CLOUD COMPUTING SERVICE BASED — REAL ESTAT DATA CHART VISUALIZATION MANAGEMENT SYSTEM

LI QING MIN, Ts. Dr.Nur Hanis Sabrina Suhaimi.

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

Abstract

Pada masa ini, industri hartanah di Malaysia menghadapi masalah pengurusan data hartanah yang tidak cekap. Untuk menyelesaikan masalah ini, Sistem Pengurusan Visualisasi Carta Data Hartanah Berasaskan Perkhidmatan Pengkomputeran Awan perlu dibangunkan. Sistem ini akan menggunakan teknologi awan untuk mencapai akses dan pemprosesan data masa nyata, dan merealisasikan visualisasi data yang berkaitan pada lapisan aplikasi. Hujung depan dan belakang akan dibina secara selari, menggunakan Vue dan Python masing-masing. Menyediakan fungsi pengesahan pengguna. Pentadbir dan pengguna mempunyai log masuk hierarki dan menyediakan tetapan antara muka yang berbeza. Sistem itu akan menggunakan kaedah pembangunan tangkas digabungkan dengan pembangunan teknologi awan untuk mencapai penyelesaian baharu bagi menggalakkan pengoptimuman pengurusan data hartanah di Malaysia.

Kata kunci: Pengkomputeran awan, Python, Vue

Abstract

At present, the real estate industry in Malaysia has the problem of inefficient real estate data management. To solve this problem, a Cloud Computing Service Based — Real Estate Data Chart Visualization Management System needs to be developed. The system will use cloud technology to achieve real-time data access and processing, and realize the visualization of relevant data on the application layer. The front and back ends will be built in parallel, using Vue and Python respectively. Provide user authentication function. Administrators and users have hierarchical logins and provide different interface settings. The system will use agile development methods combined with cloud technology development to achieve a new solution to promote the optimization of real estate data management in Malaysia.

Keywords: Cloud computing,Python,Vue

1.0 INTRODUCTION

In 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.

Recent surveys indicate rapid growth in Malaysia's cloud computing and real estat technology sectors. By 2024, the Malaysian cloud computing market is projected to reach $3.7 billion, growing at approximately 13% annually. Additionally, the real estate market saw strong performance in 2023, with transaction volumes rising by 2.5% and transaction values increasing by 9.9%. Cloud-based systems can offer faster data access, better security, and simplified project management for the real estate sector in Malaysia. Therefore, a Cloud Computing Service-Based Real Estate Data Chart Visualization Management System aligns with industry trends and significantly enhances data management efficiency

Based on the above data survey, the Malaysian real estate industry faces challenges in data management. The lack of functions for processing relevant data and visualizing data has led to certain obstacles in the Malaysian real estate industry in terms of network technology. Traditional localized systems can no longer adapt to the needs of modern real estate companies, making it unable to handle diverse user needs

and large amounts of data. Therefore, in order to overcome these problems, Cloud Computing Service-Based Real Estate Data Chart Visualization Management System provides a feasible way to improve data management efficiency. It is solved from the perspective of network technology and cloud technology.

In order to solve the above problems, this paper proposes a Cloud Computing Service-Based Real Estate Data Chart Visualization Management System as a solution. This solution plans to use an online data management platform to process Malaysian real estate data, allowing users to enter the system to update and delete relevant real estate information online, and check the real estate transaction history in the historical records. At the same time, the system is connected to the cloud computing module, using cloud technology to process and analyze the data uploaded by users and administrators, and then generate corresponding market trend reports and real estate value reports. The administrator verifies the user's registration information, and the approved user confirms his identity with his account and password when logging in. Finally, when users browse the system, there are data visualization tools to help, including charts, report tables and dashboards. Even inexperienced users can effectively understand and analyze the data in the charts, which is convenient for operation.

Migrating data to a cloud platform can be challenging, especially for companies transitioning from on-premises systems. Issues such as inconsistent data formats and large data volumes can be complicate the migration process and require additional resources and time. The system also relies on a stable internet connection. An unstable network can disrupt user access to real-time updates. Data privacy risks cannot be ignored. Although cloud services provide authentication, real estate data includes sensitive customer and financial information that may be vulnerable to cyberattacks or data leaks. For users, adapting to a cloud-based system may require extra time to adapt. Finally, as a developer with limited experience in cloud technology, I expect it will take more time to learn the relevant technical development requirements. Since the construction is very tight at the beginning, some functions may not be fully developed later. Prioritize key function development and make reasonable time planning

This chapter introduces a real estate data chart visualization management system based on cloud computing services. The goal ofthis project is to solve the problem ofthe lack of efficient data management tools in the Malaysian real estate industry. By comparing the three existing projects, their shortcomings were found. In order to solve the above problems, the new project to be developed will focus on optimization. This chapter also explains the project goals, including making data more accessible, enhancing real-time analysis, and system security. Then it analyzes the problems that may be encountered during the development and use of the project. The development method is determined and agile development is adopted. This chapter

raises key issues, determines solutions, and learns from each other's strengths to pave the way for subsequent development.

2.0 LITERATURE REVIEW

The Malaysian real estate market is one of the most dynamic and vibrant sectors in the Malaysian economy, and even occupies a large economic proportion in the world. According to the World Bank, the global real estate market was worth 228 trillion US dollars in 2016, accounting for 60% of the world's total assets (Malaysian real estate). However, the Malaysian real estate market is still facing problems in data processing and statistics.Cloud computing and storage are moving towards a strong mainstream trend. By 2024, the global cloud computing market is expected to reachapproximately US$597 billion, with a growth rate of 21.7%. Real estate companies are also turning to cloud technology solutions, with approximately 74% of companies worldwide adopting such models to diversify their operations.(cloud wards)

Brickz (Like figure 2.1) is a well-known real estate platform in Malaysia, with both a website and an iOS app. Brickz is known for its fast 1-second property valuation and 3 free valuations per day, and also provides additional features such as purchase consultation forms. Its advantage lies in providing historical transaction data, including actual sales prices of residential, commercial and industrial properties and land. Brickz has established partnerships with 90% of banks and financial institutions nationwide, providing reliable data-driven valuations to help users make informed real estate investment decisions. However, compared with our real estate data chart visualization management system based on cloud computing services, Brickz has a limited scope. It mainly provides historical transaction data and there is no visual chart for data display, which makes it difficult for users to operate. System go a step further and combine cloud storage data analysis to update data in realtime to adapt to market changes.

Zillow (Like figure 2.2)is a major real estate platform in the United States, providing a wide range of property listings, videos, real estate news and the popular Zestimate feature, a free real estate tool that estimates property values based on historical data and market trends. Zillow excels in presenting comprehensive property data, including photos, maps, school district information, taxes, and mortgage options. However, Zillows focus is mainly on the US market, limiting its applicability to users outside of the Malaysian region. Unlike Zillow, my project is more adapted to data on Malaysian real estate.

iProperty (Like figure 2.3 and figure 2.4) is another professional real estate platform, available in the form of a website and an app, that provides data on new and second-hand home prices, property information, and related market news. iProperty targets the Malaysian and wider Asian markets. However, compared to our system, the services provided by iProperty are limited in user applicability. The platform only

provides basic valuation information and10 does not have good data visualization capabilities. System go a step further and combine cloud data and Chart.js to achieve data visualization for user reference.

The advantage ofthe interface design of this project is that there is no need to download and install any software or applications. The disadvantage of the interface design of the other three projects is the lack of sufficient guidance. The interface design ofthis project provides sufficient interactivity, especially in data charting, which makes the data more intuitive. Therefore, our suggestion for the interface design of this project is to add more graphical elements and provide more interactivity. In addition, compared with the other three projects, the data storage and calculation of this project will be based on cloud technology, which greatly improves data security and data storage capacity.

3.0 METHODOLOGY

This proposal outlines the system structure and methods of Cloud Computing Service Based — Real Estate Data Chart Visualization Management System. It defines the different permissions and relationships between the two roles of users and administrators in the system. The specific system functional requirements, non-functional requirements, hardware and software requirements of the system are presented, and various diagrams are used to illustrate the system model, including the system architecture and the system operation process.

3.1 Definition of user needs

The Cloud Computing Service - Based Real Estate Data Chart Visualization Management System is designed with two main roles: user and administrator, each with different access rights and system functions. Users can log in to the front-end system. After logging in, users can view the homepage and different sections, and can view detailed property information, historical transaction data and market trends. Users can also browse data trends related to real estate through visual charts in the sections.

Administrators can log in to the backend system and enter the management interface. They can update, add, and delete stored data. Administrators manage user accounts through the user management interface and have the authority to assist them in identity authentication. Administrators can also upgrade cloud computing algorithms through the system backend upgrade module when necessary.

3.2 System Requirement Specifications

The functional requirements of the proposed system are divided into two categories: administrator and user functions. Administrators are responsible for core system operations. They must be able to add, edit, and delete property records, manage detailed property and transaction data, and oversee system maintenance, including updating algorithms and managing storage. Administrators also handle user management by reviewing and approving registrations, as well as assigning appropriate permissions. On the other hand, users should have access to comprehensive property information, their personal transaction history, and current market trends. They should also be able to view visualized market forecasts and use interactive tools such as charts to compare property prices, transaction volumes, and trends over time.

In terms of non-functional requirements, the system must prioritize usability, data security, and performance. The user interface should be intuitive and easy to navigate, allowing users to operate the system without prior training or guidance. Key features should be accessible based on users' general expectations and experience. Security-wise, the system must include user authentication mechanisms to protect sensitive personal and financial data. Additionally, it must deliver reliable performance, efficiently handling data processing tasks while minimizing system delays and ensuring a smooth user experience.

Perspective	Hardware	Minimum Requirement	Recommended Requirement
User/Admin	Processor	Intel Core i3 or equivalent, 1.5 GHz	Intel Core i 3 or higher
	RAM	2 GB	4GB or more
	Storage	16 GB SSD	16GB or more
	Graphics Card	Integrated graphics (e.g., Intel HD Graphics 380 or equivalent)	Integrated graphics (e.g., Intel HD Graphics 4000 or equivalent)
Developer	Processor	Intel Core i3	Intel Core i7 or higher, 2.5 GHz or above
	RAM	4 GB	16GB or more
	Storage	128 GB SSD	256GB SSD or more
	Graphics Card	Integrated graphics (e.g., Intel HD Graphics 4000 or equivalent)	Dedicated GPU (optional) for better performance

Table 1: Hardware requirements table

Perspective	Software
User	Windows 7 and above Edge or Google browser
	Operating System – Windows 10 and above
Developer	Programming – VScode / Phpstudy / Pycharm
	Database – Google Cloud Database / Myphpadmin

Table 2: Software requirements table

3.3 System model

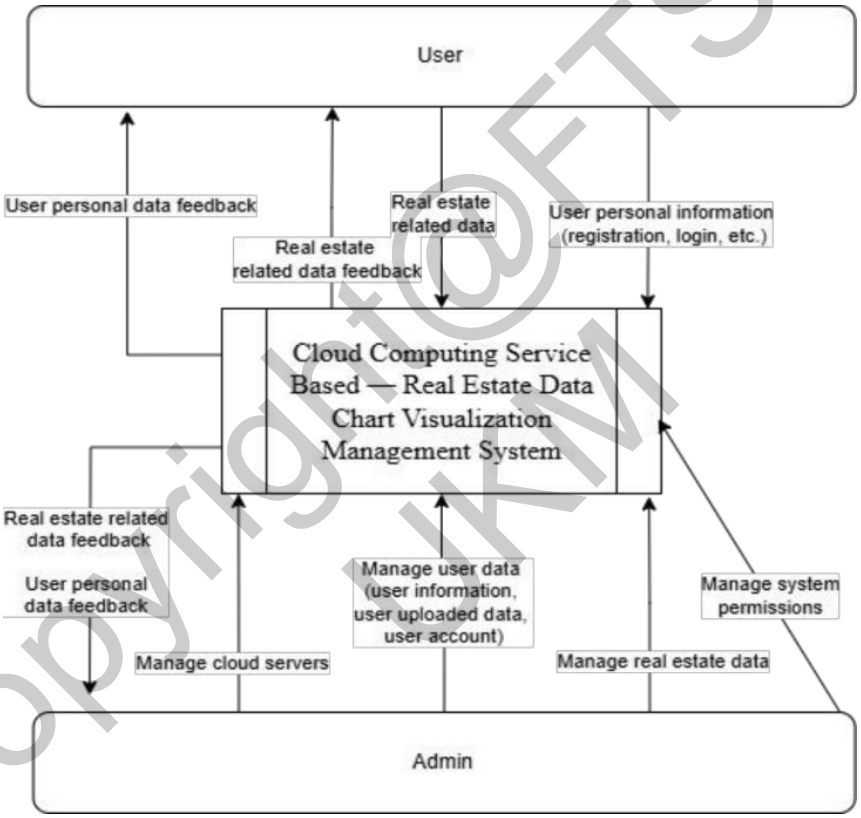

Figure 1 Context diagram

Figure 1 show the users are responsible for providing personal data feedback, accessing real estate- related data, and registering and logging in; administrators manage user data, system permissions, real estate data, and cloud servers.

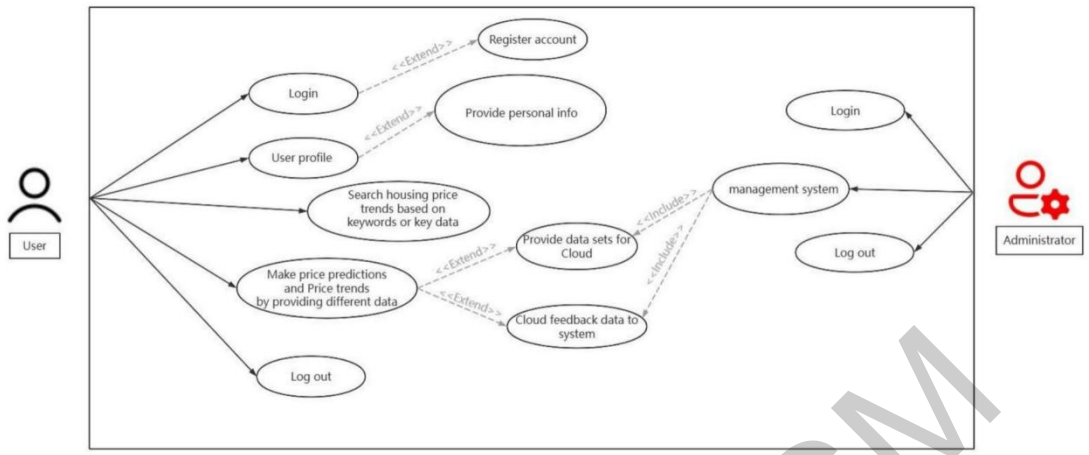

Figure 2 User case diagram

A simplified diagram of how many users and administrators interact with the system, and the relationships between users and administrators in the system for different use cases. There are two main roles: user and administrator.

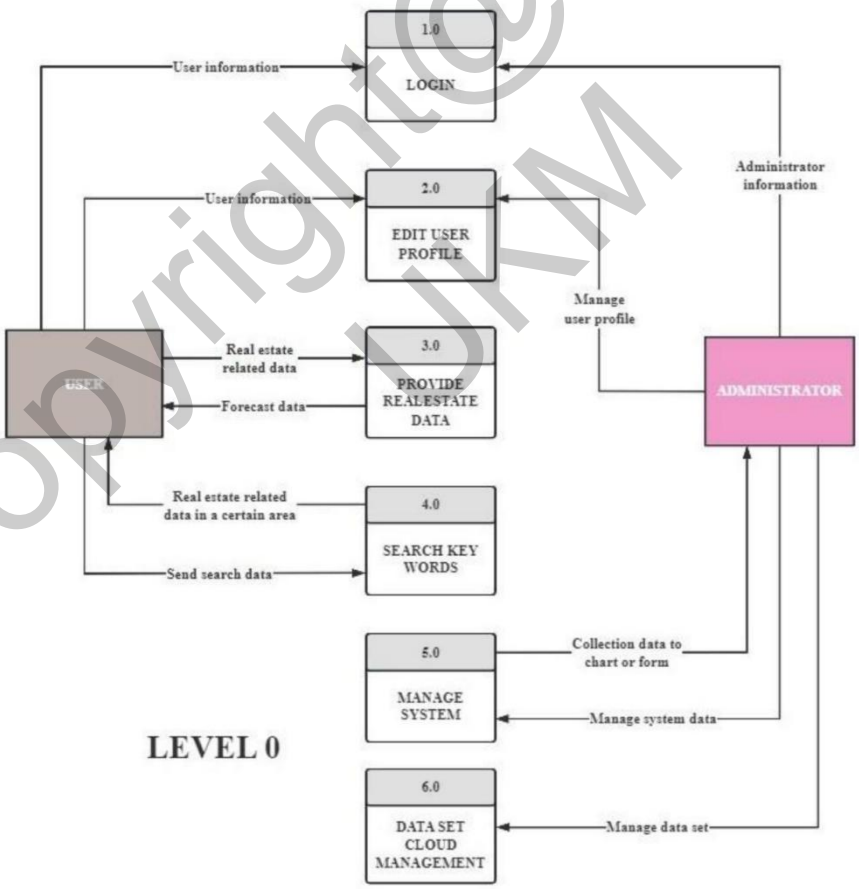

Figure 3 Data flow diagram level 0

Figure 3Data flow diagram level 0 corresponds to the data input and output of different modules for users and administrators at level 0, users and administrators of

modules 1.0 and 2.0 can input, users of module 3.0 4.0 enter data and return data, and administrators of 5.0 6.0 output data.

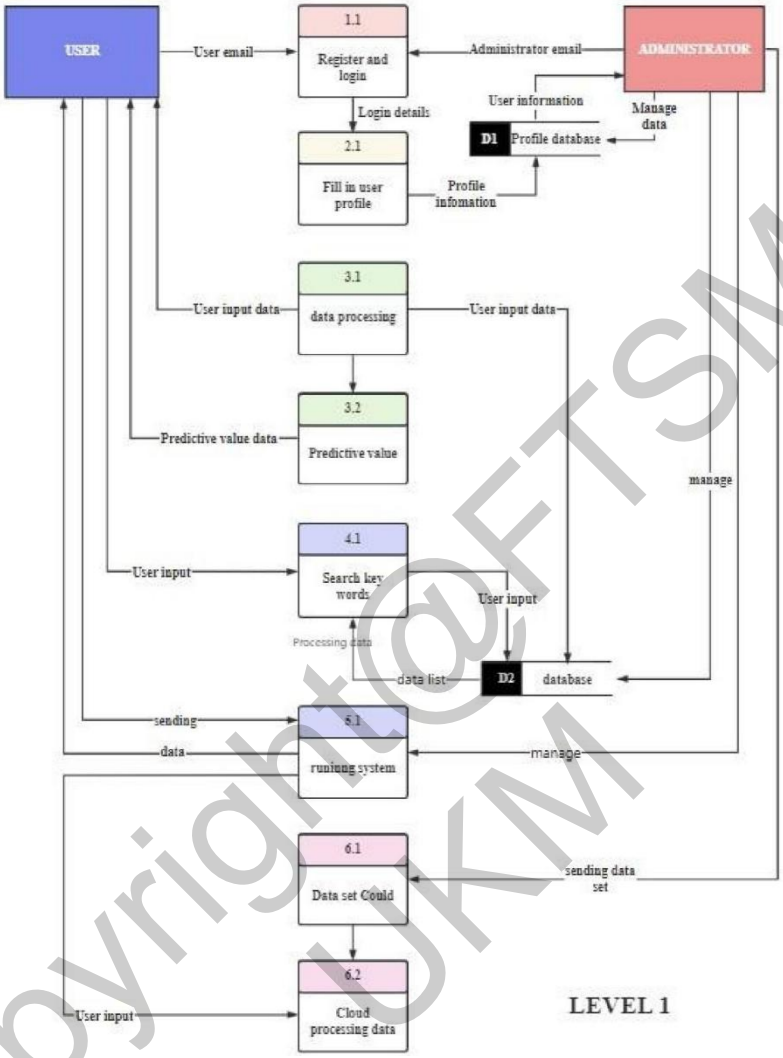

Figure 4 Data flow diagram level 1

Figure 4 Data flow diagram level 1 describes the data input and output of different modules corresponding to users and administrators in level 1 in more detail, corresponding to the data flow direction of subordinate subordinate modules in different modules and how data is transferred in and out of the database, such as D1 and D2.

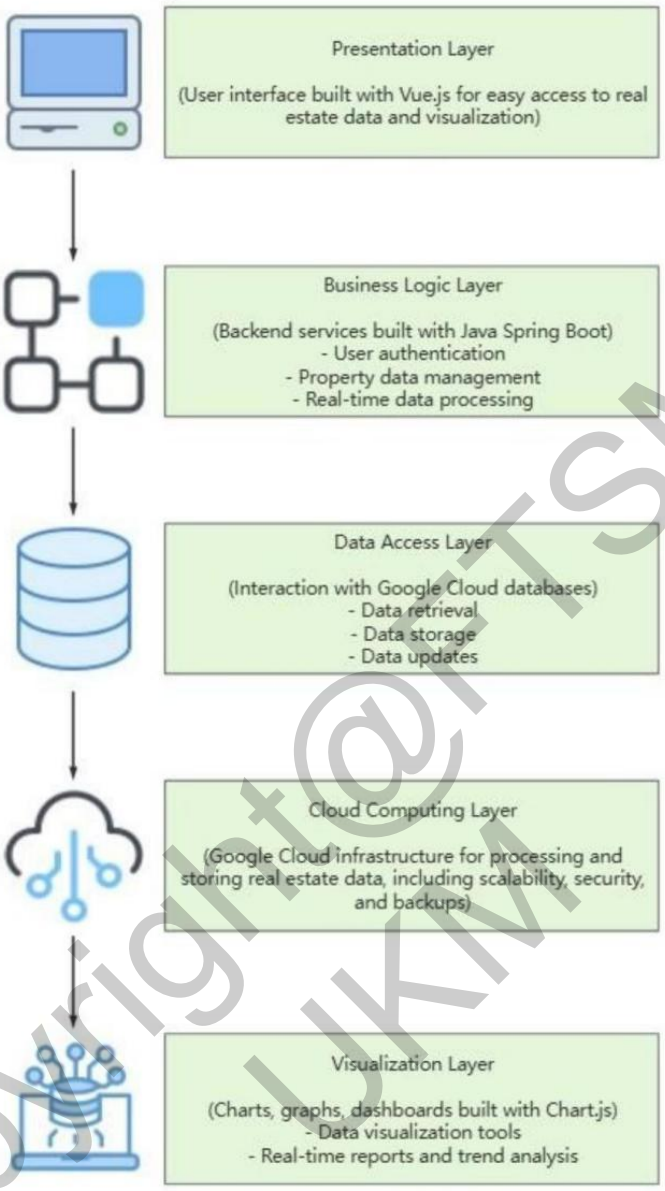

Figure.5 Layered figure

This system adopts a five-layer architecture design like figure 5, including Presentation Layer, which is used for UI display on the user and administrator side; Business Logic Layer, which handles the back-end data interface and the front-end connection; Data Access Layer, which is used for data processing and storage; Cloud Computing Layer, which provides cloud data upload and certain security guarantees for data storage; Visualization Layer, which is used for the conversion between data and visual charts. The five layers communicate sequentially through the interface in sequence, and this system architecture is simple, convenient and easy to develop.

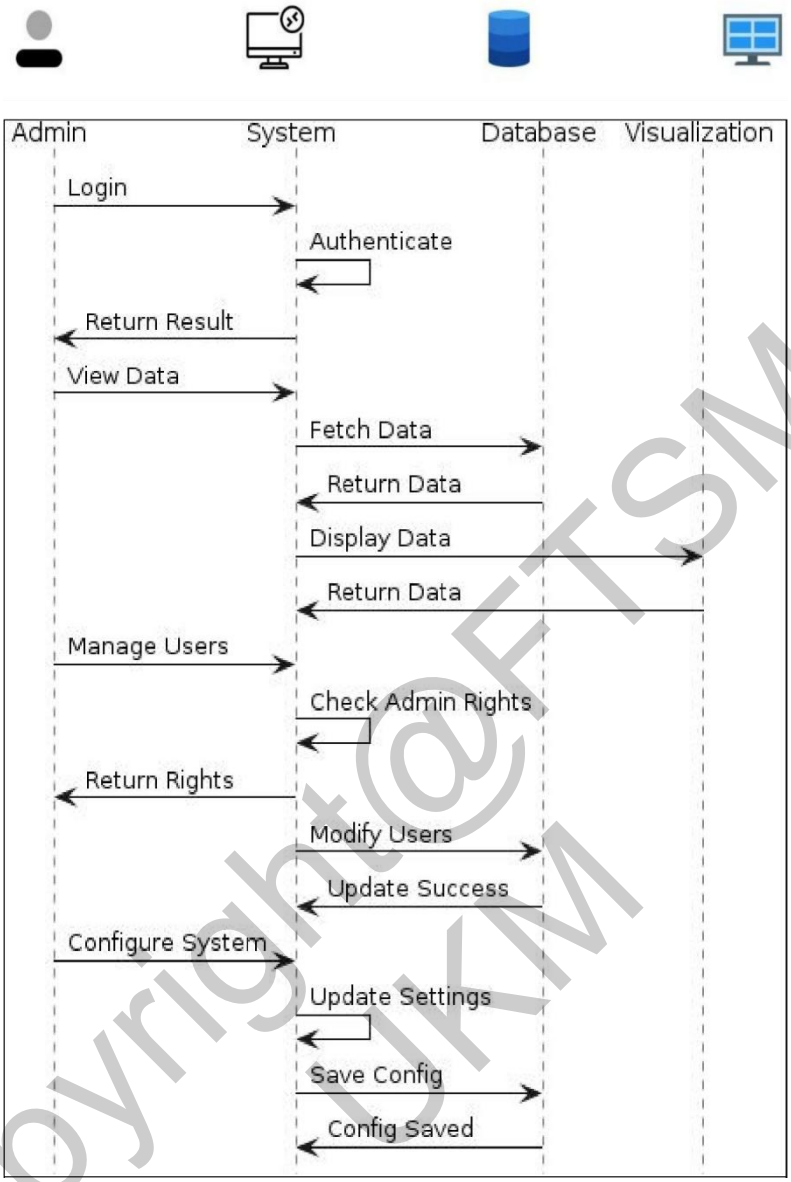

Figure.6 sequence diagram admin

Figure 6 is the user's operation sequence diagram, which includes the process of login authentication, viewing data, viewing trends and viewing history. The system obtains data by interacting with the database and displays the data to the user.

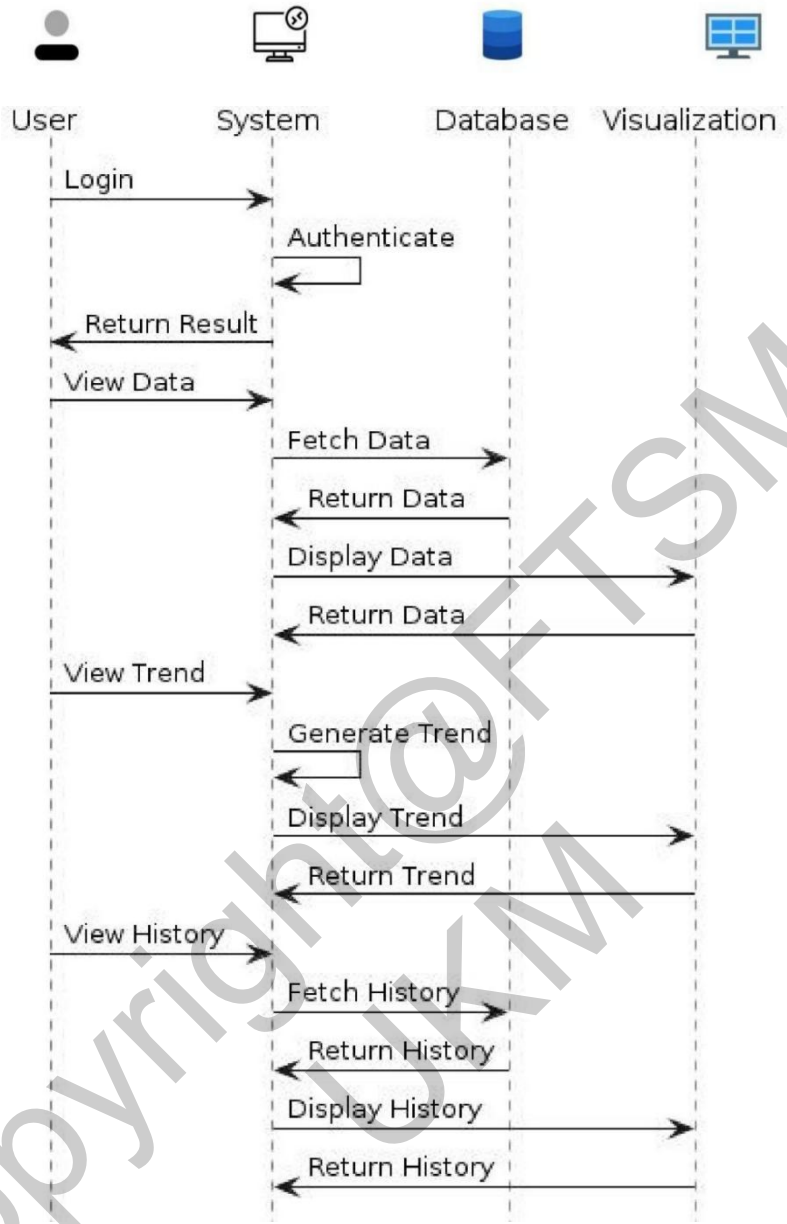

Figure.7 sequence diagram user

Figure 7 is the administrator's operation sequence diagram. In addition to logging in and viewing data, it also includes the functions of managing users and configuring the system. The administrator can check permissions, modify user information and update system configuration through the system. The system saves the changes to the database and returns the operation results.

4.0 RESULT AND DISCUSSION

This system aims to develop a real estate data chart visualization management platform based on cloud computing services for the Malaysian real estate industry to solve the current problems of inefficient data management and lack of real-time market trend analysis. The front end of the system is developed using Vue.js and the back end is developed using Python. Combined with cloud technology, the system can process and access real estate data in real time. In addition, the system also integrates visualization tools such as Chart.js, allowing users (including ordinary users and administrators) to intuitively understand market dynamics, real estate transaction trends, and real estate valuations. The system also supports online data update and management, historical transaction tracking, and automatic generation of market analysis reports, thereby improving the overall operational efficiency of the Malaysian real estate industry.

4.1 Interface Design and Layout

Use tools such as Pycharm and Sublime to develop the main interface and layout of the web page. Use Sublime to develop HTML pages, and use Pycharm to develop system pages for logged-in users. Create page elements, styles, and layouts according to design requirements to achieve a friendly interface and good user experience. After entering the backend system, the sidebar will display different function bars of the backend system: user management, property management, data management trend charts (data large screens), and other modules. The user-side interface (form figure 4.1 - figure 4.3) includes real estate data search and viewing, and popular real estate recommendations. For the backend system functions that have been completed in UI development, other functions may be added or deleted based on feedback during subsequent development.

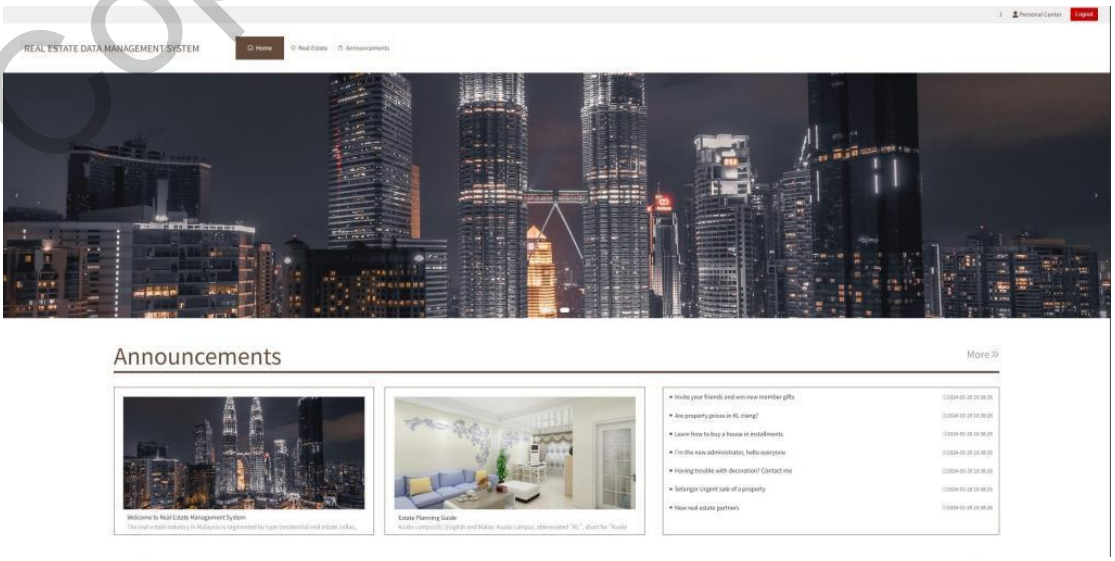

Figure 8 After login user page

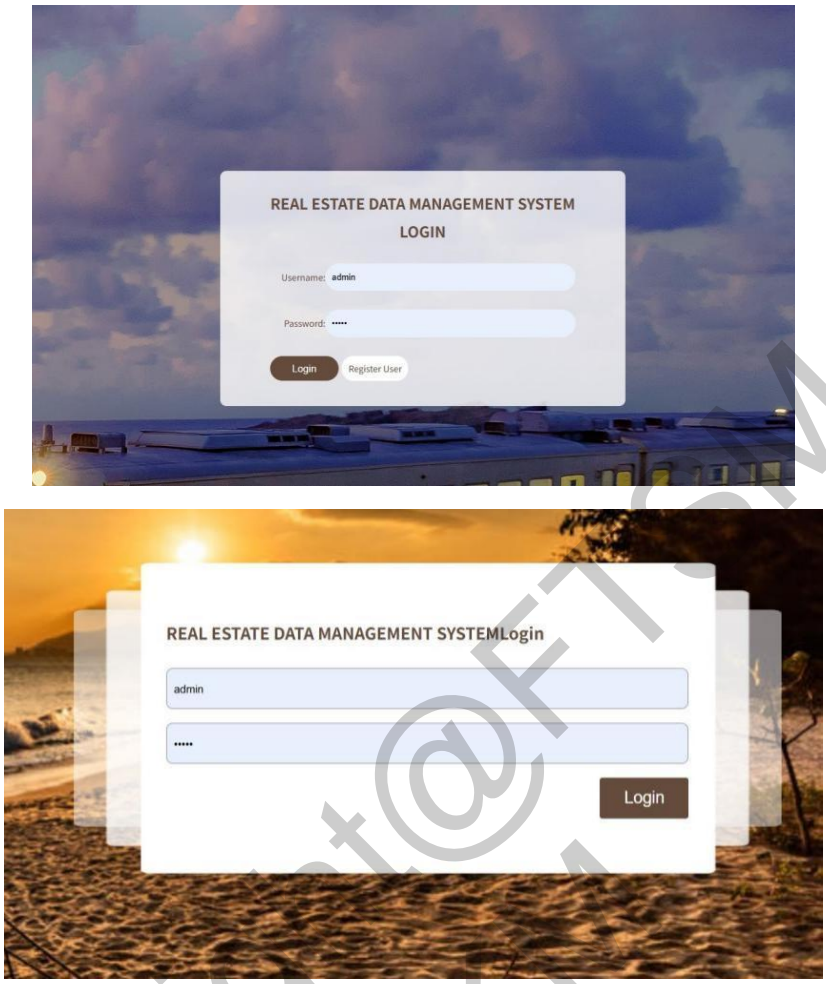

Figure 9 Login page with user (the one above) and admin (the one below)

Figure10 After login Admin back-end management page

Choose Django (Figure 11) as the development framework and use the Python programming language for backend development. Python provides features for rapid development and convenient configuration, making it suitable for building web applications.

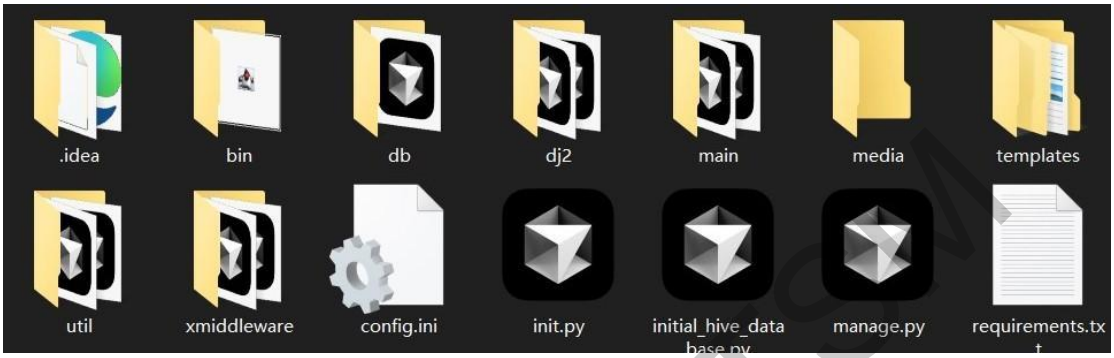

Figure 11 Framework Python (Django)

Use Python and Node.js components to implement real estate data chart functions, use Python framework to handle backend logic, and use Node.js components to achieve real time communication.

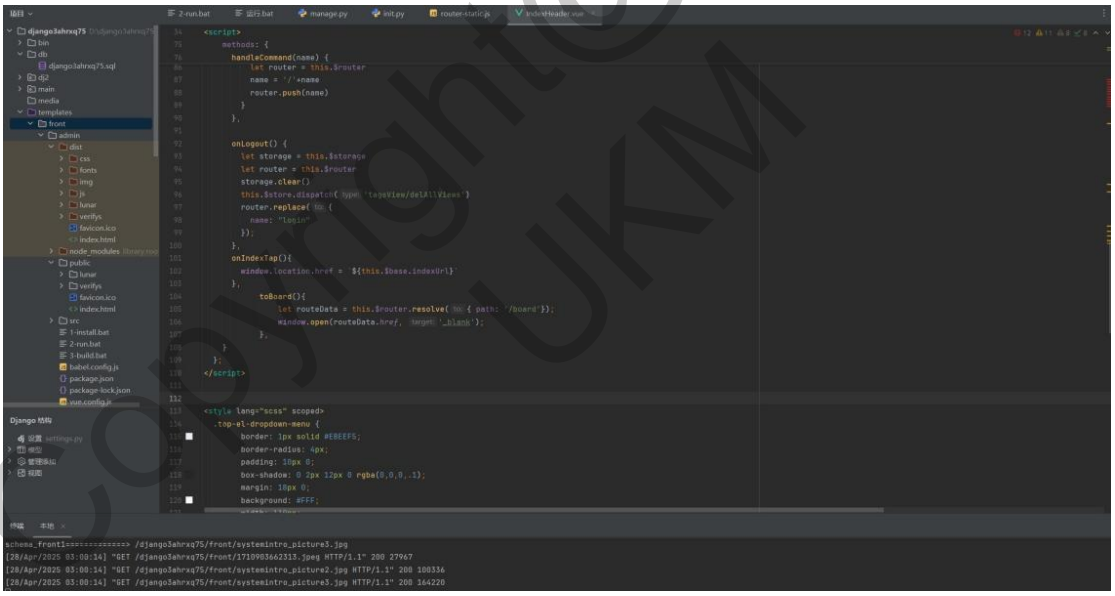

Figure 12 Function code

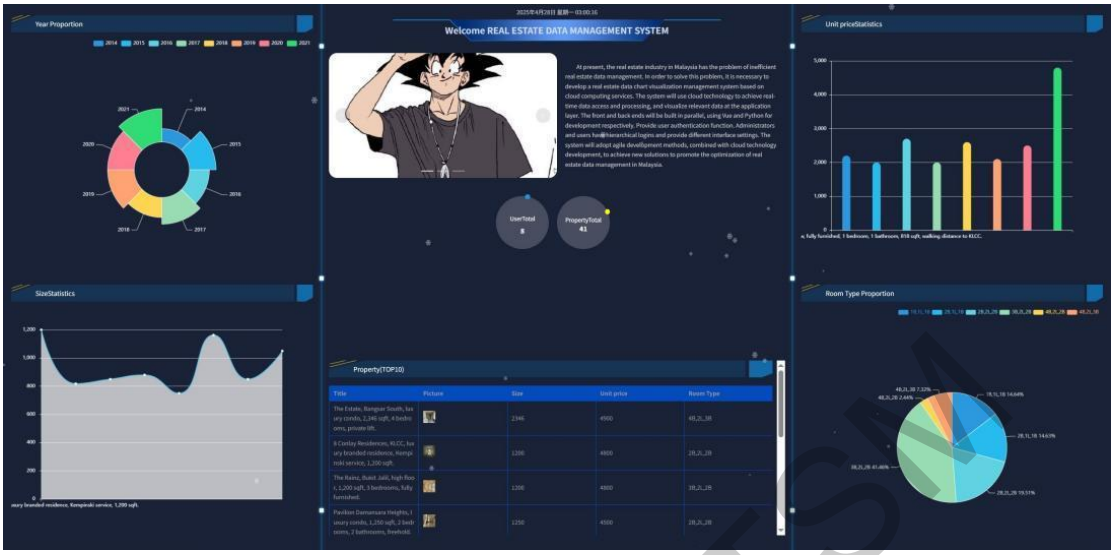

Figure 13 Function screenshot

4.2 Testing Result

This section presents the testing results obtained during the verification phase of the Cloud Computing Service Based — Real Estate Data Chart Visualization Management System. The objective of this phase was to ensure that each module operates correctly under both valid and invalid input conditions, as defined in the System Requirement Specification (SRS). The testing process focused on verifying core functionalities such as user and admin login, property management editing, chart visualization, and admin profile editing.

Testing was conducted using black-box testing techniques, including Equivalence Partitioning, Boundary Value Analysis, Decision Table Testing, State Transition Testing, and Use Case Testing. These methods were chosen to validate how the system handles input processing, behavior transitions, and user interface interactions without inspecting internal code structures. Functional test cases were carefully designed to cover typical operations, input boundaries, invalid entries, and system error scenarios.

All major functionalities were tested through manual browser interaction, API request validation using Postman, and backend monitoring via Spring Boot log analysis and SQL debugging. The system successfully processed correct inputs and rejected improper entries with appropriate error handling. It also demonstrated stable performance in handling state changes, such as login sessions, profile updates, and real estate data modifications.

The testing confirmed that the system meets both functional and non-functional requirements, including usability and efficiency. The following table summarizes the results of selected representative test cases.

5.0 CONCLUSION

This project involves the design and development of a Cloud Computing Service-Based Real Estate Data Chart Visualization Management System, aimed at solving the current challenges in Malaysia's real estate industry, particularly the inefficiency in data management and the lack of effective data visualization tools. The system leverages the capabilities of cloud computing to handle real-time data storage, processing, and synchronization, ensuring that users and administrators can access up-to-date information from any location. It features a dual-interface design tailored to meet the distinct needs of both regular users and system administrators. Users can conveniently browse real estate listings, analyze price trends, and view personalized transaction history through interactive and intuitive charts, while administrators can manage property records, monitor system operations, and control user accounts from a dedicated backend interface.

The system was developed using Python for the backend and Vue.js for the frontend, implementing Chart.js to create dynamic and user-friendly data visualizations. This architecture not only enhances the system's responsiveness but also greatly improves the clarity and engagement of the data presented. Compared to traditional real estate systems, this project brings major improvements in usability, performance, and real-time data presentation, offering a smarter and more efficient solution for real estate data management.

However, the development process also encountered several constraints. Due to limited prior experience with front-end and back-end separation technologies, a significant amount of time was spent learning and implementing core features, particularly in backend deployment and data handling. Time and resource limitations also meant that some advanced functionalities, such as API integration and more complex data analytics features, were postponed for future development. Looking ahead, there are several directions for enhancement. These include expanding the data visualization module to incorporate machine learning-based forecasting, adding mobile device support for better accessibility, integrating multi-language support to cater to diverse user groups, and connecting to third-party real estate databases and mapping services to enrich system content and functionality.

In conclusion, the system has successfully demonstrated its value in improving data accessibility, supporting data-driven decision-making, and enhancing user experience in the real estate sector. Although some functions remain under development, the project establishes a strong technical foundation and offers significant potential for future optimization and real-world application.

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LI QINMIN(A197869)
Ts. Dr.Nur Hanis Sabrina Suhaimi
Fakulti Teknologi & Sains Maklumat
Universiti Kebangsaan Malaysia