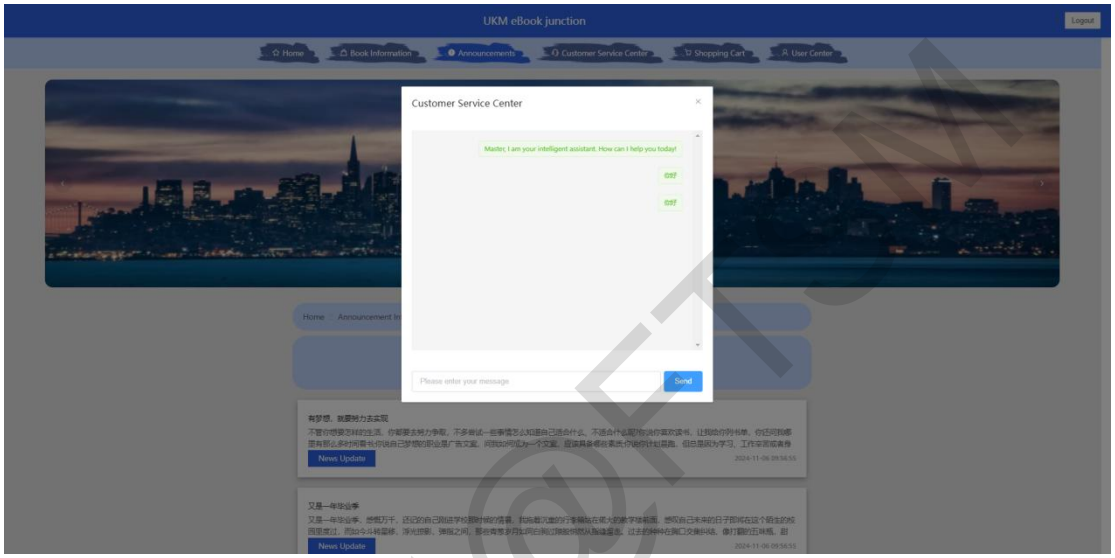


Figure 7 Customer Service Chatbox

Figure 8 shows the shopping cart page of the system. Users can access the shopping cart page by clicking the "Shopping Cart" button in the navigation bar. This page displays the items that the user has added to their shopping cart, including details

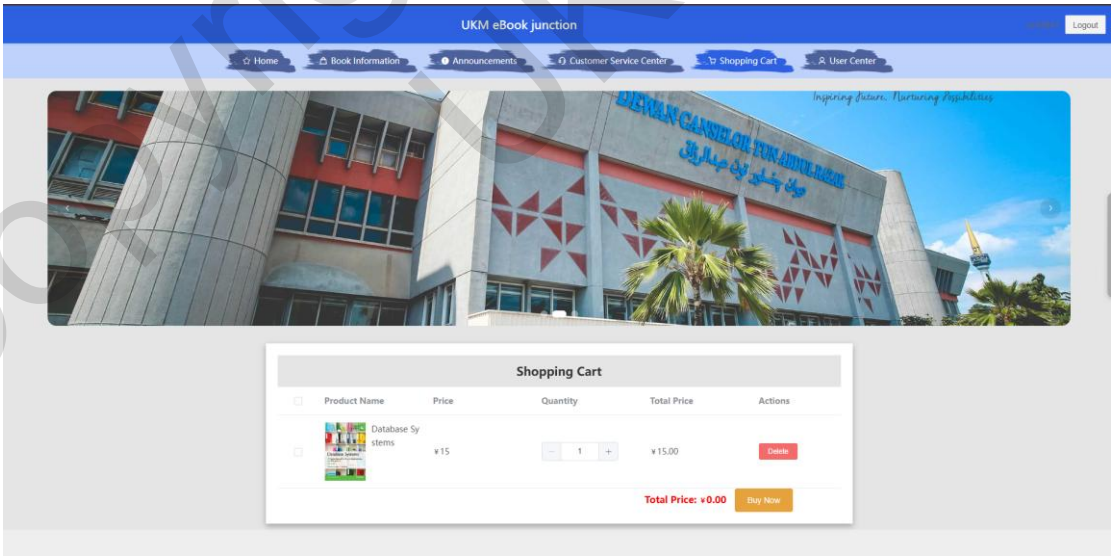


Figure 8 Shopping Cart Page

As can be seen in the figure 9On the User Profile Center page, users can view and edit their basic personal information, including their username, password, profile picture, gender, major, current semester, phone number, and security questions. On the left side of the page, there is a navigation bar that enables users to quickly access other sections.

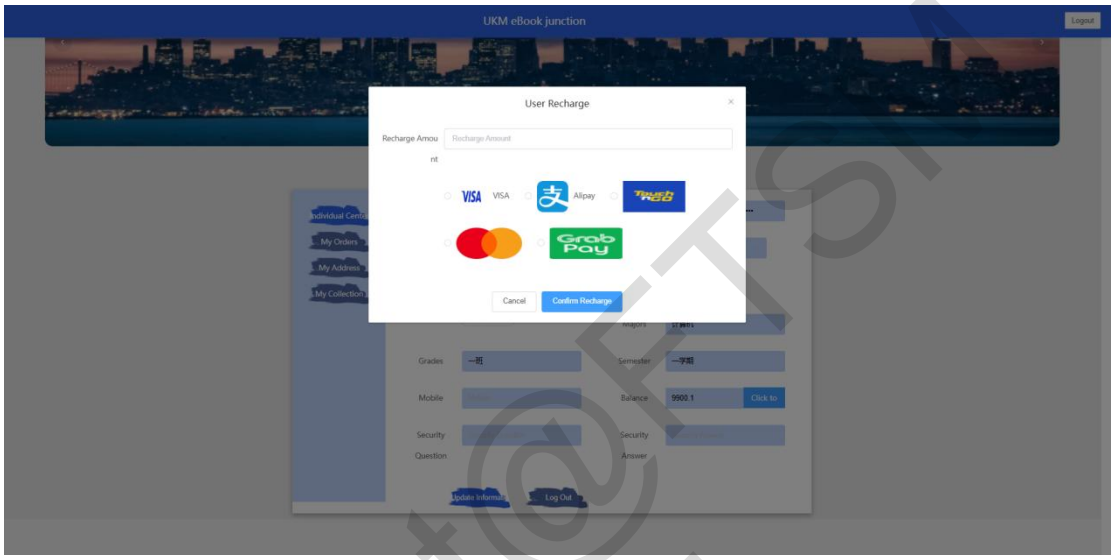


Figure 9 **User Recharge**

On the User Profile Center page, users can click the "Click to Recharge" button next to their account balance to access the recharge interface. The recharge page allows users to enter the desired recharge amount and select a preferred payment method, including options such as Visa, Alipay, Touch 'n Go, MasterCard, and Grab Pay, as shown in Figure 10

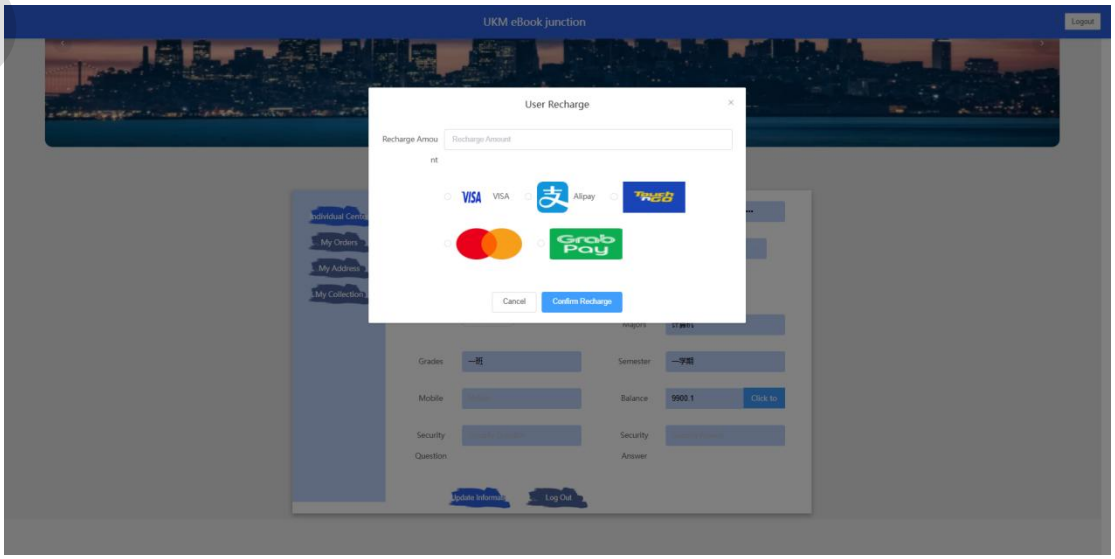


Figure 10 User Recharge

SOFTWARE FUNCTIONALITY TEST RESULTS

17 users completed the test, and the functionality results are compiled and presented as follows: Table Admin Test Results

Test ID	Description	Steps	Expected Result	Status
A001_1	Verify admin login with incorrect credentials.	1.Enter incorrect username and password. 2.Click the “Login” button.	Login failed with an error message	Pass
A001_2	Verify admin login with correct credentials	1.Enter correct username and password. 2.Click the “Login” button.	Login successful and the admin home page is displayed.	Pass
A002_1	Verify adding a new user.	1.Navigate to the “User Management” page. 2.Click “Add” and enter user details. 3. Click “Save.”	New user added successfully.	Pass
A002_2	Verify updating user information.	1.Navigate to the “User Management” page. 2.Click “Update” for an existing user. 3.Modify user details and click “Save.”	User information updated successfully	Pass
A002_3	Verify deleting a user.	1.Navigate to the “User Management” page. 2.Select a user and click “Delete.”	User deleted successfully.	Pass
A003_1	Verify updating a book classification.	1.Click “Update” for a classification. 2.Modify classification details and save.	Classification updated successfully.	Pass
A003_2	Verify deleting a book classification.	1.Navigate to the “Book Classification” page. 2.Click “Delete” for a classification.	Classification deleted successfully.	Pass
A004_1	Verify adding new book information.	1.Navigate to the “Book Information” page. 2.Click “Add” and enter book details. 3.Save the book	New book added successfully.	Pass

		entry.		
A004_2	Verify searching for a book by title	1.Navigate to the "Book Information" page. 2.Enter a book title in the search field and click "Search."	Relevant book entries are displayed	Pass
A005_1	Verify viewing refunded orders	1.Navigate to the "Order Management" page. 2.Select "Refunded Orders" from the sidebar.	List of refunded orders is displayed.	Pass

Table User Test Results

Test ID	Description	Steps	Expected Result	Status
C001_1	Test whether the system enforces the special requirement that the account is a student account, that is, a letter plus six digits.	1.Enter random content that does not meet the requirements. 2.Click the "Register" button. 3.Check the result prompt.	Registration fails with an appropriate error message	Pass
C001_2	Enter a student account that meets the requirements	1.Enter an account number and password with right student matric number. 2.Click the "Register" button. 3.Check the result prompt.	Registration succeeds, and the account is created	Pass
C001_3	Test whether duplicate account registration is prevented	1.Register an account with an account number and it is a right student matric number 2.Log out of the system. 3.Attempt to register again using the same account number and password. 4.Check the result prompt.	Registration fails with a message indicating that the account already exists.	Pass
C002_1	Test login with a non-existent account	1.Enter a non-existent account number and any password (both longer than 3 characters). 2.Click the "Login" button. 3.Expected result: Login fails with an appropriate error message.	Login fails with an appropriate error message	Pass

C002_2	Test successful login with valid credentials	1.Enter a registered account number and the correct password. 2.Click the "Login" button.	Login succeeds, and the user is redirected to the home page.	Pass
C002_3	Test login when the account is already online	1.Log in with a registered account. 2.Keep the session active. 3.Attempt to log in again with the same account credentials.	Login fails with a message indicating the account is already logged in.	Pass
C003_1	Test the search function with valid keywords	1.Enter a valid keyword in the search bar. 2.Click the "Search" button.	The system displays a list of relevant books matching the search criteria.	Pass
C003_2	Test the filtering function by category	1.Select a specific book category from the filter options. 2.Apply the filter.	The system displays books that belong only to the selected category	Pass
C004_1	Test adding a book to the shopping cart	1.Navigate to a book's detail page. 2.Click the "Add to Cart" button. 3.Go to the shopping cart page.	The selected book appears in the shopping cart with the correct details	Pass
C004_2	Test removing a book from the shopping cart	1.Add a book to the shopping cart. 2.On the shopping cart page, click the "Remove" button for the selected book	The book is removed from the shopping cart, and the cart is updated	Padd
C005_1	Test personalized book recommendations based on user profile	1.Log in with a registered user account. 2.Go to the home page.	The system displays book recommendations tailored to the user's academic year, major, and purchase history.	Pass
C006_1	Test placing an order successfully	1.Add books to the shopping cart. 2.Proceed to checkout and provide valid payment details.	The order is placed successfully, and a confirmation message is displayed	Pass
C006_2	Test viewing order history.	1.Log in to the system. 2.Navigate to the "My Orders" page.	The system displays a list of past orders with their details.	Pass
Test ID	Description	Steps	Expected Result	Status
A001_1	Verify admin login with incorrect credentials.	1.Enter incorrect username and password. 2.Click the “Login” button.	Login failed with an error message	Pass

A001_2	Verify admin login with correct credentials	1.Enter correct username and password. 2.Click the “Login” button.	Login successful and the admin home page is displayed.	Pass
A002_1	Verify adding a new user.	1.Navigate to the “User Management” page. 2.Click “Add” and enter user details. 3. Click “Save.”	New user added successfully.	Pass
A002_2	Verify updating user information.	1.Navigate to the “User Management” page. 2.Click “Update” for an existing user. 3.Modify user details and click “Save.”	User information updated successfully	Pass
A002_3	Verify deleting a user.	1.Navigate to the “User Management” page. 2.Select a user and click “Delete.”	User deleted successfully.	Pass
A003_1	Verify updating a book classification.	1.Click “Update” for a classification. 2.Modify classification details and save.	Classification updated successfully.	Pass
A003_2	Verify deleting a book classification.	1.Navigate to the “Book Classification” page. 2.Click “Delete” for a classification.	Classification deleted successfully.	Pass
A004_1	Verify adding new book information.	1.Navigate to the “Book Information” page. 2.Click “Add” and enter book details. 3.Save the book entry.	New book added successfully.	Pass
A004_2	Verify searching for a book by title	1.Navigate to the “Book Information” page. 2.Enter a book title in the search field and click “Search.”	Relevant book entries are displayed	Pass
A005_1	Verify viewing refunded orders	1.Navigate to the “Order Management” page. 2.Select “Refunded Orders” from the sidebar.	List of refunded orders is displayed.	Pass

USER FEEDBACK QUESTIONNAIRE RESULT

These test cases cover essential features of the UKM Book Junction platform, ensuring the system meets functional requirements and provides a seamless user experience.

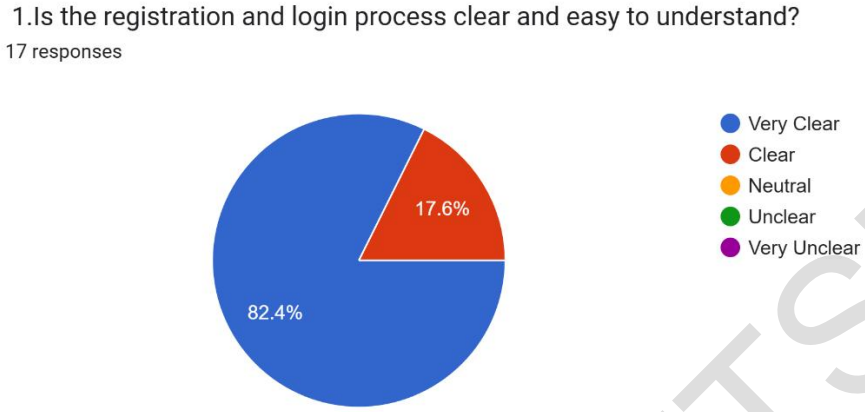


Figure 11 Payment Process Smoothness and Security Feedback

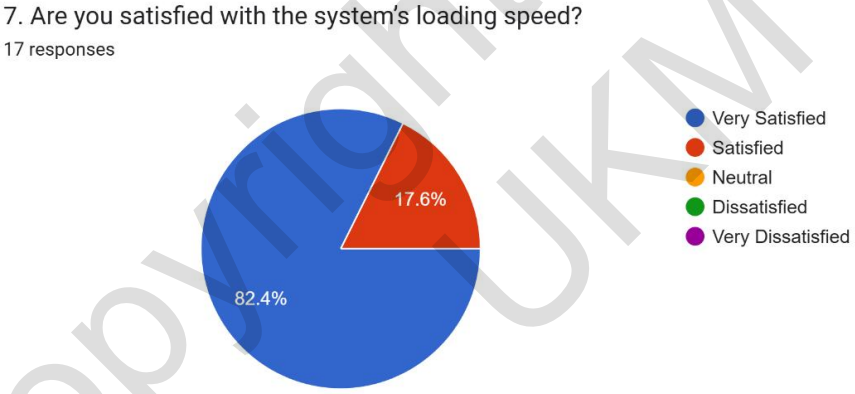
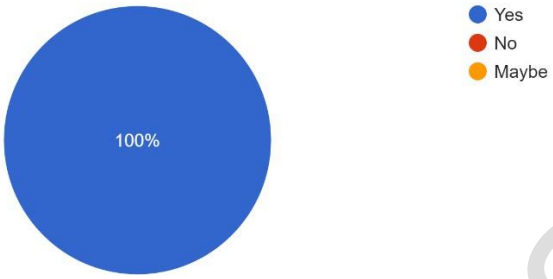


Figure 12 System Loading Speed Satisfaction Feedback

3. Does the setting and atmosphere of the Chinese Traditional Trail game fit the theme?

17 responses



8. Does the real-time customer support chat provide effective assistance?

17 responses

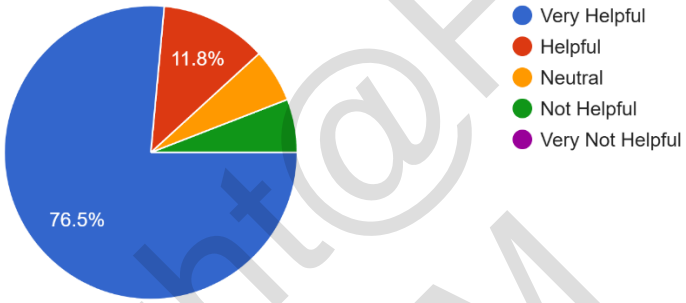


Figure 13 Real-Time Customer Support Chat Effectiveness Feedback

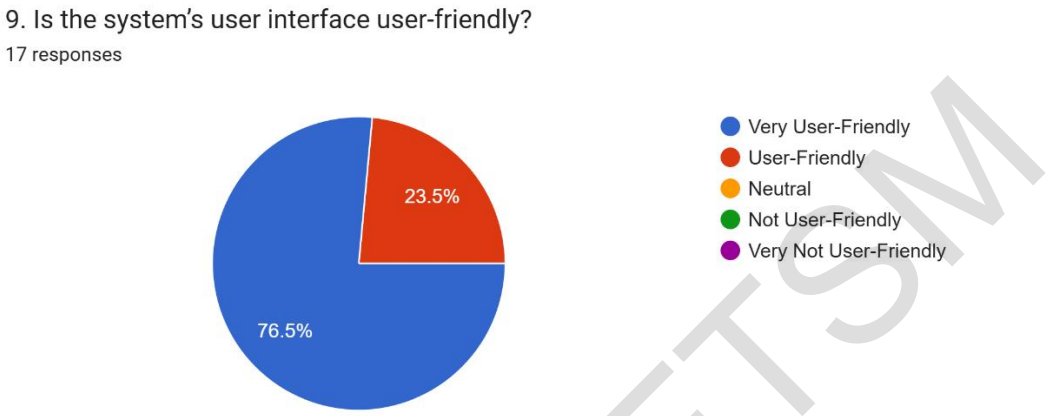


Figure 14 System User Interface Friendliness Feedback

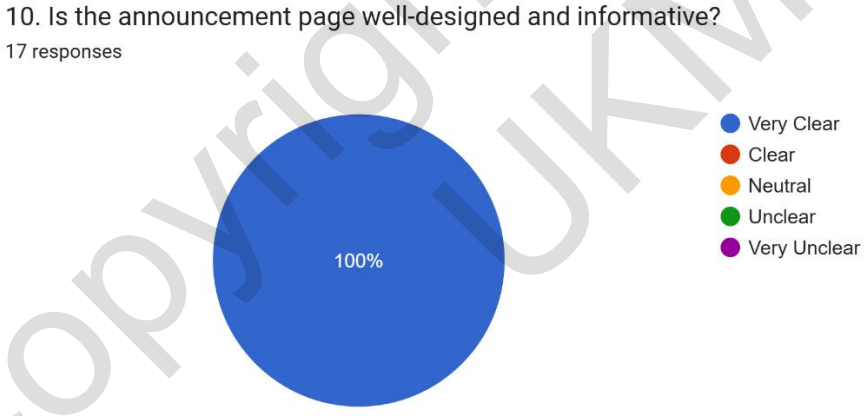


Figure 15 Announcement Page Design Feedback

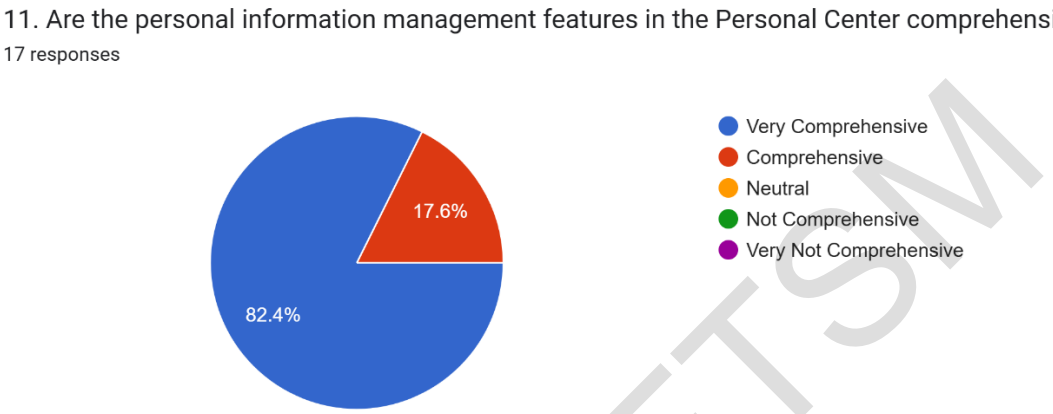


Figure 16 Personal Information Management Features Feedback

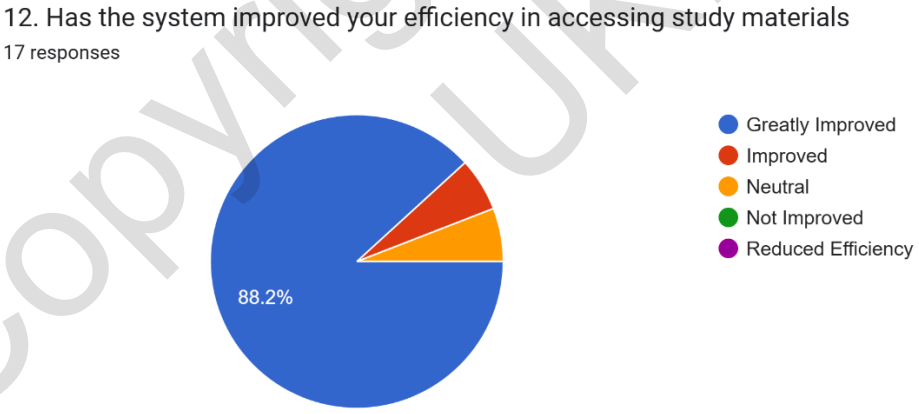


Figure 17 System Efficiency in Accessing Study Materials Feedback

13. How would you rate your overall experience with the UKM BookJunction system?
17 responses

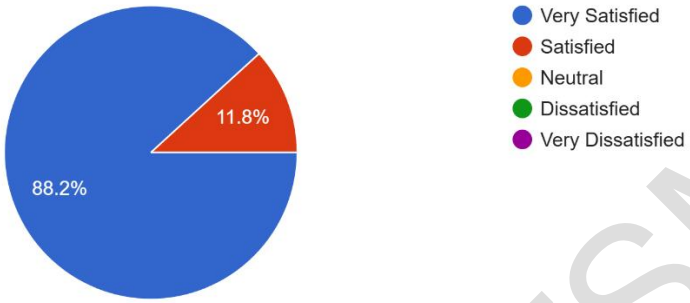


Figure 18 Overall User Experience Feedback

14. Does the system meet your expectations?
17 responses

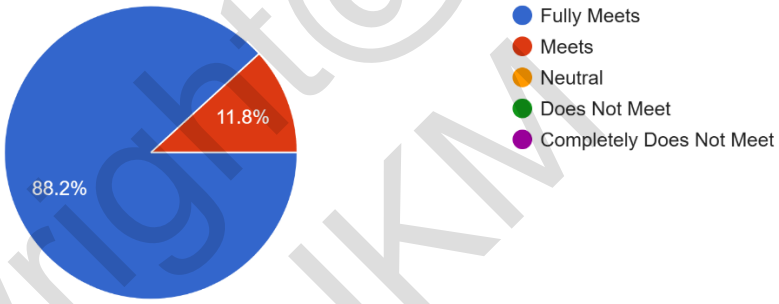


Figure 19 System Meeting Expectations Feedback

15. Would you recommend UKM BookJunction to other students?
17 responses

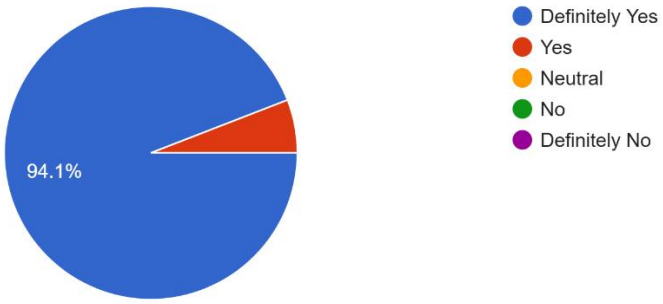


Figure 20 Feedback of Recommend

There are 17 users who participated in the test. The test plan for the UKM BookJunction platform is based on the functional and non-functional requirements outlined in the requirement specifications. These requirements ensure the system meets the needs of FTSM students by providing essential features for book purchasing, order management, and user engagement. The functional and non-functional tests cover the following aspects. In terms of functional testing, the first is white-box testing, which includes unit testing of key modules, such as user authentication syste nms and database queries. The second is black-box testing, which focuses on end-to-end functionality, including user interaction with shopping carts and the checkout process.

FUTURE CONCEPTION OF APPLICATION

In conclusion, the development and deployment of the UKM BookJunction platform demonstrate technical proficiency and a strong understanding of user needs. The project emphasizes the importance of iterative development and continuous feedback to achieve a functional and reliable solution. While there are areas for improvement, the platform's current capabilities mark a significant step forward in enhancing the academic and personal experiences of FTSM students. Future efforts should aim at expanding the platform’s scope and integrating cutting-edge technologies to sustain its competitive edge and utility.

The UKM BookJunction platform successfully fulfills its primary objective of providing a robust and efficient e-commerce solution tailored to the needs of FTSM students. By focusing on user-centric design and seamless integration of functionalities, the platform addresses challenges associated with book purchasing and trading within the academic environment. Through systematic planning, iterative development, and rigorous testing, the platform ensures key functionalities such as user registration, book search, personalized recommendations, shopping cart management, and real-time customer support are effectively implemented.The functional and non-functional testing phases played a critical role in identifying and addressing issues related to system performance, security, usability, and reliability. The integration of black-box and white-box testing methods ensured that both individual components and the platform as a whole meet the desired quality standards. Additionally, the inclusion of features such as secure payment processing and data encryption aligns with industry best practices for privacy and security.

ADVANTAGES OF THE DEVELOPED SYSTEM

The functional and non-functional testing phases were instrumental in ensuring system performance, security, usability, and reliability. The integration of black-box and white-box testing methods validated both individual components and the system as a whole, meeting the desired quality standards. Secure payment processing and data encryption further reinforce the platform's alignment with industry best practices. These features collectively enhance user confidence and engagement, offering a seamless and intuitive experience for students.Moreover, the platform's ability to provide personalized book recommendations based on academic preferences adds significant value to its functionality. The scalability of the system, coupled with its robust architecture, ensures its capability to handle a growing user base, reflecting a well-thought-out design approach.

LIMITATIONS OF THE DEVELOPED SYSTEM

Despite its achievements, the UKM BookJunction platform has certain limitations. While the current implementation effectively caters to the specific needs of FTSM students, it is not yet optimized for a broader audience. Additionally, the lack of advanced features such as AI-driven recommendation engines or predictive analytics constrains its potential for future enhancements. Further, administrative tools could benefit from more refined functionalities to support complex operational requirements.

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