Software Design Document

1. Introduction

This document details the design plan of the "Campus Mart" application, a campus-specific platform focused on efficient, reliable, and environmentally friendly circulation of idle items and campus life services. Its core objective is to address pain points such as underutilized idle resources, lack of trust in close-range transactions, and high transaction costs among teachers and students, while promoting the concept of green and sustainable living.

1.1 Project Goals

- Build an exclusive campus trading environment that supports dual-mode circulation of idle items ("Sell" + "Give Away"), meeting diverse needs for fund recovery and charitable sharing.
- Establish a high-trust system through campus identity verification to reduce transaction risks and enable logistics-free transactions within a 1-kilometer radius.
- Provide intelligent search, official notification push, and other functions to improve information access efficiency and reduce the risk of missing important campus updates.
- Create an economical and convenient campus trading ecosystem with a low commission model (1%, minimum 1 yuan) to lower transaction costs.

1.2 Project Scope

- **Target Users**: College students (graduates, freshmen, students of all grades), faculty, and staff, who must complete campus identity verification (student/staff ID, campus email binding).
- **Core Coverage**: Release of campus idle items (for sale/giveaway), browsing and searching, private messaging, order management, collection and evaluation, and push of official campus notifications.
- **Out of Scope**: Off-campus commercial organization entry, cross-border transactions, large-sum financial services (installment payments), and transactions outside campus scenarios.

2. Requirements Specification

2.1 User Requirements

- Complete registration and identity verification through school name, student/staff ID, and campus email; support account-password login with clear feedback prompts upon successful login/registration.
- Publish idle item information, including uploading 1-3 images, filling in name, description, condition (new/used degree), price (for sale mode), and selecting "Sell" or "Give Away" mode.
- Browse products via keyword search, category filtering, and sorting by release time to quickly locate target items.
- Communicate transaction details with product publishers through the built-in private messaging function and receive transaction reminders (e.g., inquiry replies, order notifications).
- Save favorite products and manage personally published items (edit, take down, delete) and historical orders (check transaction status).
- Receive official campus notifications (e.g., dormitory maintenance, event announcements) with intelligently classified notification information to avoid information redundancy.
- Evaluate transaction partners after completing transactions and view the historical evaluation records of product publishers.

2.2 Functional Requirements

- **User Authentication Module**: Supports campus identity binding (student/staff ID, school name, campus email), account-password login/registration, and personal profile (nickname, avatar) management to ensure user identity authenticity.
- **Product Management Module**: Enables publishing (filling in basic information, uploading images, selecting "Sell/Give Away" mode), editing, taking down, and deleting products; provides product category tags (e.g., textbooks, electronic products, daily necessities) for easy filtering.
- **Search and Recommendation Module**: Offers keyword search, filtering and sorting by release time, price, and category; displays product lists on the homepage in a waterfall layout sorted by release time to improve browsing efficiency.
- **Messaging Module**: Features built-in real-time private messaging (supports text and images) to record communication history; pushes transaction reminders (inquiry replies, order status changes) and official notifications to ensure timely information delivery.
- **Transaction Process Module**: Buyers can initiate transaction inquiries, and sellers can check transaction status in "My Orders"; after offline transactions are

completed, buyers click "Confirm Receipt" to update the order status to "Completed"; the platform charges sellers a 1% transaction commission (minimum 1 yuan) with no logistics fees.

- **Collection and Evaluation Module**: Supports saving and un-saving favorite products; both parties can rate and leave comments after transaction completion, with evaluation records publicly accessible.
- **Notification Management Module**: Intelligently classifies official campus notifications and provides a notification search function; pushes reminders for important events (e.g., transaction progress, campus activities) to avoid missing key information.

3. Overall Design

3.1 System Architecture

Adopts a three-tier client-server-data layer architecture to ensure system stability and scalability:

- **Client Layer**: Native Android application (developed based on Android Studio) compatible with mainstream Android devices, providing an intuitive user interface.
- **Server Layer**: Matches the front-end technology stack, responsible for processing business logic (transaction processes, identity verification, notification pushes), data validation, and third-party service integration (e.g., message pushes, cloud testing).
- **Data Layer**: Stores user information (identity verification data, personal profiles), product data (images, descriptions, transaction modes), transaction records (order status, commissions), and message/notification data to ensure data security and efficient access.

3.2 Primary Functions

- **Core Functions**: Campus idle item transactions ("Sell" + "Give Away"), campus identity verification, real-time private messaging, and official campus notification pushes.
- **Supporting Functions**: Intelligent search and filtering, product collection, transaction evaluation, order management, and personal published content management.

4. User Interface Design

The interface follows the design principle of "simplicity, intuition, and alignment with campus scenarios," with core layouts and interactions as follows:

- **Login/Registration Pages**: Clear form layouts with distinct "Login" and "Register" buttons. The registration page includes fields for "School Name, Student/Staff ID, Username, Password, Verification Code," while the login page includes "Username, Password." Clear feedback prompts are displayed upon successful login/registration.
- **Homepage**: Features a search bar at the top, category navigation below, and a waterfall layout in the middle displaying product cards (including product name, condition, publisher, and thumbnail); a prominent "Publish" button is fixed at the bottom for quick product release.
- **Bottom Navigation Bar**: Includes four core entries—"Home, Categories, Messages, Mine"—covering main user operation scenarios.
- **Product Detail Page**: Displays product images on the left and product price (or "Give Away" label), detailed description, and publisher information on the right; "Contact Seller" and "Save" buttons are located at the bottom. Supports viewing the publisher's historical evaluation records.
- **Posting Page**: Divided into "Basic Information" and "Detailed Description" sections. Allows filling in product name, condition, price (for sale mode), uploading 1-3 images, selecting "Sell/Give Away" mode, and a "Submit" button at the bottom; a feedback prompt is displayed after successful posting.
- **Personal Center**: Integrates four core modules—"My Products" (manage published content, support editing, deletion), "Collection List" (view/unsave items), "Historical Purchases" (view past orders), and "Basic Information" (update nickname, avatar).
- **Messages Page**: Displays private message records in a conversation list format, including contact nickname, latest message content, and time; entering the conversation page enables real-time text and image communication with support for quick sending of common phrases.
- **Notification Page**: Features a search bar at the top and displays official campus notifications (e.g., dormitory management, class teacher announcements) by category below, with each notification including the issuer, content, and time for clear accessibility.
- **Animations and Color Scheme**: Interface animations conform to mainstream aesthetics with smooth navigation transitions and no lag; the main color palette uses clean and bright tones, highlighting interactive buttons (e.g., "Publish," "Confirm") to improve operational recognition.

5. Key Technologies

5.1 Primary Technologies

- **Front-end Development**: Java + Android Studio, adopting a responsive layout to adapt to Android devices of different screen sizes, ensuring interface consistency and stability.
- **Back-end Technology**: Matches the front-end technology stack to build RESTful APIs, responsible for business logic processing, user identity verification, and data interaction; integrates message push services to implement transaction reminders and official notification delivery.
- **Data Storage**: A structured database stores user identity information, product data, transaction records, and evaluation information; supports image storage services for uploading and displaying product images.
- **Third-party Services/Tools**: Testin cloud testing platform (compatibility and performance testing); security and automated testing tools (high-concurrency and security testing); campus identity verification interface (connecting to school information to complete student/staff ID authentication).

5.2 Technical Challenges

- **Campus Identity Verification Integration**: Needs to adapt to identity verification rules of different schools to ensure the authenticity of student/staff IDs and campus emails, reducing integration complexity through standardized interfaces.
- **Transaction Trust and Security**: Reduces fraud risks through "campus identity binding + public evaluation system"; adopts keyword filtering and manual sampling mechanisms to review product release content and avoid false information.
- **High-concurrency Processing**: During peak periods (e.g., graduation season, freshman enrollment), the surge in product releases requires optimizing database read/write performance and server load to ensure stable system operation.
- **Device Compatibility**: The diversity of Android device models requires responsive layouts and cloud platform testing to resolve installation, operation, and display issues on different models.

6. Testing and User Experience Analysis

6.1 Cloud Platform Testing

Testing was conducted on the third-party cloud platform Testin, focusing on three core dimensions: functionality, compatibility, and performance:

- **Functional Testing**: Verified the integrity and accuracy of core processes (registration/login - product publishing - search and browsing - private messaging - order completion - evaluation) to ensure no functional abnormalities in each module.
- **Compatibility Testing**: Covered mainstream Android devices; test results showed smooth operation and good interface adaptation on most models, though some models experienced installation or execution failures, which have been targeted for optimization.
- **Performance Testing**: Simulated high-concurrency scenarios (e.g., concentrated product releases during graduation season) to verify system response speed; ensured page loading and message sending delays were within reasonable ranges with no lag or crashes.
- **Security Testing**: Conducted comprehensive testing using security testing tools to prevent data leakage, malicious attacks, and other risks, safeguarding user information and transaction security.

6.2 User Experience Feedback and Evaluation

- **Experience Survey Results**:
  - Interface Experience: 90% of test users reported being able to quickly locate target functions with an intuitive layout; animations were aesthetically pleasing, and navigation transitions were smooth with no noticeable lag.
  - Satisfaction Score: The average user satisfaction score reached 4.2/5, with key satisfaction points focusing on interface design, operational convenience, and campus-specific positioning.
- **Core User Feedback**:
  - Optimization Suggestions: Improve page loading speed, enrich interface style options, and add a "Visitor Mode" (browse content without logging in).
  - Functional Needs: Expand product category dimensions and optimize search accuracy.
- **Planned Improvements**: Prioritize "Visitor Mode" and "loading speed optimization" in the next phase; adjust product classification logic, refine category tags, and enhance search matching.

7. Conclusion

7.1 Project Summary

Campus Mart has successfully implemented the core needs of campus idle item circulation. Through differentiated designs such as dual-mode transactions ("Sell + Give Away"), campus identity verification, and close-range transactions, it has built an efficient and secure trading platform adapted to student life scenarios. The application has completed the development of core Android functions, covering the entire process from product publishing to transaction completion, while integrating official campus notification pushes to enhance platform practicality and user stickiness.

7.2 Achievements

- Established an exclusive campus trading ecosystem, with core functions (identity verification, sell/giveaway switching, private messaging, notification pushes) verified through testing and high functional completeness.
- Cloud platform testing confirmed good compatibility with mainstream Android devices and stable system performance under high-concurrency scenarios; user satisfaction reached 4.2/5, with 90% of users recognizing interface intuitiveness and operational smoothness.
- Implemented a low-commission, logistics-free transaction model that aligns with the consumption habits and needs of student groups.

7.3 Challenges

- Cross-school adaptation of campus identity verification is highly complex, requiring separate communication with each school for interface permissions and a long adaptation cycle.
- Some Android models have compatibility issues, requiring continuous resource investment for model adaptation and optimization.
- High-concurrency scenarios during peak seasons (graduation season, enrollment season) place higher demands on system performance, necessitating further optimization of database and server architecture.

7.4 Future Improvement Directions

- **Function Expansion**: Add a "Campus Services" category (e.g., tutoring, package collection) to expand platform service boundaries.
- **Experience Optimization**: Launch "Visitor Mode" and improve page loading speed; enrich interface themes to meet personalized needs.
- **Technology Upgrade**: Optimize product recommendation accuracy using AI algorithms, pushing matched products based on user browsing history, grade, and

major; integrate campus card payment to support online settlement and enhance transaction convenience.

- **Ecosystem Improvement**: Deepen official campus cooperation to expand the coverage of notification pushes; establish a more comprehensive product review mechanism to further enhance transaction security.