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Campus Second-Hand Textbook Trading Platform based on Vue 3 and Spring Boot

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Abstract

The campus used textbook exchange program is essential for meeting the needs of students in terms of accessible educational materials, resource recycling, and building relationships with the campus community. With the help of cutting-edge front-end and back-end technologies like Vue 3, Spring Boot, and MySQL, this platform offers students a practical and affordable way to exchange and buy textbooks. It promotes a feeling of community among students and enables smooth transactions with its intuitive interface and effective management features. This essay examines the platform's architecture, design tenets, and application possibilities, emphasizing how well it might support sustainable development and resource sharing on campus.

Keywords

Campus; Second-hand Textbook; Trading Platform; Vue 3; Spring Boot; MySQL; Resource Recycling.

1. Introduction

In today's educational environment, with the increasing demand for academic resources, students face economic pressure in acquiring necessary textbooks. Especially at the higher education level, textbooks are frequently updated, and new ones come at considerable prices. Addressing this issue, campus second-hand book trading becomes crucial, as it not only alleviates students' financial burden but also promotes resource reuse, aligning with sustainable development principles. However, at Liaoning University of Science and Technology, despite the growing demand for second-hand textbooks, there lacks an efficient platform to facilitate book transactions. Currently, students mainly rely on social media and ad hoc offline transactions to buy or sell second-hand books, which are not only inefficient but also prone to information asymmetry and security risks. In light of this, this study aims to design and implement a campus second-hand textbook trading platform, based on WeChat Mini Program for easy access and operation by students. By creating a tailored online platform for Liaoning University of Science and Technology, this project aims not only to simplify the buying and selling process and enhance transaction security and transparency but also to promote resource sharing and sustainable development within the campus through this innovative solution. Furthermore, this paper will explore the feasibility and benefits of using modern frontend and backend technologies such as Vue 3, Spring Boot, and microservices architecture to develop this platform. Through this research, we hope to provide an effective technical solution for the circular economy model within the campus and offer practical experience for other higher education institutions to emulate.

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2. Main Technologies

2.1 Frontend Technologies

2.1.1 Vue 3

Description: Vue 3 is a progressive JavaScript framework designed for building user interfaces, particularly suited for developing dynamic single-page applications (SPAs)[2]. As the latest version, it offers faster rendering speed and smaller bundle size. Features: Vue 3 introduces a reactive system and Composition API, significantly enhancing development efficiency and application performance. The reactive system, rewritten using Proxy objects, allows for finer and more efficient data change detection. The Composition API improves code organization, making functionalities more modular and aiding in handling complex state management and logic reuse in large projects.

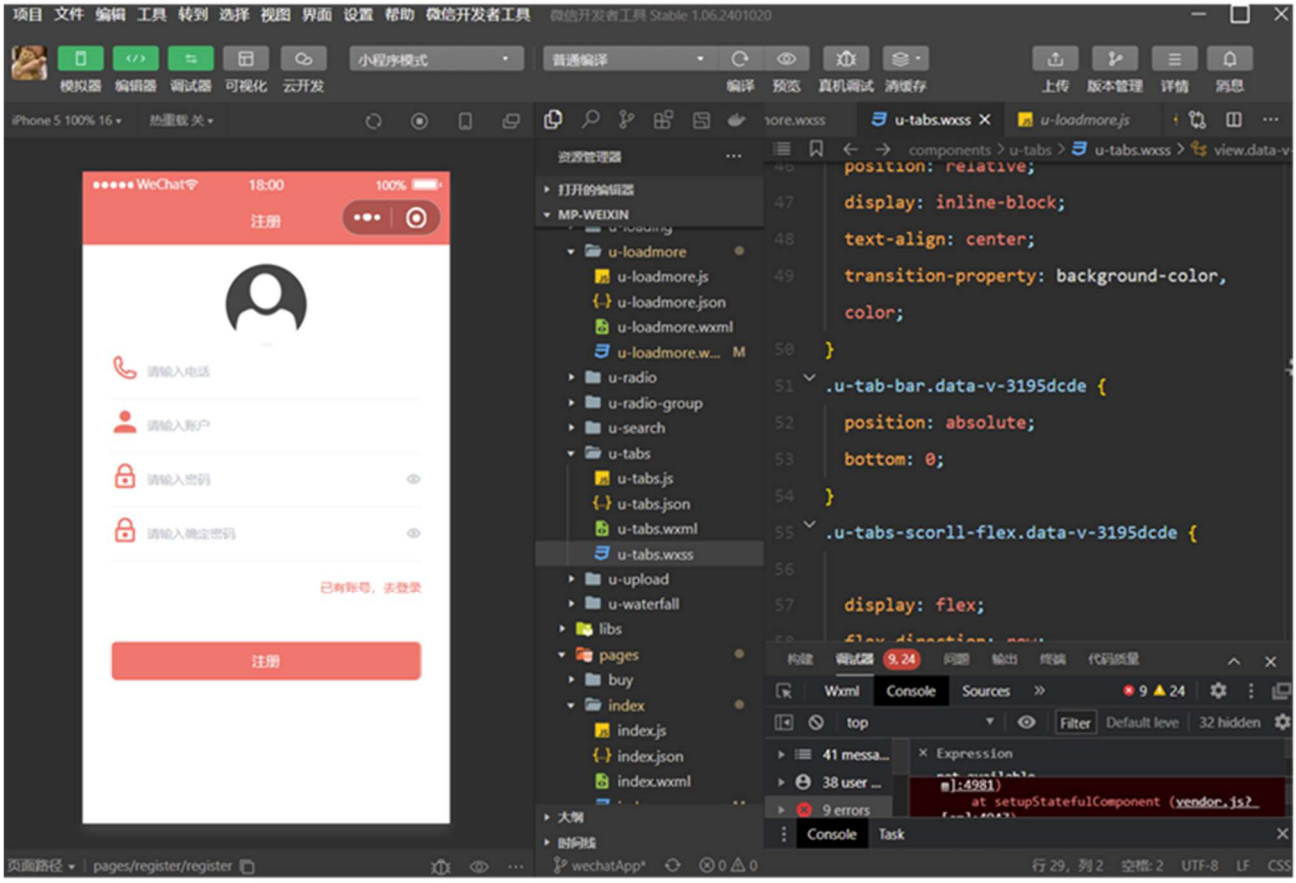

Figure 1. Mini program construction

Vite is a novel frontend build tool that provides fast cold start and hot module replacement (HMR) functionality[3]. It achieves rapid reloading by leveraging native ES module imports supported by modern browsers, optimizing the development experience. Application: Vite's rapid compilation significantly reduces the project development cycle, enabling developers to instantly see the results of code changes without waiting for lengthy build processes typical of traditional build tools. This is particularly crucial for iterative development and debugging, facilitating quick adjustments and optimizations to the user interface. Element Plus Description: Element Plus is a UI component library based on Vue 3, offering a range of pre-designed components such as buttons, input fields, and dialogs to help developers build high-quality user interfaces rapidly. Application: In this project, Element Plus is used to swiftly develop and implement visually appealing, responsive frontend interfaces. By utilizing these ready-made components, we can save development time while maintaining consistency and responsiveness in the application interface, ensuring a favorable user experience.

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Pinia Description: Pinia serves as the official alternative to Vuex for state management in Vue.js applications. It provides a simpler, lightweight approach to storing and managing the application's global state. Advantages: Pinia's straightforward API simplifies state management, allowing developers to easily achieve data sharing across components. Its modular features are particularly suitable for large-scale projects, aiding in maintaining and tracking state changes, thereby enhancing development efficiency and application performance.

2.2 Backend Technologies

2.2.1 Spring Boot

Spring Boot[4] is an open-source Java-based framework specifically designed for creating microservices. Its primary advantages include: Automatic configuration: Spring Boot offers automatic configuration capabilities, enabling the automatic configuration of Spring applications based on application dependencies. Stand-alone execution: Spring Boot applications can run as standalone processes without requiring external containers, facilitating deployment and management. Integration capabilities: Spring Boot integrates well with other technologies such as Spring Cloud and Spring Data, enabling the rapid construction of complex microservices architectures. These advantages make Spring Boot the preferred framework for developing microservices applications, greatly simplifying backend development and deployment processes. Java Java is a cross-platform programming language known for its platform independence and strong typing system. The reasons for choosing Java as the backend programming language include: Stability: Java is known for its high stability, with a mature ecosystem and widespread community support, capable of meeting the needs of large-scale projects. Widespread application: Java is widely used in enterprise application development, large-scale systems, and cloud computing, demonstrating strong applicability and scalability.

2.3 Backend Technologies

2.3.1 MySQL

MySQL is a popular relational database management system (RDBMS) widely used in applications of various scales[5]. Below is a detailed introduction and application scenario of MySQL: Description: MySQL is an open-source relational database management system that supports multi-user, multi-threaded SQL database servers. MySQL's architecture adopts a client-server model, where clients communicate with the server via TCP/IP protocol to execute SQL queries and updates. Advantages: Maturity and stability: MySQL is a mature and stable database system widely used in various types of applications globally. High performance: MySQL boasts excellent performance, capable of handling large-scale data and high-concurrency access. Scalability: MySQL supports technologies such as master-slave replication, partitioned tables, and clustering, enabling horizontal and vertical scalability. Flexibility: MySQL supports multiple storage engines (such as InnoDB, MyISAM, etc.), allowing users to choose the appropriate storage engine based on specific requirements. Applications: User data storage: In the campus second-hand textbook trading platform, MySQL can be used to store user information, such as account information for registered users, transaction records, etc. Product information management: MySQL can be used to store information about second-hand books, including book names, authors, prices, statuses, etc. Transaction record storage: MySQL can be used to store transaction records corresponding to user-posted second-hand book information, including purchase orders, sales orders, etc. Data association and querying: MySQL supports SQL query language, capable of executing complex data association and querying operations, providing flexible data processing capabilities for the campus second-hand textbook trading platform. Transaction processing and security: MySQL supports transaction processing, ensuring data consistency, integrity, and durability. MySQL provides rich security features, including user authentication, access control, data encryption, etc., ensuring data security and privacy.

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3. Functional Modules and System Implementation

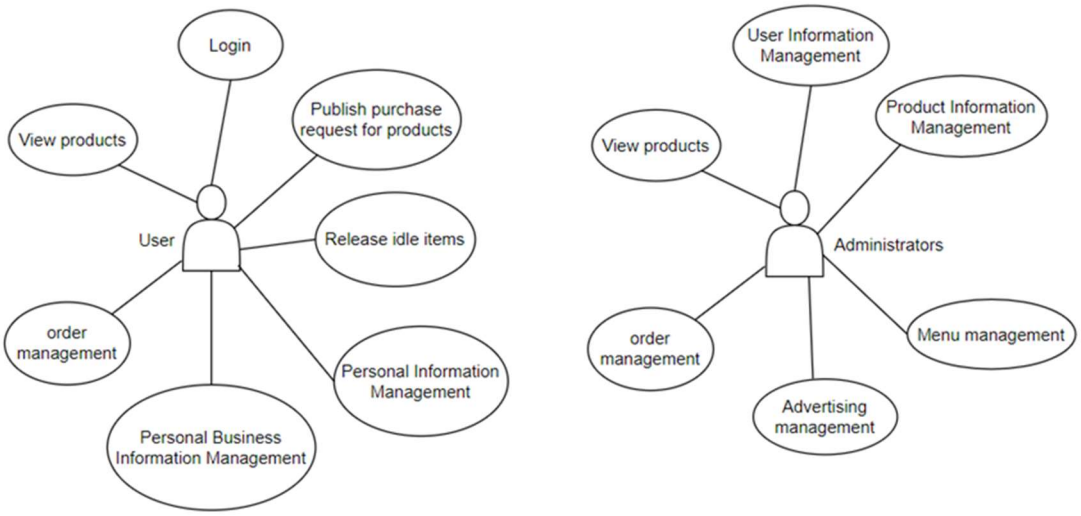

Figure 2. System Use Case Diagram

3.1 Main Features

3.1.1 Backend Management System Basic Features

(1) Administrator Management:

Manage user information in the backend system, including CRUD operations.

Set and modify administrator permissions.

Reset administrator passwords.

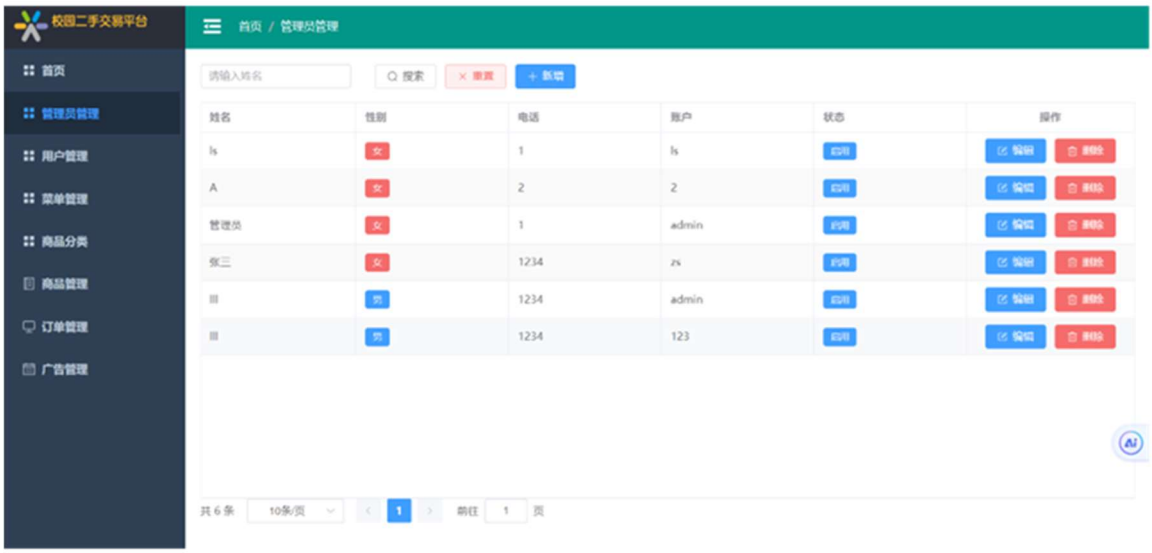

Figure 3. Administrator interface

(2) User Management:

Manage registered users of the mini-program, including CRUD operations for user information.

Reset user passwords.

Set account status (normal/disabled).

(3) Menu Management:

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Assign administrator functions and customize the management menu displayed for different administrators.

(4) Product Classification:

Manage classification information for second-hand books.

Perform CRUD operations on book categories.

(5) Product Management:

Display and manage second-hand book information uploaded by users of the mini-program. Perform CRUD operations on information uploaded by users.

Set recommended second-hand books for the mini-program homepage.

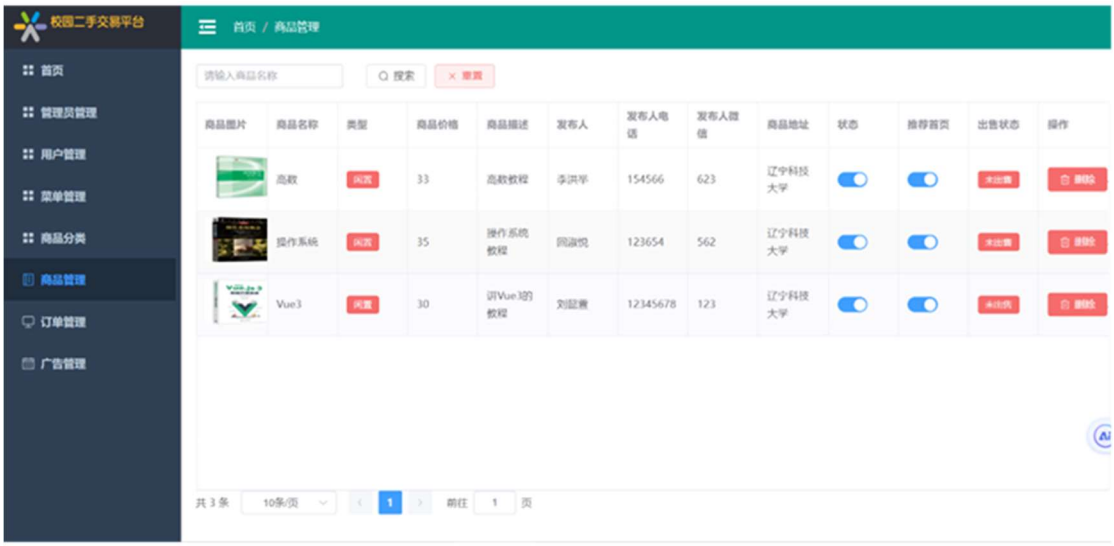

Figure 4. Product management interface

(6) Order Management:

Display successful transaction records in the mini-program.

(7) Advertisement Management:

Set and manage advertisement information for the mini-program homepage.

(8) Complaint Management:

Receive and handle user complaints about second-hand book information.

Provide a complaint information display and handling interface.

3.1.2 Mini-program Basic Features

(1) Homepage:

Display advertisements in a carousel and recommend second-hand book information in a waterfall layout.

(2) Idle Interface:

Display all users' posted second-hand book idle information.

Provide search functionality for users to search for relevant second-hand book information by keywords.

(3) Publishing Interface:

Users can upload basic information about second-hand books.

(4) Buying Interface:

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Display all users' posted second-hand book buying information.

Provide search functionality for users to search for relevant second-hand book buying information by keywords.

(5) Personal Center:

After logging in, users can view their posted second-hand book idle information, buying information, favorite information, purchase orders, and sales orders.

Provide a password modification function to ensure account security.

3.2 Program Architecture and Design Philosophy

(1) Frontend-Backend Separation:

Separate the frontend user interface from the backend server logic to achieve high decoupling and independent development, testing, and maintenance.

The frontend utilizes Vue 3, Element Plus, Pinia, etc., to build dynamic and responsive user interfaces.

The backend is based on Spring Boot and Java, handling business logic, data processing, and storage.

(2) Microservices Architecture:

The backend adopts a microservices architecture, with each service responsible for a specific functional module, such as user management, product management, order processing, etc. Enhances system maintainability and scalability, making it easy to add new features and services.

(3) Database Design:

Utilize MySQL relational database management system.

Design rational data models and table structures to ensure data integrity and optimize performance.

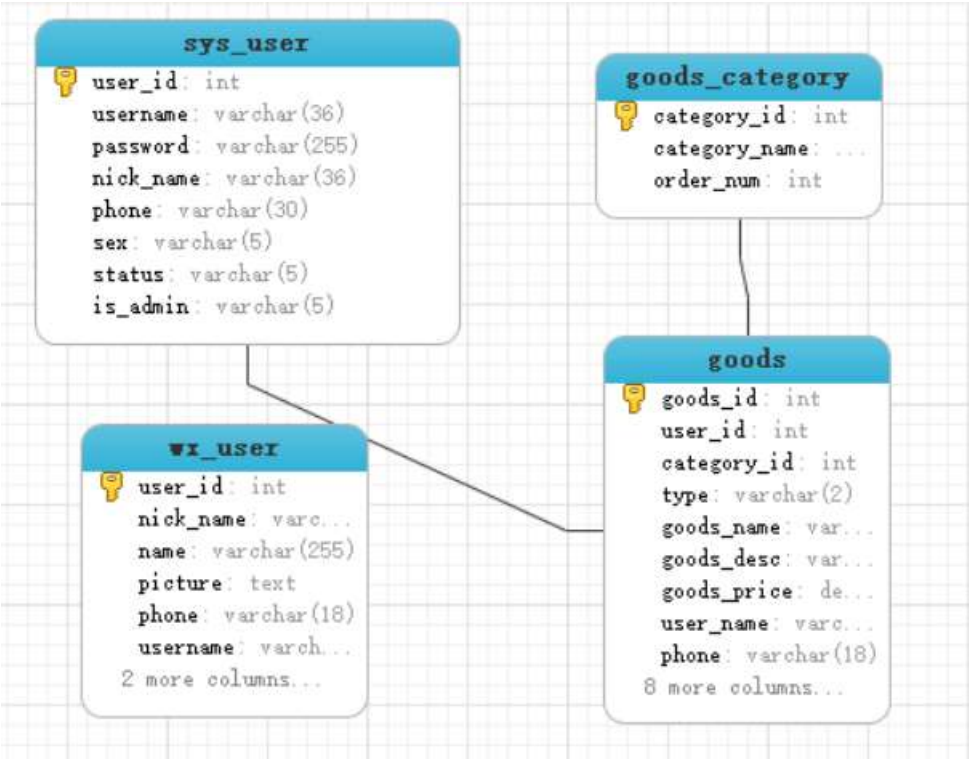

Figure 5. Database design

4. Application Prospects

The campus second-hand textbook trading platform has vast application prospects, mainly reflected in the following aspects:

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(1) Meeting Student Needs:

Addressing the issues students face when purchasing textbooks at the start of each semester, the campus second-hand textbook trading platform provides a convenient channel for students to acquire required textbooks at lower costs, thereby alleviating financial burdens.

(2) Promoting Resource Recycling:

Through the second-hand textbook trading platform, students can transfer textbooks they no longer need to other students who require them, facilitating the recycling of educational resources and reducing textbook waste, aligning with the principles of sustainable development.

(3) Strengthening Campus Community Connections:

The campus second-hand textbook trading platform not only serves as a trading platform but also fosters a community for student interaction. Students can exchange learning experiences on the platform, enhancing campus community connections and fostering a spirit of mutual assistance.

(4) Enhancing Learning Efficiency:

Students can access required textbooks and related study materials more conveniently through the platform, which helps improve learning efficiency and knowledge utilization.

5. Conclusion

In summary, the campus second-hand textbook trading platform provides an ideal platform for students to buy, sell, and exchange textbooks, offering advantages such as convenience, affordability, and environmental sustainability. Through technological innovation, the platform will play a significant role in meeting student needs, promoting resource recycling, strengthening campus community connections, and enhancing learning efficiency. It holds positive implications for promoting campus resource sharing and sustainable development.

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