Propchan: A Mobile Application for Property Management

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***Abstract*— Tenants, the management team, and the administrator can all monitor and manage their property using the property management system. The current systems have issues with several capabilities, including poorly functioning notifications, a perplexing user interface, bad visitor management, and unclear payment options. To close these gaps and streamline a variety of processes, including management and monitoring, business operations, and management-to-management communication, the Propchan program was created. By applying the in-depth comparison, Dart with the Flutter framework was selected as a back-end programming language. Android studio is an interactive development environment for developing mobile apps, and VSCode is the IDE for the server. PostgreSQL was chosen as the database management system, and Windows 10 Home Edition was chosen as the operating system. The system development process was implemented using a waterfall model. In future studies, it is necessary to strengthen the security measures of the Propchan program to further secure user confidentiality as well as the problem with connecting the client to the server in terms of adding data and getting database results.**

Keywords— property management system, residential management, lodging industry

I. INTRODUCTION

A property management system is software used to manage commercial and residential rental properties as well as hospitality establishments. The assistance includes scheduling and carrying out the regular chores and commercial dealings of the lodging industry. It can be offered as integrated solutions or on a standalone basis (Halvitigala & Gordon, 2014). However, the current manual procedures for tracking rental payments, invoicing and billing, maintenance, and other tasks become ineffective and increasingly prone to errors. It is true that when tenants and owners need to contact management about a variety of concerns, such as payment, maintenance, or complaints, it can be difficult. The facility is also undesirable and has practiced visitors to complete lengthy documents only to visit their family or friends who reside there (Jing & Lim, 2020). The existing property management systems in Malaysia, such Gprop and JagaApp, were created to meet the demand for routine services for the lodging industry and to keep up with the times (Mokhsin et al., 2020). It was designed exclusively for commercial and residential rental properties as a platform that enables renters, the management team, and the administrator to monitor and manage their property. Unfortunately, these systems have a number of bug problems, including poorly working notifications, a confusing user interface, poor visitor management, and unintuitive payment methods. The purpose of this research is to close this gap by developing an app that owners and managers may use to manage paperwork, payments, complaints, and tenant tracking. The project's goal is to make it simple for users to keep track of their payment and transaction history wherever they are and to automatically make digital payments with their consent. Users can speak with management about a variety of topics without having to physically be there. Users can use the system to invite guests, and guests can use a QR code to authenticate their identity without needing to go through security personnel.

II. LITERATURE REVIEW

Following the advancements in information and communications technology, property management, a profession that was once primarily reliant on manual paperwork and administrative activities, has evolved into a strong market position. In New Zealand, property management software is used to manage one-third of both rental and residential properties (Halvitigala & Gordon, 2014). Computers are used to automate processes including managing lease payments, invoices, announcements, and notices. Property managers can profit greatly from having current information and adopting computerized systems as more and more data become available.

Property management is a dynamic process that can be extremely complex because it comprises a variety of interconnected tasks (Stoyanova, 2019). As more and more residential areas are constructed for people to live in, the market for real estate has experienced a large increase in demand (Quek et al., 2020). To meet requests and to cut maintenance costs as well as the growth of property volumes, information technology is used to support property management (Stoyanova, 2019). The goal of implementing digital transformation in property management is to streamline numerous operations, including management and monitoring, business operations, and management-to-management communication.

The digitization of paper documents is one of the biggest digital changes (Stoyanova, 2019). The likelihood of human error, document misplacement, or missing papers is decreased because these documents are safely saved in a database. The management team may readily and whenever verify these documents. The adoption of Enterprise Resource Planning (ERP) systems enables improved connectivity with business network operations, resulting in a unified IT architecture.

The repercussions of the Covid-19 epidemic have affected real estate management, especially property

management. Due to social interaction restrictions, management has been forced by the Covid-19 issue to adjust the way they operate with respect to the property owners (Gross, 2021; Munas & Arun, 2021). This causes problems because tenants or property owners can't easily meet with the management team to talk about problems or pay their rent. Additionally, due to the worry of infection, accessing a specific owner's apartment in an emergency has required numerous additional processes (Gross, 2021). For instance, numerous tests and verifications must be made before a repairman will come to the apartment to remedy a leak.

There are still a lot of residential that use outdated management techniques that are exceedingly inconvenient for their occupants, even outside of the Covid-19 situation. The management staff manually recodes transactions in some high-rise residential buildings (Thevaraju, 2019). Because everything is done manually, managing data becomes more challenging. Additionally, getting access to the data will take longer because the management team will need more time to look for it. Additionally, since management employees might readily handle these files and documents incorrectly, it increases the possibility of human mistake.

Over time, it is simple to lose or misplace paperwork filing, which causes some data to vanish from the system. In addition, the management office often has set business hours and is typically closed on Sundays and other holidays (Thevaraju, 2019). Residents will find the timing to be extremely difficult, especially those who are employed and are unable to file complaints and requests because of office hours. On the other hand, because Saturday is a day off for most people, the management office will be congested on that day. This is because many residents wish to lodge complaints as well as request for maintenance in their residential (Thevaraju, 2019). This method of information gathering may cause the loss of data as they are being collected and recorded manually, as well as taking up both management and the residents time as they must wait in line and for the details to be recorded.

In addition, some residents make flimsy arguments to avoid paying their dues or outright refuse to pay (Mokhsin et al, 2020). It gets more difficult to maintain track of users and the maintenance of the high-rise residential building when many users fail to pay their rent and maintenance payments. Inability to conveniently pay for their rent or maintenance payments using an application is another problem that residents have. The resident is inconvenienced by this because they must manually remember when to pay their rent as opposed to being able to do it anywhere, at any time. By attending to their needs and treating them quickly and kindly, it is crucial to give inhabitants of high-rise residential structures precedence.

III. METHODOLOGY

There were technical research and software development methods conducted for this study. The technical research conducted includes identifying the programming language, interactive development environment, libraries and tools, database management system, operating system, and server to be applied to Propchan. Meanwhile, there are several kinds of software development methodologies that can be applied (GeeksforGeeks, 2022). All methodologies have advantages and disadvantages, depending on the need for the project to be implemented (Sharma, 2021).

A. Technical Research

- **Programming language:** Mobile applications with a database are built using two components, the front end which is responsible for the mobile application UI, and the back end which handles the data and stores them in a table. An in-depth comparison analysis was conducted on the ease of use, speed, type safety, use cases, and learning curve between Dart and Javascript. Dart is chosen as the back-end programming language. It was used by Google to build mobile applications, web, and servers. Indeed, employing Flutter frameworks with Dart will enable cross-platform mobile app development.

- **Interactive development environment (IDE):** The selected IDE to develop the server is VSCode, whereas the IDE to develop the mobile app is Android Studio. The reason VSCode is chosen is due to its ability to support many languages, with helpful tools such as syntax highlighting, bracket-matching, box-selection, auto-indentation, and more. There are also intuitive keyboard shortcuts making it easy to navigate the code, as well as a lot of customization to make the ideal development environment. Among the many plugins provided, VSCode was able to utilize Dart as well, making it suitable to develop the Dart programming language-based server. For the mobile application development, Android Studio was chosen because the application proposed is created Android phones. Android Studio comes with an emulator that has vast amounts of features and fast performance, making it perfect to test the application. The emulator can emulate different kinds of Android mobile phones and tablets, while also simulating a combination of hardware features such as touchscreen input, network latency, and multi-touch input (Android Studio, 2022). This makes it suitable for prototyping and testing the application. Besides that, Android Studio has an intelligent code editor, with features such as advanced code completion, code analysis, and safety refactoring. This IDE also works well with Flutter, which used to develop the mobile application.

- **Libraries and tools:** Additional libraries do help in project's development by enabling the additional features to be add-in. Flutter has been chosen as the library for creating the application. Google introduced Flutter in 2017 as an open-source, cost-free mobile user interface solution. It is a native mobile application that uses a single codebase and a single programming language to build apps for iOS and Android. The Flutter programming framework is enhanced by the numerous capabilities included in Flutter libraries. These libraries are concerned with enhancing the user experience on the mobile application, including the addition of notifications, handling of permissions, choosing files from the device, and more.

- **Database management system:** PostgreSQL, usually known as Postgres for short, is the chosen database management system (DBMS). This is due to the chosen framework, Flutter, is integrated with PostgreSQL. Indeed, PostgreSQL also excels at handling large amounts of data.

- **Operating system:** Microsoft Windows 10 Home Edition will be the operating system used to construct the suggested system. This operating system was selected since it is the only one that is readily available. The Windows operating system can handle a number of excellent IDEs, including Visual Studio, VSCode, and Pycharm, and it also provides access to a large number of third-party tools for debugging and graphics. Additionally, the instructions for using these tools are clear, concise, and easy to follow.
- **Server**: This tool has been switched out in favour of a Dart server due to problems with using Odoo to construct the server. As a result, the management will no longer have access to Odoo's user interface and will instead need to manually enter data into the database. VSCode used to create the dart server, which will connect to the Postgresql database and the Android Studio-created client.

B. Software Development

Based on the project's nature, which has clearly stated needs and little change, the waterfall model becomes the superior option overall.

- **Requirement Analysis:** Analysis was carried out using information obtained from close-end data-gathering methods. The replies were gathered from APU students, staff members, and occasionally from Malaysian residents who do not attend APU but live in condominiums or apartments. Each requirement is provided so that it may be thoroughly documented and examined when the project is being developed. After research was conducted by reading through a variety of books and comparable systems, further requirements or features were added to the system. A Software Requirements Specification (SRS) document is made as a development reference based on the requirements.
- **System Design:** For system design, the Class diagram was used to specify the functionality of the classes. The Use Case diagram to specify the features that the user would interact with. It acts as a crucial guideline to ensure that no issues arise by making it apparent how each element in the system is related to the others. The evaluation on hardware and software requirement for Android-powered mobile devices was carried out to understand various types of Android smartphones. The design of the application was tested against minimum requirements as well as recommended requirements to increase the number of devices that can appropriately utilize the software.
- **Implementation:** The database was created on the Pycharm IDE using the Python programming language. On the Android Studio IDE, the mobile application is designed using the Dart programming language. Utilizing unit testing, all individual functionality or classes are tested. Any modifications to the logical design are noted, and the development process was adequately documented.
- **Testing and Integration:** The units were tested separately, to ensure that they can all function properly on their own. To confirm the software's inner workings, the developer integrated the testing and white box testing on the software's architecture, coding, and design. The modules were gradually be combined to create a fully operational system. The programme is then tested on several target consumers, largely for user experience, and their input is gathered.
- **Deployment of the System:** In this stage, the system is finally prepared for deployment, and the application will be distributed to a variety of participants who represent the application's target users to collect feedback.
- **Maintenance:** Any user-reported problems, such as failures and bugs, will be gathered for remedial maintenance once the product has been developed and deployed. As soon as a remedy was discovered, patches were made available to fix the problems. Further functions added to the system, which would be very beneficial to Propchan.

IV. RESULTS

The "Propchan" software enables renters to manage their rental properties. Through their mobile application, management staff can keep an eye on and take care of any problems that arise on the property. Both users would be able to conduct tasks like paying bills and sending invoices without having to interact physically or visit the management office to fulfill the necessary procedures. The simplicity of being able to manage the property remotely from any location at any time would be very advantageous to both parties.

Propchan gives consumers the option to manage their real estate, including paying rent and looking over tenant complaints, depending on who is using it. Users have the option to set up an account and request approval from the management office of their housing facility. The management team can easily keep tabs on whether a tenant has paid their rent. Each registered user's information will be kept in a database at the back end. Fig. 1 depicts Propchan's Use Case diagram and table 1 explains it's specifications.

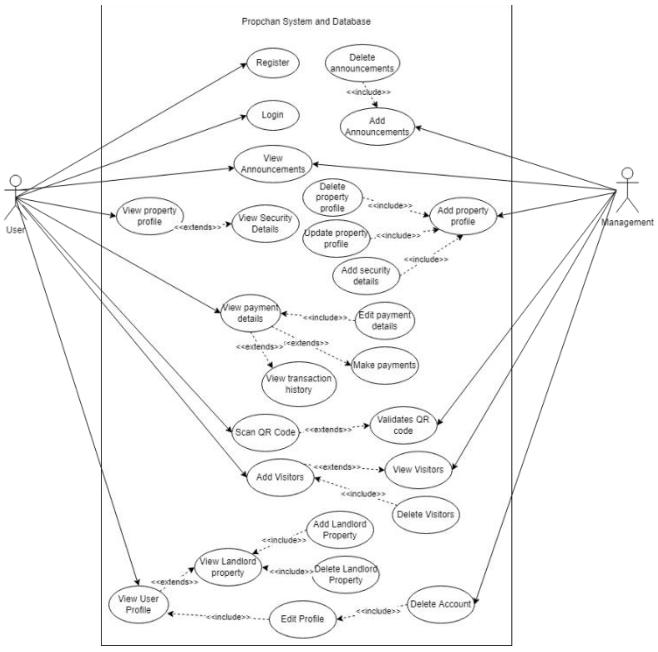

Fig. 1: Propchan Use Case Diagram

Table I: Use Case Specification

Functions	Descriptions
Register	This function allows users who are the residents to create an account that will allow them to use the login function.
Login	This function allows users who have created an account to log in into the system. This includes the residents only. The user has to input the credentials they used to register an account to successfully login into the system.
View Property	This functionality allows the user to view the property details they reside in. The user can also view the details of the security guards that are on duty in the property, which provide their names and contact number that may be used during emergencies.
Announcements	This functionality allows the user to view the announcements that are posted by property management from most recent to oldest. The management can update the announcement of their respective property into the database.
Payment	This feature allows the user to update their payment details that will be used to make payments to either the landlord or property management based on the specified bank account. The user can add a payment detail if none exists and also make payments. The transaction history of all the payments that have been made can also be viewed.
Scan QR code	This feature replaces the need to manually write down name while visiting the resident. User can scan a QR code to verify themselves as actual visitors that can visit the property.
Add Visitors	Residents of the property can use this feature to add visitors that will be visiting them into the system. This registers the visitors as valid and can visit the property with no issues.
User profile	This feature allows the user to view the profile they have created. The user can edit their information from here or delete their profile from the database.
Landlord property	This feature, accessible from the user profile, allows user who are landlords to view, add, and delete the properties they own.

The core functionalities of the system are:

1) For tenants/owners/residents

- Allow the user to register and log on to the system as a tenant, owner, or resident.
- Allow the user to access their transaction history so they can track their payment.
- Allow the user to access pertinent information about the residential building and management office.
- Allow the user to add visitors who will be arriving at the premise.
- Allow users to either automatically or manually pay the fee.
- Allow users to scan a QR code to verify their status as a visitor.
- Allow the user to examine their own account details.
- Unpaid balances are carried over to the following month and added to the total amount owed.
- Users are notified if they have not made their payment.

2) For management staff

- Allow users to approve system registration requests.
- Allow the user to monitor every occupant of the rental.
- Allow the user to remove anyone that is on their property.
- Allow the user to view visitors that will be coming to the premises.

3) For admin

- Able to modify the application and database.
- Allow admin the ability to add or remove users and properties.

V. CONCLUSIONS

The study's goal was achieved by creating the Propchan program. A comprehensive programme was acquired with many benefits that will probably make it simpler for inhabitants, owners, tenants, and management to communicate and oversee the various activities. In addition, there are several areas that could utilize improvement for future studies, particularly in terms of the various security precautions to further secure user confidentially. Additionally, the problems with connecting the client to the server by demonstrating that inserting data into the database and retrieving results from also can be improved in the future.

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