# Web-Based Second-Hand Marketplace

Shi Zeyu, Elankovan A. Sundararajan

Faculty of Information Science & Technology
Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

**ABSTRAK**

Tesis ini membentangkan pembangunan platform perkhidmatan terpakai dalam talian yang direka khusus untuk komuniti pelajar UKM. Trend perdagangan terpakai yang semakin meningkat di kalangan pelajar universiti didorong oleh permintaan untuk penggunaan yang berpatutan dan mampan. Walau bagaimanapun, platform sedia ada dan kaedah tradisional selalunya tidak mempunyai organisasi, keselamatan dan kebolehcapaian yang diperlukan untuk transaksi berasaskan kampus yang cekap. Banyak platform gagal menggabungkan elemen komuniti interaktif, pilihan pembayaran selamat dan antara muka mesra pengguna. Had ini mengurangkan penglibatan pengguna, meningkatkan risiko penipuan dan mengurangkan keberkesanan keseluruhan proses perdagangan. Untuk menangani cabaran ini, Platform Perkhidmatan Terpakai UKM telah dibangunkan dengan tumpuan untuk menggalakkan interaksi komuniti, mewujudkan sistem reputasi yang telus, dan meningkatkan pengalaman pengguna melalui reka bentuk intuitif. Sistem ini mengikut model pembangunan air terjun berstruktur, merangkumi analisis keperluan, reka bentuk sistem, pelaksanaan, ujian dan penggunaan. Ciri utama termasuk antara muka responsif yang dibina menggunakan Vue.js dan Spring Boot, menawarkan fungsi penuh untuk kedua-dua pengguna dan pentadbir. Platform ini menyepadukan berbilang lapisan ujian untuk memastikan prestasi dan kebolehgunaan. Secara keseluruhan, sistem ini memberikan penyelesaian yang selamat, mesra pengguna dan praktikal untuk perdagangan terpakai di kampus UKM. Melalui ciri komuniti, mekanisme reputasi yang telus dan teknologi pembangunan moden, platform ini meningkatkan kepercayaan, menggalakkan kemampanan dan meningkatkan pengalaman pengguna.

**Abstract**

This thesis presents the development of an online second-hand services platform specifically designed for the UKM student community. The growing trend of second-hand trading among university students is driven by the demand for affordable and sustainable consumption. However, existing platforms and traditional methods often lack the necessary organization, security, and accessibility required for efficient campus-based transactions. Many platforms fail to incorporate interactive community

elements, secure payment options, and user-friendly interfaces. These limitations reduce user engagement, increase the risk of fraud, and diminish the overall effectiveness of the trading process.To address these challenges, the UKM Second-hand Services Platform was developed with a focus on promoting community interaction, establishing a transparent reputation system, and enhancing user experience through intuitive design. The system follows a structured waterfall development model, encompassing requirements analysis, system design, implementation, testing, and deployment.Key features include a responsive interface built using Vue.js and Spring Boot, offering full functionality for both users and administrators. The platform integrates multiple layers of testing to ensure performance and usability. Overall, the system delivers a secure, user-friendly, and practical solution for second-hand trading within the UKM campus. Through community features, transparent reputation mechanisms, and modern development technologies, the platform enhances trust, promotes sustainability, and improves the user experience.

## 1.0 INTRODUCTION

With the spread of the concept of circular economy and the popularity of social media in the world, there has been an increased growth in the global supply and consumer demand for second-hand products (Han et al.,2022). More specifically, sales of used clothes, shoes and accessories are expected to grow from $24 billion in 2018 to $51 billion in 2023. On top of that, the resale of phones was $19 billion in 2017 and is expected to rise to $44 billion by 2026 (Han et al.,2022). This trend aligns with a broader societal shift towards sustainable consumption, where the reuse and recycling of goods are increasingly prioritized. For students, particularly those on university campuses, second-hand trading provides a valuable solution to obtain essential items at affordable prices or to sell unused goods to recoup some value. This approach not only promotes a culture of sustainability but also offers economic benefits to students, who often operate on limited budgets. For the international students, the demand for second-hand goods is more obvious, because they move around usually and are often constrained by their budgets (Han et al.,2022).

,Based on the fact that there are many idle items on campus and increasing the circulation rate of items, this project aims to establish a campus Internet platform that can conduct second hand goods trading, shopping on the basis of learning and life, and discussion on consumption concepts to fill the gap in the second hand commodity

trading platform on campus, meet students' basic shopping needs, and help students establish a sustainable consumption concept and psychology of thrift, green, and environmental protection (Wei et al.,2023).Traditional methods of buying and selling—such as on-campus posters, social media groups, or word-of-mouth often lack the organization, security, and reach required for effective transactions. Moreover, these informal channels can limit the discoverability of available goods, reducing the chances of timely sales or purchases.today's digital era, data related to real estate has gained increasing importance forcompanies and industries in Malaysia. Managing and analyzing this data has become a critical task. However, Malaysia lacks advanced real estate datavisualization tools, particularly those using cloud computing, resulting in low data analysis efficiency. To address this gap, this paper proposes the development of a Cloud Computing Service-Based Real Estate Data Chart Visualization Management System. This system leverages cloud technology to handle data processing, storage, and online visualization, improving the technical efficiency of real estate data management.

## 2.0 LITERATURE REVIEW

The increasing demand for affordable, sustainable shopping options has led to a rise in second - hand marketplaces, especially among students. An increasing number of young people and college students are buying, and even selling, used goods, a trend that not only enhances the utilization of products but also reflects their evolving consumption behavior — favoring cost - effective but high - quality items over concerns about buying used stuff(Jiang, 2024).

The secondhand goods market has experienced significant growth in recent years, influenced by factors such as sustainability awareness, economic considerations, and evolving consumer preferences (Bank, 2024). This trend highlights the increasing demand for platforms that facilitate secondhand trading, particularly in campus environments where affordability and environmental consciousness play crucial roles.Building on insights from this research, the proposed project introduces a robust platform for student-driven second-hand trading.

The goal is to empower students with an accessible, trustworthy marketplace for buying and selling used items, fostering a community focused on affordability and sustainability while reducing the financial and environmental impacts of consumerism.

In today's market, the demand for sustainable and affordable shopping options has led to a growing interest in second-hand goods, particularly among students. This rise

in second-hand purchasing helps students save money, reduce waste, and promote sustainability.

Accord to Research on the Practice of College Students Second Hand Trading Platform(Wei et al., 2023),663 college students in a public university of science and engineering were selected as the research objects, and the second-hand consumption of college students was investigated through online questionnaires (designed by the first author of this article). The following results were obtained. The survey is for college students of all grades in order to understand the psychology of students at different ages. The number of respondents in different grades is relatively average.

The respondents'willingness to trade second-hand goods is shown in Figure 2.1 and Table 2.1. 41.03% of the respondents directly expressed their willingness, 51.28% of the respondents need to be neutral depending on the situation, and only a small number of people are unwilling to purchase second-hand goods. As shown in the figure, 89.74% of the respondents are willing to choose second-hand trading of books such as professional textbooks and postgraduate entrance examination materials, 51.28% and 41.03% of the respondents choose electronic equipment and transportation equipment respectively, and the remaining 17.95% of the respondents choose household goods. On the one hand, due to family economic reasons, it is the best choice to be economical and affordable to buy the goods you need. Books have great advantages in this respect. First, they are affordable. At present, compared with the genuine physical bookstores, the genuine books are more expensive, the use of books by college students is low, the reuse rate is high, and the books used are also similar. And second-hand old books really solve this problem. Consumers can buy genuine books at low prices. Second, environmental protection and energy conservation. The market of second-hand books is the embodiment of resource reuse. The cost of second-hand bookstores is relatively low and there is considerable room for interest. The university campus covers a large area and is not easy to transport. Electronic products are generally expensive, but many people pursue the update and iteration of new products, so there is a considerable second-hand market for transportation equipment and electronic equipment. On the

other hand, life products are particular, and few college students choose second-hand trading.

## 3.0 METHODOLOGY

The UKM Second-hand Service Platform aligns with the university's strategic goals of promoting sustainability and fostering a community-driven economy. By providing a convenient space for students to trade second-hand items, the platform encourages sustainable consumption while offering financial benefits to those with limited budgets.

Designed for seamless cloud integration, the system ensures scalability, reliability, and real-time accessibility across multiple devices. Leveraging modern technologies such as SpringBoot, MySQL, and AWS Cloud, it creates a secure and efficient environment for both transactions and data management.

The platform improves traditional trading by offering a simple, organized, and user-friendly design. Features such as secure authentication, order status tracking, and community interaction enhance the user experience and resolve common issues like, inefficient interfaces, and low engagement found in current systems.

### 3.1 Needs Analysis

The needs analysis phase involved understanding the pain points of traditional word learning and identifying user expectations. Most learners find rote memorization tedious and ineffective. To address this, a prototype of the game platform was sketched and presented to language learners and educators for feedback. Interviews with

experienced educators revealed the need for structured quizzes, engaging visuals, and adaptive difficulty levels. Based on this input, key gameplay features such as boss battles, progress tracking, and real-time feedback were prioritized. Comparative analysis with applications like Duolingo and Memrise further informed requirements related to personalized pathways and competitive mechanics.

**3.2 Conceptual Design and Architecture**

To comprehensively identify user requirements for the UKM Second-Hand Services Platform, questionnaires were employed as the primary data collection method. The survey covered areas such as prior experience with second-hand platforms, concerns regarding transaction security, and preferences for item categories and platform features, yielding valuable insights. Further understanding was supported by informal discussions with members of the UKM community, including students and staff, to explore their specific needs and expectations. (Refer to Appendix A for detailed questionnaire responses and feedback.)

A user requirement questionnaire was distributed to gather insights into the behaviors and preferences of potential users for the UKM Second-Hand Trading Platform. The findings indicate that the majority of respondents had previously engaged with second-hand trading platforms such as Mudah or Carousell, suggesting a certain level of familiarity with such services. A smaller portion had no prior experience, highlighting the importance of user onboarding and education to support new users effectively.

When asked about the most important aspects of a second-hand trading platform, the majority of respondents highlighted transaction safety, user-friendliness, and the ability to find buyers or sellers quickly as key considerations. Additionally, product variety and availability were also noted as influential factors in their decision-making process.

When it comes to product preferences, respondents showed a strong interest in electronics, books, furniture, and dorm essentials, highlighting the need for a diverse

range of categories on the platform. Regarding additional platform features, the most requested functionalities included item search and filtering, instant messaging between users, and a user review system to enhance trust and credibility. Some participants also suggested implementing a dispute resolution system to address potential transaction issues.

In terms of safety concerns, respondents had mixed opinions—some were highly concerned about the risks associated with second-hand transactions, while others expressed only slight or moderate concern. However, when asked about the necessity of identity verification for buyers and sellers, responses were divided: 40% supported verification measures, while 60% felt it was unnecessary. This split highlights the challenge of balancing trust and ease of access on the platform.

Additional suggestions for improving the platform included restricting participation to verified UKM students to ensure a secure community, introducing a "hot deals" section to feature popular or trending items, implementing secure payment methods to minimize fraud risks, and allowing users to rate and review their trading partners. Furthermore, some respondents stressed the importance of promoting sustainability by encouraging responsible trading and extending product lifespans.

These findings highlight both opportunities and challenges in developing an effective second-hand trading platform tailored to the UKM community. While the demand for safety and user-friendly features is evident, addressing concerns around trust, reliability, and market adoption will be crucial to the platform’s success.

**3.3 Requirement Specification**

Functional requirements include user registration, gameplay in boss and challenge modes, dictionary lookup, multiplayer features, and progress tracking. Non-functional requirements focus on reliability, usability, and security. The platform employs Firebase

for real-time data and authentication, with offline support to enable gameplay without internet access.

### 3.4 System Modeling

Use case diagrams were developed to visualize interactions between users, administrators, and the system. Sequence diagrams show the chronological flow from login to gameplay and progress tracking. Activity diagrams illustrate user pathways, highlighting decision points such as mode selection and dictionary use. Figure 2 will clearly show the main functions of users and administrators and the relationship between them

### 3.5 Implementation Tools

The platform was developed using Unity and C# in Visual Studio. Firebase handles cloud storage and user authentication. Minimum development requirements include an Intel i3 processor and 8GB RAM, with user-side operation requiring a dual-core processor and at least 6GB RAM.

### 3.6 Database and Algorithm Design

Figure 3 illustrates the class diagram of the UKM Second-hand Management System, showcasing the relationships and functionalities of the system's core components.

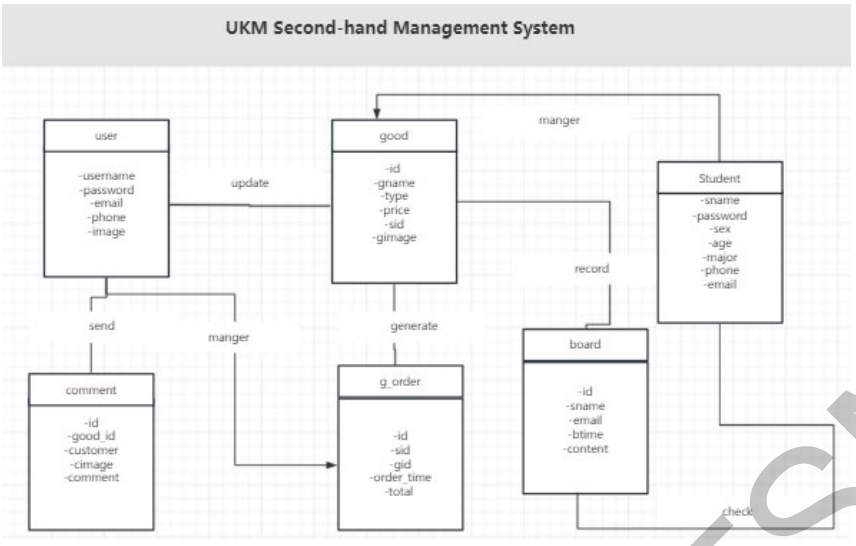


Figure 3 :Class diagram for ukm second-hand management system

## 4.0 RESULTS

### 4.1 Application Development

UKM second-hand services platform will adopt the Model-View-Controller (MVC) design architecture. According to the design architecture, the UKM second-hand services platform will be divided into the following three parts: Model, View, and Controller, which will be developed according to the different modules of the project. During the development of the UKM second-hand product service platform, the View part was initially developed, including the platform login and registration interface, user pages, and administrator pages, etc. This part was mainly developed in Unity. This

part was mainly based on web development, using the Thymeleaf template engine. The pages were HTML files, and were combined with front-end technologies such as CSS and JavaScript to achieve. Subsequently, the database will be created. Finally, the database will be connected, and the user's transaction data will be stored.

The Model-View-Controller (MVC) structure is used because it has good scalability and stability, each module is independent, has clear responsibilities, and has low dependencies at runtime. It helps to expand the application later. At the same time, it is easy to maintain and modify a module as long as it does not involve the interface between the modules; it will not have a serious impact on other parts.

**4.2 Key Modules**

4.2.2 Key Modules, Code Display

a. Main interface UI of the project

The main interface has Log in and Register buttons. Clicking Log in jumps to the login interface; new users click Register to enter the registration interface, with button clicks triggering page redirection.

b. User Registration

Registration requires: username (≤15 characters), password (>8 characters, with letters and numbers), UKM email (@siswa.ukm.edu.my), and a valid email verification code. Accounts are unique and saved; a button returns to the login page. It’s implemented via web form submission (front-end sends info, back-end verifies and saves to server database), with an email verification code sending function.

Login works similarly, via client-server message passing.

User homepage: Features a welcome banner, "easy to buy and happy to sell" concept, a "Shopping Now" button to the product list, and highlights low prices, wide range, and convenience. A notification area shows real-time updates. Code includes "client-side" (handles homepage requests) and getRecommend (personalized product recommendations).

Shopping interface: Users select products; clicking "check" lets them save for later or add to cart.

Collection page: Users view product ratings and inventory, with a "cancel" button to remove collections.

Shopping cart page: Users view items, prices, quantities, and use delete/payment functions. Code has cart (handles cart requests), payOrder (processes payments), and goodToCart (adds products to cart, checks duplicates/inventory).

User good interface: Users view, modify, and delete posted products. Code displays user products, handles image uploads, and has update/delete/add functions.

Order interface: Divided into "My Purchases" and "My Sales". Buyers view details, pay via QR code, track status, etc.; sellers manage buyer info, receipts, and order status. Back-end code handles display, status changes, deletions, and receipt uploads via related methods and services.

Personal info page: Users access/correct basic info, upload photos/QR codes, and manage passwords. Code has profileUser (handles profile requests) and updateStudentProfile (updates info, encrypts passwords).

**4.3 Issues Encountered and Solutions**

During the development of the savings trading platform, various challenges were encountered. One major challenge involved the design of the user interface, which needed to balance operational ease with visual aesthetics. How to establish a simple interface and ensure its full functionality was a major issue. Secondly, there was a balance issue between data validation, information security, and the user's experience in implementing the user registration and login modules. The functions between users and the product included querying and displaying valid data. How to ensure the rapid response of the system and the consistency of data was also a key issue in the development process. Additionally, on the official page of the officer, a large amount of data must be standardized managed, authorization control, and data security have become issues that cannot be ignored. During the development process, there were also

some technical problems, such as the low efficiency of data response between the front end and the back end, and insufficient compatibility between certain functions.

**4.4 Application Testing**

The level of testing for the project UKM second-hand services platform is acceptance testing, which identifies website defects promptly and enables the website to meet users' needs better and provide a positive user experience. It can accurately align expectations with results.

The following are specific testing objectives:

a. Test the registration function: Ensure that the user can successfully register an account and that the account will still be saved after registering. The username must not exceed 15 characters in length, and the password must be longer than 8 characters and must contain both letters and numbers. An UKM exclusive email ending with @siswa.ukm.edu.my must be used for registration.During the registration process, the email verification code needs to be entered.The verification code must be consistent with the one sent by the system to this email and must not have expired. The registered account will be saved, and the same account cannot be registered repeatedly.

b. Test login function: Ensure that registered users can successfully access the homepage of the website after entering the correct account and password.

c. Test the browsing and searching functions of the product: Ensure the completeness of product information, the page display function, and the normal loading of product images.

d. Test the collection and shopping cart functions: Ensure that the user's collected products can be added and deleted normally, and the shopping cart function can complete normal additions, deletions, modifications, queries, and order placement.

e. Test the order management function: Ensure the order creation process, receipt upload function, order status tracking, and confirmation of delivery function.

f. Test the management of personal products: Ensure that users can normally publish and manage products.

g. Test the management of user personal information: Ensure that users can complete the editing of personal information.

**4.5 Test Results**

Users completed the test, and the functionality results are compiled and presented as follows:

| **Test Case ID** | **Content of the test** | **Pass/Fail** | **Remark** |
|---|---|---|---|
| Case_001_1 | Registration function and email reception | Pass | - |
| Case_001_2 | UKM's email confirmation | Pass | - |
| Case_001_3 | Successful login of registered users | Pass | - |
| Case_002_1 | Browse and search for products to improve | Pass | |
| Case_002_2 | The collection and shopping cart functions are well-developed. | Pass | - |
| Case_002_3 | The normal use of the order | Pass | - |
| Case_003_1 | The release and management of goods | Pass | - |
| Case_004_1 | Management of personal information | Pass | - |

Table 4.1 Website Functionality Test Results

Table 4.1 summarizesthe results of functional testing conducted after user interaction with the UKM Second-Hand Trading Platform. The test cases covered core features such as user registration and login, product browsing and search, shopping cart and collection functionalities, order processing, product management, and personal information management. The results indicate that all major functions of the platform operated smoothly, with all test cases marked as "Pass," demonstrating the system's stability and functional completeness.

## 5.0 CONCLUSION

With the rapid development of network technology and the rise of e-commerce, especially in educational settings, the demand for second-hand trading platforms is increasing day by day. Students have a strong need for convenient, safe and economical indirect services. The advancement of science and technology provides technical support and innovative ideas for more intelligent and user-friendly platforms. Nowadays, more and more second-hand trading platforms tend to enhance their practicality and reliability in terms of user experience and transaction security. This project offers users a complete set of second-hand goods trading functions in the form of a web application, including core services such as product posting, browsing and purchasing, order management, and user evaluation. The responsive design can provide users with a more convenient access experience and a more intuitive operation interface. The design of free browsing and personalized management functions can better meet the diverse needs of users. At the same time, the security verification and credit assessment mechanisms can enhance the integrity of transactions and the credibility of

the platform for users. The unique geographical location of the campus and the complete closed business cycle can promote more efficient circulation of goods and create a more reliable trading environment than traditional second-hand trading methods.

**7.0 REFERENCES**

Han, D., Du, S., Fang, Y., Wang, S., & Xing, T. (2022). Evaluating entrepreneurial opportunities in the university second-hand trading market. In The 2022 International Conference on Financial Technology and Business Analysis (pp. 299-310). https://doi.org/10.54254/2754-1169/5/20220094

Wei, S. J., Fang, D., Liu, M. T., Yang, Y. D., Mo, N. H., Jiang, Y., & Yang, B. (2023). Research on the practice of college students' second hand trading platform. Open Access Library Journal, 10, e10405.https://doi.org/10.4236/oalib.1110405

Dolgobrod, M. (2013). Developing a user interface for a cross-platform web application (Master's Thesis). Helsinki Metropolia University of Applied Sciences.https://www.theseus.fi/handle/10024/61290

Chen, H.-M., Chang, K.-C., & Lin, T.-H. (2016). A cloud-based system framework for performing online viewing, storage, and analysis on big data of massive BIMs. Automation in Construction, 71(Pt 1), 34-48. https://doi.org/10.1016/j.autcon.2016.03.002

Zhang, W., & Luo, W. (2023). Dynamic decisions between sellers and consumers in online second-hand trading platforms: Evidence from C2C transactions. Transportation Research Part E: Logistics and Transportation Review, 185, 103925.https://www.sciencedirect.com/science/article/abs/pii/S1366554523002454

Royce, W. W. (1970). Managing the development of large software systems. Proceedings of IEEE WESCON, 26, 328-388. https://www.scirp.org/reference/ReferencesPapers?ReferenceID=1706135

Jiang, C. (2024, May 04). When second - hand comes first. China Daily. https://www.chinadaily.com.cn/a/202405/04/WS6635a12ea31082fc043c531c.html

Bank Vogue. (2024, July 24). Trends in secondhand goods: Analyzing current trends in the secondhand market.https://www.bankvogue.com/trends-in-secondhand-goods

Strandell, J. (2019, November 27). The second-hand trend: The future of online marketplaces. Besedo.https://besedo.com/blog/second-hand-online-marketplace/

Othman, N. Z., Hussin, A. R. C., & Rakhmadi, A. (2008). Trust mechanisms: An integrated approach for E-commerce website development process. In 2008 International Symposium on Information Technology (pp. 1-6). IEEE.https://doi.org/10.1109/ITSIM.2008.4631568

Dong, Y., Jiang, Z., Alazab, M., & Kumar, P. M. (2021). Fraud investigation; Machine learning; electronic markets; BIT error rate; Internet marketing; Error rates. Journal of Multiple-Valued Logic & Soft Computing, 36(1-3), 191.https://openurl.ebsco.com/EPDB%3Agcd%3A7%3A13810231/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A150221432&crl=c&link_origin=schola