HOUSE RENOVATION SERVICE APPLICATION

BY

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A REPORT

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It is hereby certified that _____*JEE JIA EARN*_____ (ID No: __*19ACB01752*__) has completed this final year project entitled " House Renovation Service Application " under the supervision of DR SYADHILA BINTI CHE LAH (Supervisor) from the Department of Information System, Faculty of Information and Communication Technology.

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Name : _____JEE JIA EARN_____

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ABSTRACT

Renovation of houses can become a terrible and troublesome process, especially for people who own their houses for the first time. They do not have any idea what they should do. From setting a budget, locating the appropriate materials and hiring a reliable contractor. In order to prevent financial loss, careful planning is necessary. The most difficult activity in renovation is finding a reliable service provider. House owners may search for provider online by opening many tabs in the browser, or they may visit the physical store of the provider one by one to compare the service and the price offered. This will waste owner time and energy to find the most suitable provider for their house.

Therefore, this proposal writing focuses on developing a mobile application which can help house owner enjoy the renovation process. This application has search nearby provider module which allow the users hire suitable provider to renovate their house. Besides, the request quotation module in this application enables users to know the estimated price of renovation from different service providers and compare it to get the lowest price. This application not only will beneficial the house owner but also the renovation providers. This is because this application has service provider module which allows the providers to find and accept jobs from house owner. Besides, this module also can assist providers manage their business effectively with the quotation and invoice template function. This will help providers retain their customer and make considerable profit.

This application will be developed by using Android Studio Chipmuck Version. The AR features in this application will be created by using Unity3D. All the data in the application will be stored in Firebase to allow user access and update the data in real time.

This application will provide a clean and pretty UI design for users and let them have a good user experience when using this application. Besides, the data collected by this application will be protected to prevent any leakage of user information.

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LIST OF ABBREVIATIONS

AR   Augmented Reality

SDLC   Software Development Life Cycle

3D   3-Dimension

Chapter 1

Introduction

In this chapter, it will present the problem statement of this project and the motivation of the project follow by the objectives of this project. Besides, the scope of the project will also be presented in this chapter. Finally, it will discuss the contributions to the renovation and construction fields.

1.1 Problem Statement and Motivation

Since getting more and more people is struggling with the renovation, the problem domain of this project is renovation and remodeling. As most people know, one of the most basic requirements is a place to live since it gives us the comfort and safety that we need. When a family grows in size or achieves economic stability, they often desire to improve their living environment. Besides, the decrease of house rate due to the pandemic nowadays had encourage many people to buy property, for example, row-houses, apartments, or semi-detached houses. Whether a family is expanding or someone is looking to buy a new house, one of the most crucial steps is to carry out renovation work in order to turn their dream home into a reality. However, home renovation can become a tough activity because it requires a lot of researches on contractor, materials, design patterns, and so on. Furthermore, this process requires careful and precise decision-making in order to avoid the risk of wasting valuable time and money. The problems that house owners and service providers face are discussed further below.

1.1.1 Owner difficult to find a suitable and reliable service providers

Many of the owners are facing difficulties finding the right people, for example the contractor, designer or supplier of materials for the renovation job. This is because there are a lot of choices among contractors and designers on the market nowadays. It is difficult to distinguish between contractors with a track record and those who are only looking to profit quickly. They provide different services and different price ranges that require house owners to compare them one by one in order to find the most suitable contractors. They may need to search on different online platforms such as Facebook, Instagram, Twitter and Google, open many tabs in their browser or visit the stores physically. When the house owners want to

combine and compare all the information or details from different sites in order to choose the most suitable service provider, it may be a tough and troublesome process.

Not only that, the owner needs to contact each provider one by one to get the relevant details for the renovation, such as the quotation, material used or service provided. Another problem that arises is the uncertainty regarding the contractor's ability to deliver quality work and complete the task within the specified time frame. House owners may also have concerns about the accuracy of the contractor's quotations, which could result in unexpected additional expenses. This is because most contractors will only promote their strengths and hide their weaknesses. This may cause the owner to make the wrong judgement and choose the wrong constructor. Therefore, customer reviews are important to solve this problem. In conclusion, they need a solution to help them find a reliable service provider in a short time.

1.1.2 Owner do not have idea of renovation

On the other hand, many owners are lack of ideation to renovate their house. Most of the owners are not sure what they actually want, they do not know what the actual view of their dream house is. They need to do a lot of research on the renovation information of the house such as the suitable contractor, design pattern and price of the materials. Therefore, they need some suggestions from the service providers. Furthermore, communication between service providers and owners may be difficult without a proper reference, such as the expected look after the renovation or a requirement survey form. This is due to the owner's thoughts being difficult to convey properly through only verbal expression. Actually, most of the owners prefer to have an actual view of the final result before the renovation, but most of the providers do not provide this service. This is because most of the providers do not have AR technology to show the customer the expected result. If the house owner wants to buy new furniture, they may face the same problem too. They have no way of knowing whether the furniture they want to buy is appropriate for their home. This makes it difficult for customers to identify issues and adjust requirements before the renovation begins. Therefore, they need a solution to help them identify the requirements and provide the expected look of the renovation to stimulate house owner's ideas.

1.1.3 Service providers hard to attract new customers and enter new market

Lastly, it is important to note that the number of contractors and renovation companies has increased rapidly in recent years, making the remodeling and renovation field a highly competitive industry. Service providers face difficulty in gaining new customers because People have many options when it comes to hiring service providers. This will cause most of the company in this industry hard to survive because they are hard to gain the revenue from their company. This will cause a serious problem since foreign investors may refuse to invest in this industry after knowing the bad situation in this industry. As a result, the remodeling and renovation industries will struggle to improve. Therefore, they need a platform to help them promote themselves to the public.

1.1.4 Motivation

The aim of the project is to propose a new home renovation services mobile application to the owner who wants to renovate their house. The motivation of this project is to solve the problems of the owner who wants to renovate their house. The pace of modern life is increasing, and most people want to save time so they can do more work and be more efficient. Therefore, having an application that can help the house owner decide the contractor and designer of the renovation job in a shorter time is encouraged. Besides, it also helps some small and medium-sized renovation and design companies gain new customers and expose themselves to the public. In addition, service providers can also keep track of their business records using this application.

1.2 Objectives

There are several goals that this project wants to accomplish. The project objectives are listed as follow:

1. **To develop a mobile application to enhance user's house renovation and remodeling experience**

   This project aims to provide users with a better experience when renovating their house. This project combines all useful features from the existing systems or software after evaluating them. Not only that, this project will also provide a real-time view of the furniture to let users have a better sight to choose the furniture that will fit their house.

2. **To allows real-time interaction between users and service providers**

The project must allow users to interact with the providers from time to time. For example, when the user requests a quotation from the providers, the request must be sent in real-time. In other words, the providers must receive the request right after the user sends it. Moreover, if the provider accepts the request of the user, the quotation request in the user interface must be updated instantly. This helps to prevent any issue when finding the providers. This is because it may arise a situation in which users cannot get the best quotation price because the system delays the response of the service providers.

3. **To save the time of the users in house renovation process**

This application enables users to search for and hire a service provider in a short time. This is because users no longer need to search for nearby providers one by one because this application provides a list of service providers to let the user compare them easily.

4. **To promote the business of service providers to the public and increase their sales**

This application serves as an effective platform for service providers to increase their sales by showcasing their business to a wider audience. The rating and feedback system enables the service provider to showcase their reputation and reliability, thus increasing their chances of being hired by potential clients. Additionally, the application also provides a convenient way for service providers to find new clients, reducing the need to wait for clients to come to them.

1.3   Project Scope and Direction

In this proposal, the main delivery is an Android application which will help the user find the service providers in effective ways and in a short time. All the UI designs and features/functions will be created using Android Studio. The application should be developed on the Android Studio Chipmuck version. The language used in Android Studio is Java language. Besides, this application will also use Blender to create the 3D model and import the 3D model file to Android Studio. With that, users are able to use AR furniture in this application. This 3D model will be used to show AR furniture to users on their device. In addition, the database of this application will be created using Firebase which is suitable for large data storage application. This application needs to interact between different users, so the

data stored in the cloud is better because this enables to sync data between the users in real-time. Below are the modules which will include in this project.

House Owner Interface

Table 1.1: House Owner Interface Modules

Module	Section	Description
Authentication	Registration	User can create a new account by using the email and setting the password.
	Login	The user can sign in with their account email address and the password. User can click the forget password if they want to reset the password.
	Choose User Type	The user can choose the user type either as a house owner or service provider.
	Set up Profile	The user can set up their profile by providing information such as username, contact number and other relevant details.
Request Quotation	Questionnaire	The users can request the quotation from the service provider by answering the questionnaires set by the system. This allows the service provider know more about the details of the renovation job.
Service provider	Filter function	The users can filter the service providers by region.
	Provider Detailed Page	The user can see the details of the service provider such as their contact number, rating, comments and other relevant details.
	Rating and Comments	The users can provide feedbacks to service provider by rating and leaving comments.
Chat room	Send Message	The users can send the messages to the service providers to obtain additional information.
Furniture / Products module	Product / Furniture List	The user can view all the relevant furniture or product based on the category such as bedroom, bathroom and so on.
	Search furniture	The user can search the furniture by type.
	Furniture Detailed Page	The user can view the details of the furniture and products such as the prices, ratings and descriptions.

	Add to cart	The user can add the desired furniture into their shopping cart for further reference.
	AR furniture feature	The user can place the virtual furniture in the real environment. This is able to provide a realistic estimation of how the furniture will look in the actual space and whether is it suitable for the overall design.
History	Filtering function	The user can filter the history by service provider types.
	Perform the action	The users can response to the quotation provided by the service provider by clicking the specific buttons.
	Delete the record	The user can delete any unwanted record from the history list.

Service Provider Interface

Table 1.2: Service Provider Interface Modules

Module	Section	Description
View House Owner Request	List of requests from house owner	Contractors can view all job request from the house owner by job category.
	Create Quotation	Contractor can create and send the quotations to the house owners if they are interested in a particular job. They just need to fill in the job description then the quotation will be generated automatically with the estimated base price of the job.
Chat room	Send Message	Contractor can send the messages to the house owner through the chat room feature.
Quotation	Create Quotation	Contractor need to input all the necessary details to create the quotation.
Invoice	Create Invoice	Contractor need to input all the necessary details to create the invoice.
Client History	View the list of clients	Contractor can view clients by filtering them based on the status whether house owners have accepted, pending or declined the job.
	Delete the client	Contractor can delete the unwanted record from client list.
Sales Visualization	View sales report	Contractors can visualize their business by filtering the sales by date and visualizing them in graphs.

1.4 Contributions

As this application will used by both normal users and service provider (contractor and designer), the application targets and contributions are listed below:

1. House owner

    The home renovation services mobile application can allow the owner of the house to compare the price and services between the service providers within a short time. This is because this application will provide a list of different types of service providers to the owner. Hence, owners can save much more time and energy by doing the research on by one online or visiting the store physically. Besides, owners can also communicate directly with the service provider in real-time.

    Besides, the owners can also see the actual view after placing the furniture they want to buy through augmented reality (AR) features in this application. By using the camera of their smartphone or tablet, the owners can see a virtual representation of the furniture in their room in real-time. This feature helps the owners to make precise decisions about the placement and arrangement of the furniture. This can also help them avoid the hassle of purchasing and returning furniture items that do not fit well with the overall design of the room. Overall, the AR feature provides a more immersive and interactive experience for the owners to design and plan their dream house.

2. Service provider (contractor and designer)

    This application can also help the contractor gain more customers because they can promote their services in it. By promoting their services on the platform, contractors can reach a wider audience and attract potential customers who are looking for services related to their expertise. This marketing strategy helps to build brand awareness and establish a reputation in the industry, which can lead to more business opportunities in the future. Moreover, the application allows service providers to communicate directly with customers in real-time, which can lead to more efficient and effective communication. This application enhances the customer service experience, which can lead to more satisfied customers and increased business for the service provider. Besides, the sales report will help

service provider manage their business more effectively and make the precise decisions based on accurate sales data.

1.5   Report Organization

This report is organized into 7 chapters. Chapter 1 is the introduction of this project. This chapter include problem statement, objective, project scope and contribution of this project. Chapter 2 present the literature review focusing on some mobile applications that have related backgrounds with this project. Chapter 3 outlines the methodology used and proposed solutions, along with a project timeline. In chapter 4, the system design will be discussed by using some diagrams such as use case diagram and sequence diagrams. Additionally, the system implementation will be present in the following chapter including the software setup and configuration, UI screenshots and the implementation issues. In Chapter 6, it will evaluate the system by performing test cases, addressing project challenges, and evaluating the objective. Finally, Chapter 7 provides the conclusion, limitations, and recommendations for future development.

Chapter 2

Literature Review

Based on my research at App Gallery, Play Store and App Store I found some applications which have related background with my project and some suitable features that can be implemented as one of the features in the House Renovation Service Application. The applications I studied are recommend.my, Houzz Interior Design Ideas, HomeStars, Jobber and Ikea Place. Lastly, I also do research on the paper regarding augmented reality (AR) furniture to expand my knowledge in this field that will be used in Augmented Reality features in this application.

2.1   Previous Works on Renovation Services Related Application
2.1.1   recommend.my for Service Providers (Malaysia) application/websites [9]

Recommend.my is a powerful constructor recommendation platform that allows the owner to find the most suitable renovation profession. The aim of developing this system is to improve the services industry in Malaysia. This mobile application/website allows users choose their location and the type of services needed such as plumber, interior designer, electrical and wiring service etcetera.

Strengths

The user can see a list of service provider related to the service you have selected. Users can contact the service providers if they are interested. Otherwise, users can also fill in the form to tell the system as much as possible about what they really need. Depending on the selected service, different questions will be asked. For example, when choosing interior design services, you need to specify the type of property, the areas you want to design, design style and so on. These details will help the service providers to give more accurate quotations to the users. After submitting detailed information, the system will help users find suitable providers, and the interested providers will respond according to user 's quotations. This is time-effective, because the scenario is provider come to you, instead of you looking for them one by one.

In addition, the system allows users to see the review and investment portfolio of service providers, and can ask more questions before hiring them. This enables the user to find a reliable constructor in a short time. You can make the payment directly after confirming the details with the providers. This system is powerful because it has fast response, buyer protection and payment protection.

Besides, recommend.my also has provider interface that allows pros to check the requested quote of the customer. In order to become a registered provider, they need to pass the company validation check. This is to ensure the identity of the company to prevent any issues. It has a dashboard which allows providers check the open jobs. In order to quote the jobs of the user, providers need to buy the credit and check for the suitable package (RM288/month, RM1488 for 6 months).
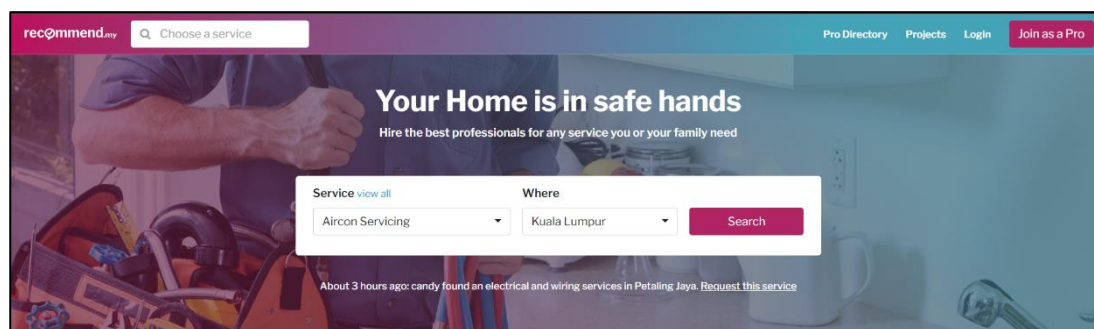
Figure 2.1: recommend.my - Home Page from [9]

Figure 2.2: recommend.my - quotation request form from [9]

Figure 2.3: recommend.my - List of service providers from [9]
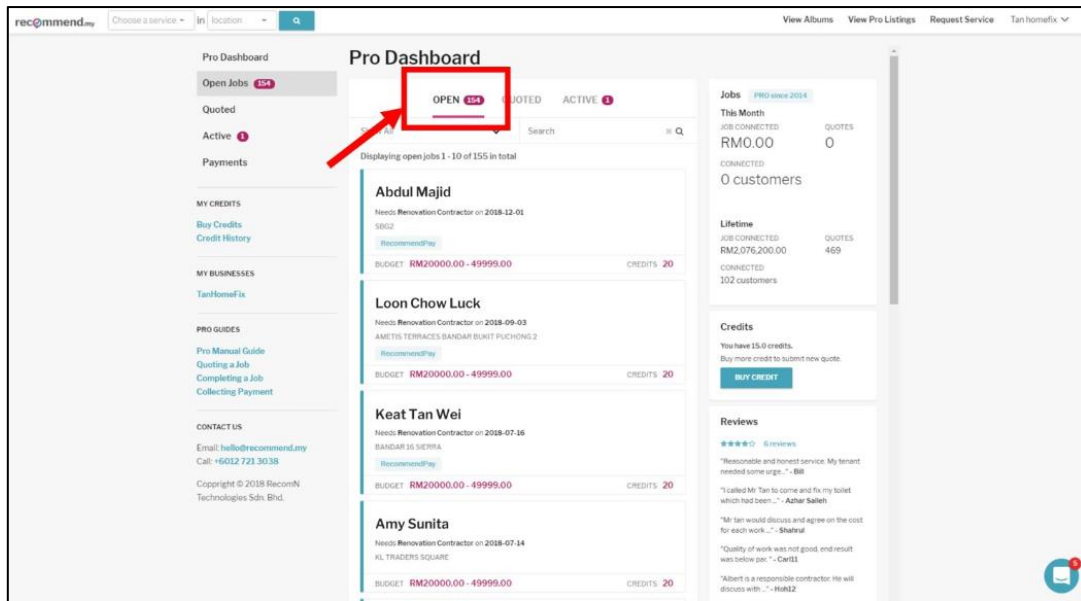
Figure 2.4: recommend.my – Pro dashboard from [9]

Limitations

The mission of recommend.my is to bring up the service quality in Malaysia. It does have strict policies to ensure that providers deliver good service to customers. Therefore, as a service provider, they need to have Recommend Credits in their account if they want to take the job from the customers. The process is like this: the quotes request of the customer will appear in the service provider's dashboard. If the service providers want to quote that project, they need to use Recommend Credits in order to proceed. They can see how many credits it will cost to submit a quotation to the customer. If they do not have enough credit, they can purchase it using credit card or bank transfer. If the credit balance is insufficient, the service provider will not be able to accept any jobs. The amount of the credit depends on the type of service needed and the budget range stated by the customers.

This policy causes a serious problem for the service providers. Even if they don't know if they can get the job, the provider needs to pay high amount of credit. This problem gets worse when they do not get any refund for the credit even if the customer has cancelled the job. This is too unfair for the providers. The policy protects the customer well but ignores the right of the service provider.
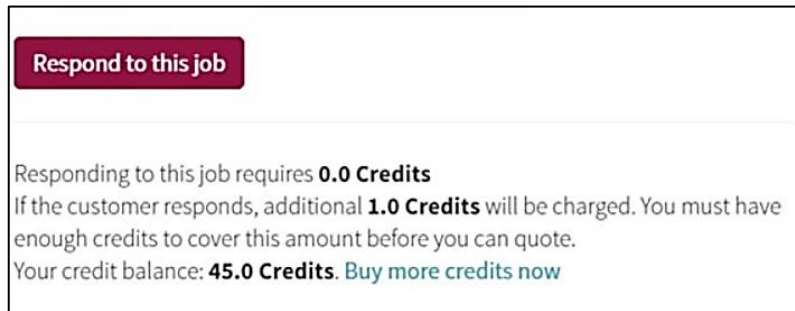
Figure 2.5: recommend.my - Recommend Credit system from [9]

Resolved solution

The solution to overcome this weakness is to come up with a system that will quote providers with lower credit, but charge more after the work is done. This solution can protect the rights of both the user and service provider.

2.1.2 Houzz Interior Design Ideas [10]

Houzz Interior Design Ideas is an interior decoration application, which won the Google Play Awards Award for Best Application. Whether you are building, renovating or decorating, Houzz is covered. Users can find ideas, find some furniture or products, decorating skills and find service providers.

Strengths

This application contains a shopping menu, which allows users to quickly select the product they want, such as furniture, lighting, home decoration, kitchen and dining, etc. Besides, it also allows users to find the service providers. It provides a lot of provider categories such as kitchen design, home extension, custom cabinets and so on. Users need to choose the provider they are looking for and request a quote. Users will be asked some questions in order to let the providers give a more accurate price based on the user requirement. Not only that, users can also follow their profile and even call them directly within the application. Users can also see their idea books, recent projects and where they are based and the reviews of the customers. Besides, it also has a cool feature which is the photo book feature. This photo book contains more than 25 million photos that allow the user to browse through or search for a particular style. Users can

also filter by room type, room style, budget. Once the users find the images they like, they can tap on more for additional information. The picture will be embedded with the price tag that allows the user to check for the price of that particular furniture or product. The most powerful feature in this app is the 'View in My Room' feature. It allows the user to place the furniture, artwork, décor piece in the user's space virtually. Users can resize the object to fit the room and save it to the idea books. [5]

Besides, it is very easy to use because the UI design of this application is concise and clear. The features provided are also straightforward and the user can learn how to use the application by just testing it by themselves.

In addition, this application also has a pro version that allows providers to keep track the customers and tasks. Providers can say goodbye to multiple logins, spreadsheets apps and sticky notes. Houzz Pro helps them save time and organize their work well. It helps providers create professional estimates and proposals in minutes using Houzz's library of labour and material costs, then send them to clients to approve instantly. The unique feature of this pro version is can take the customer experience to the next level as providers help clients visualize end result with renderings created using 3D floor planner [5].
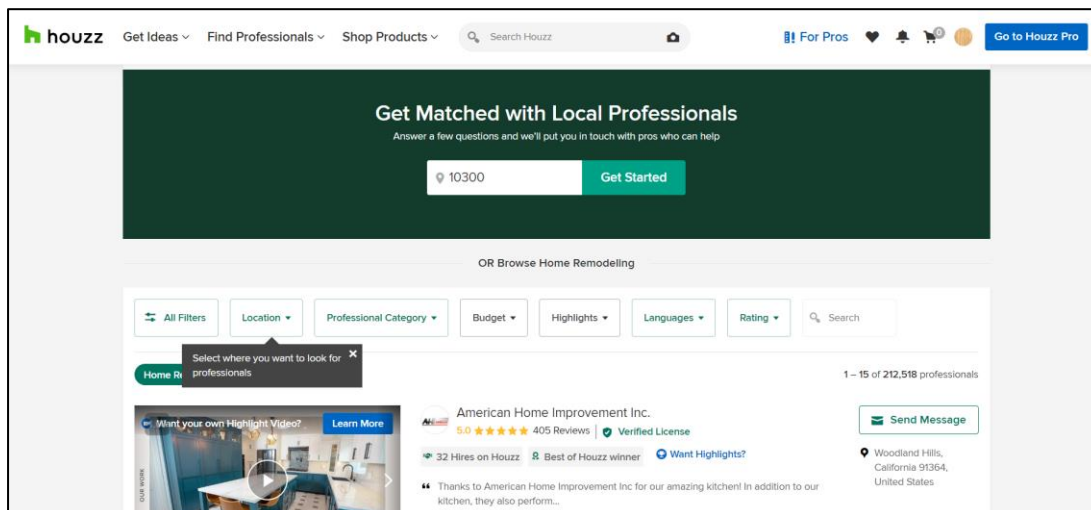
Figure 2.6: Houzz - User interface from [10]
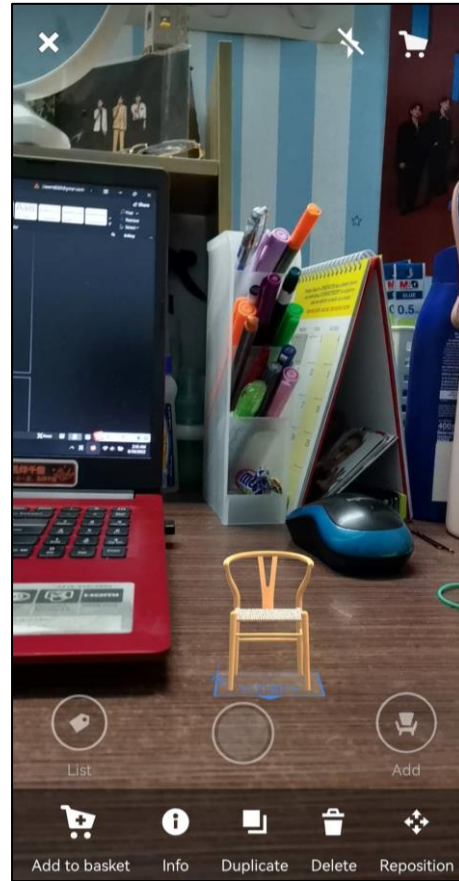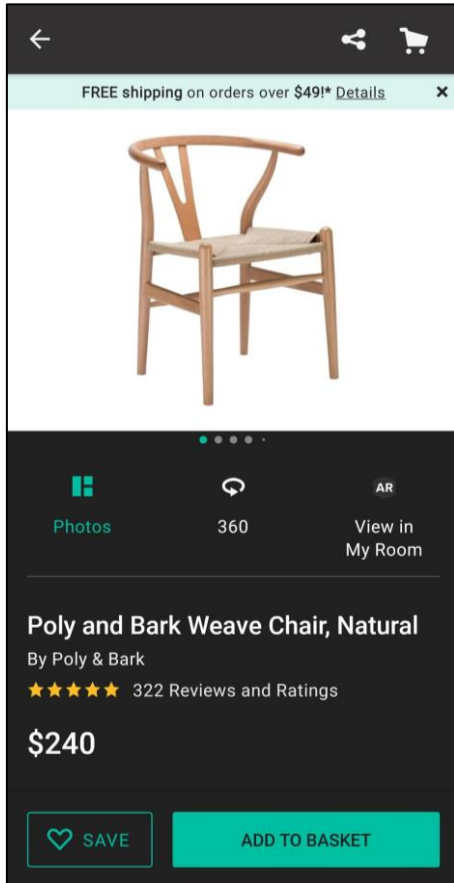
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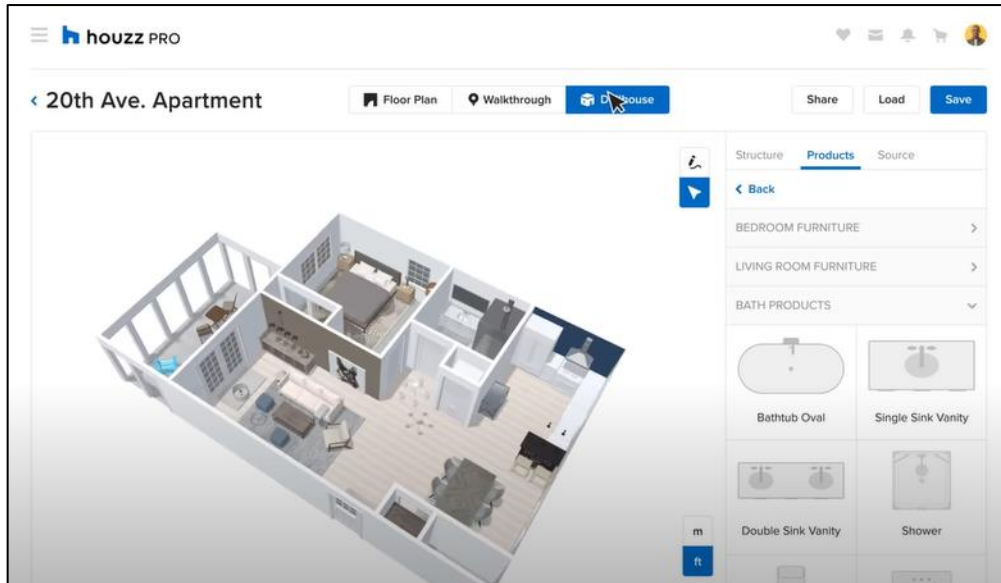
Figure 2.9: Houzz Pro - 3D Floor plan from [10]

Limitations

The user must be more careful when dealing with the service provider. This is because the providers who register in this application have not been proven or authenticated by the system. This may make it hard for users to find a reliable service provider. Users need to do more research on the Internet to determine whether it is a reliable provider.

Besides, the AR feature in this application is not user friendly. It is difficult to put virtual furniture through this application. As users are very concerned whether the furniture can fit their room, the real-world scale is very important. However, this application is not able to let the user place the furniture nicely and this may cause some trouble for the user.

Resolve solution

This application should strictly check the identity of the registered constructor. The admin of the system needs to validate the constructor's company or request documents from the constructor to support their identity. Admin plays an important role in protecting the rights of the user. For the second limitation, it can be solved by implementing a more powerful AR technology that allows real scale virtual furniture or object to be placed in user's space. When a user travels towards or away from a virtual object, the programme will scale it up or down automatically.

2.1.3   HomeStars [11]

HomeStars can allow user get matched with local pros for their next home project. Nancy Peterson founded HomeStars in 2006. It is an application which provides consumer reviews of contractors, repairman and retailers who work in the home improvement and renovation industry.HomeStar started as a website where home owners could share their recommendations based on their own experience to help others finding trustworthy contractors. Any review that are published regarding contractors can reply by themselves.

Strengths

The user can choose the service they need and enter the postal code to let the system find the nearby constructor. The system will ask some details and try to match with related providers for user to compare when requesting the quote. The system will provide the home owner three different constructor companies that capable of delivering the requested service. Besides, user can also find the service providers through the list created by the system. After find the suitable provider based on provider's profile and customer ratings, user can get a quote from the provider. Besides, user can also write a review after service by that particular provider. User can review the company by rating the service provided, write a short story or add a photo. Besides, the special feature of this application is it provide the cost guide to let the user estimate the cost of the works. User can see the range of price based on the type of service and the location of the city [6].

This application not only will benefit the home owner, it will also help contractors to boost their sales. The service providers can stay in touch with the customer anytime and anywhere. Besides, they can also upload photos of projects they are worked on. After the customer request the job from the service constructor, they can accept the job directly. Lastly, provider can also read, respond to and even request reviews from the customer.
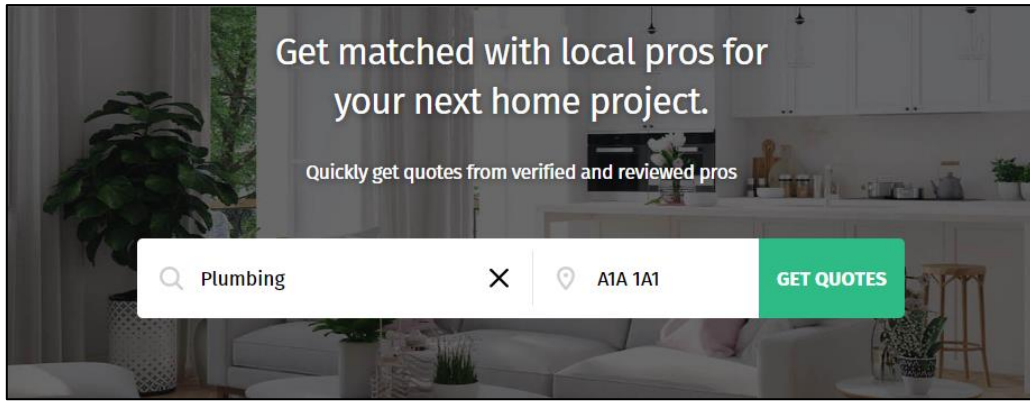
Figure 2.10: HomeStars - Home page from [11]
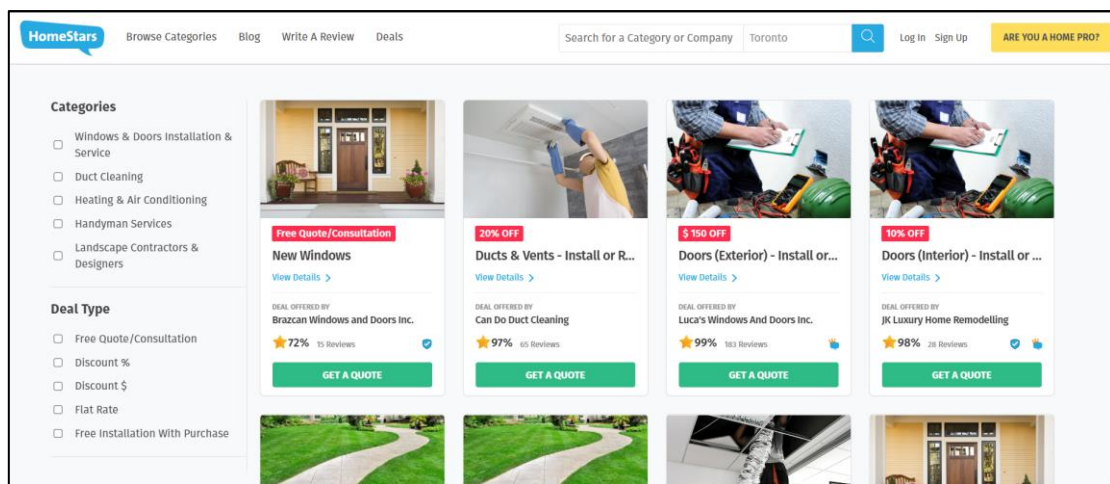
Figure 2.11: HomeStars - List of providers from [11]

Figure2.12: HomeStars – Review form from [11]

Figure 2.13: HomeStars - Pro interface from [11]

Limitations

HomeStars Pro do not have the create quotations and invoices templates.

Resolve solutions

Add quotation and invoice template module to this application.

2.1.4 Jobber [14]

Jobber is a service management platform used by over a hundred thousand service professionals in over 50 different industries. Jobber is great for small to medium-sized service businesses that have a high recurring job. This solution comes with built-in automated payments, robust scheduling tools, and customer relationship management (CRM).

Strengths

The dashboard of the Jobber shows the overview of the business. It will show the overview of the appointment on that day in order to prevent the provider from missing any work. Next,

Jobbers help constructors create, send and track quotes. It allows providers to create quotation that include details such as a description of the job, discount, deposit and the total price. After that, the quotation can be sent by the providers to clients. The clients can accept, reject or request changes. 'Client Hub' connect between clients and providers. Clients can create a work request, approve the quotation, check appointments and pay invoices. Besides, Jobber offers customer relationship management that helps to keep track of client details such as past work history, quotes and invoices. Not only that, Jobber includes scheduling features with the drag and drop calendar. Providers can schedule different events like upcoming tasks and visits, set reminders for quote follow-ups and invoicing. With Jobbers, providers can also send clients the electronic invoices. It allows providers to create the customize invoice which require they fill in some important information such as due dates, payment options and so on. Lastly, Jobber includes many reports that aid in data visualization and business's performance monitoring. All reports can be exported to a CSV file [7].
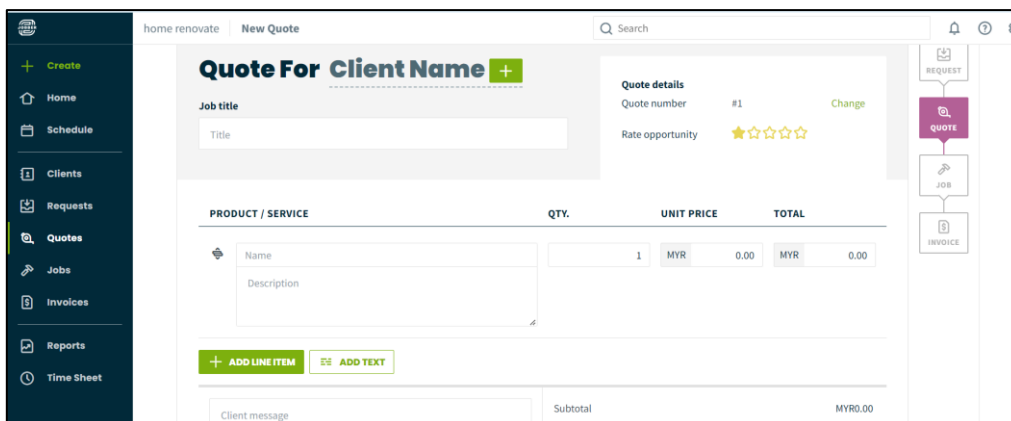
Figure 2.14: Jobber – Quotation template from [14]
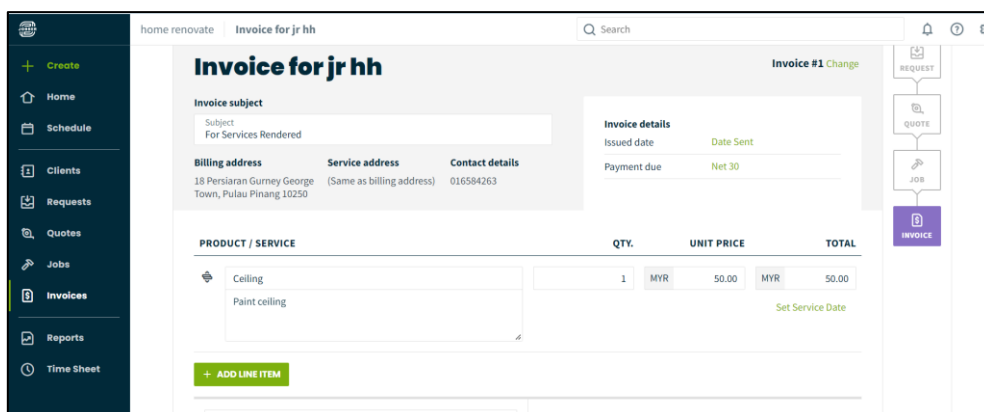
Figure 2.15: Jobber – Invoice template from [14]
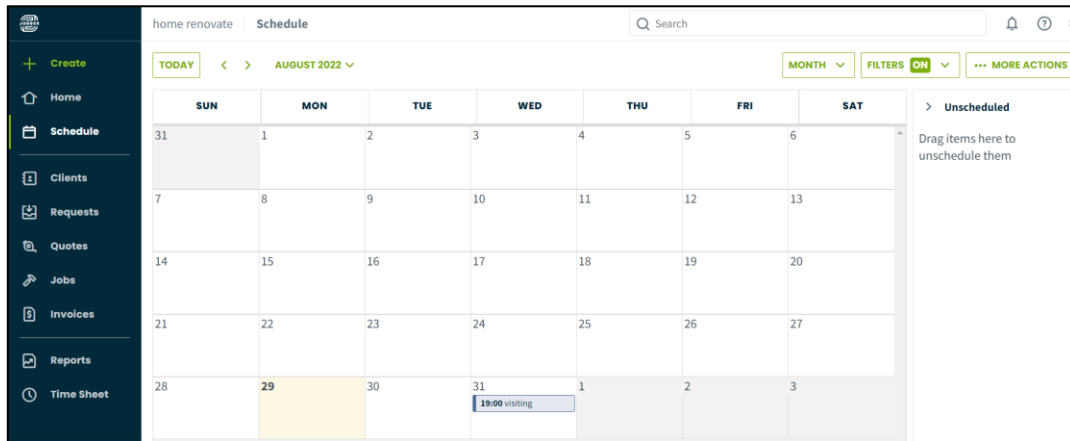
Figure 2.16: Jobber – Scheduling feature from [14]
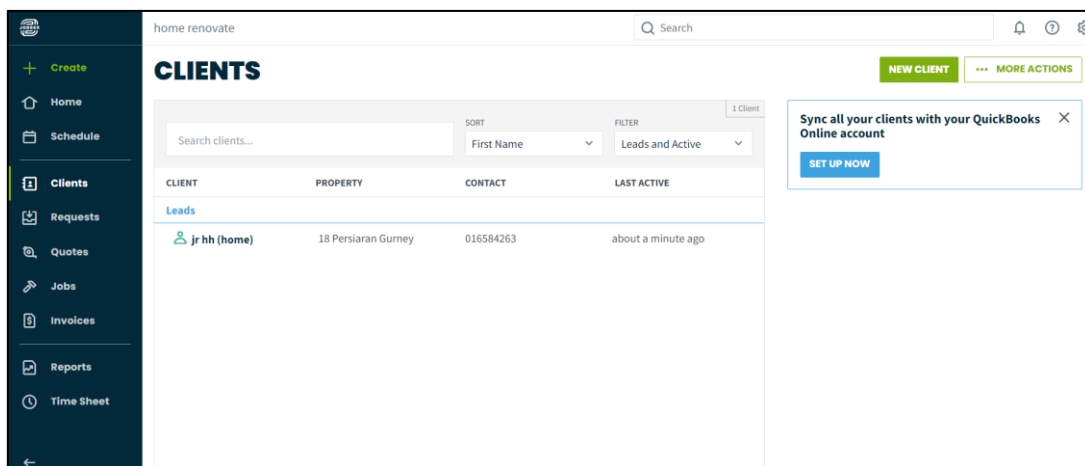
Figure 2.17: Jobber – Client list from [14]

Limitations

Jobber does not include an open API. Besides, two-way texting and automated quote follow-ups are only available in Grow Plan which costs 199 USD per month. It is expensive for certain service providers to afford. Some of the user reviews state that the application will be prone to lag when multiple users are logged in simultaneously. Therefore, Jobber only suitable for smaller companies instead of bigger companies. The CRM feature is not suitable for large businesses with a high volume of clients.

Besides, Jobber do not have user interface that allow the user find the service provider directly.

Resolve solution

Jobber can offer a more affordable package for small size business. Besides, this application should be improved by the multiuser access which can support a large number of user access in one time. Besides, Jobber can create a user interface for normal user to find the service provider easily.

2.1.5   Ikea Place in App store [12]

IKEA is the first furniture and home accessories company which developed its own AR app using Google's AR Core system. It is an application that allows users to virtually place actual size 3D models or furniture from the IKEA catalogue in the user's space. Besides, it can also let users know how many pieces of furniture suitable in their house. This is done by the latest AR technology that associates virtual information with the world in reality. Users can figure out what they want in their home with this application. 1For example, users can place desks, beds, chairs, cabinets and any other things that users might need at home, and let users have an effective planning strategy. The items in the catalogue can be scaled dynamically, so the user can see exactly how furniture looks in their own space. The scale accuracy of this application is around 98% [1].

Strengths

The IKEA Place app has many advantages. Firstly, this application is easy to use. On the IKEA Place app, everything is quite clear and straightforward. There is a tutorial for first-time users on how to use this application effectively. Along the process of using this application, users will get tips and messages from the app to help users to have a better view of their space. In addition, there is a search bar in the upper right corner of the application, allowing users to easily search for items that user already knows. Next, this application provides accurate scanning. It takes a few minutes to scan the user's room correctly and after the user done this, it is not difficult to arrange and place the virtual furniture in the user's space. As users move the items, the scale also changes automatically which will provide a realistic look at what users expect. The next advantage is providing easier shopping experiences for users. Users can save the items by hitting the 'like' button next to the items that want to buy

later. User and check back the details of the desired furniture in the wish list, so they can act this list as a shopping list when they actually visit IKEA [1]. Not only that, users can purchase the furniture and items directly through the app once they find the things they desire. This helps to increase the users and support users to decide the dreamed furniture without involvement physically in IKEA store.
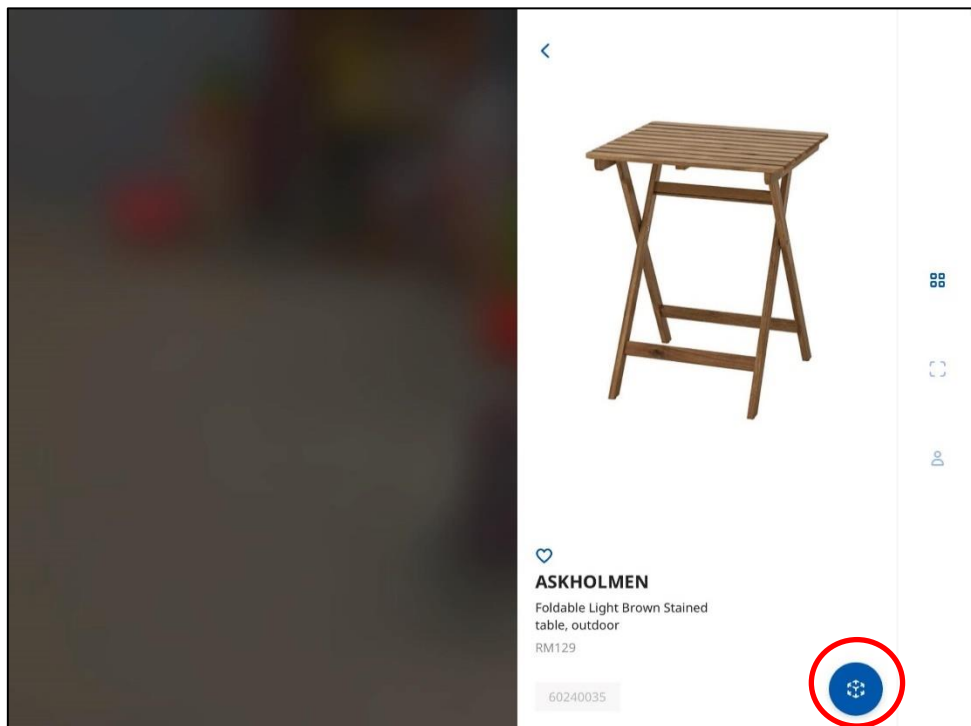
Figure 2.18: Ikea AR - Furniture catalogue from [12]

Figure 2.19: Ikea AR in real world from [12]
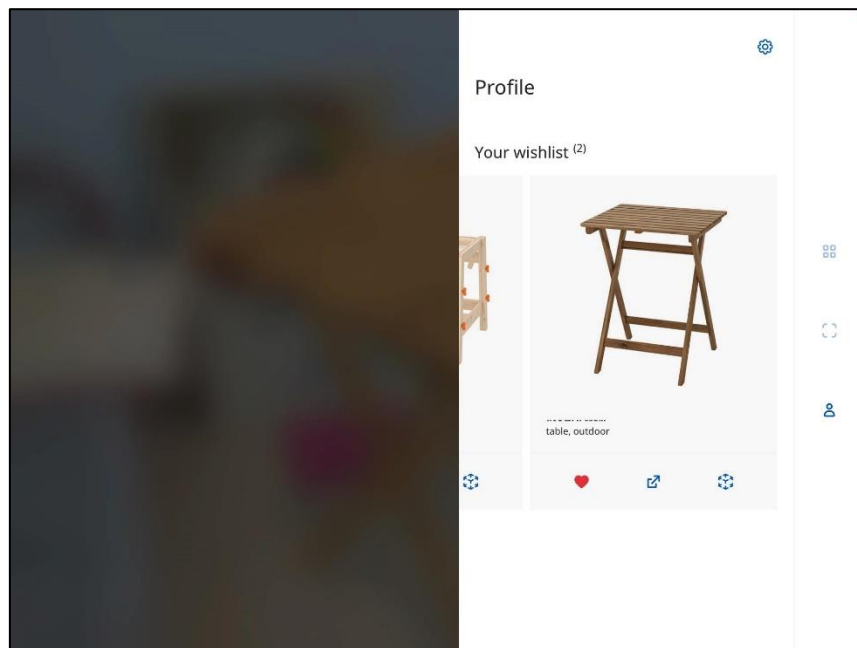
Figure 2.20: Ikea AR – Wish List from [12]

Limitations

IKEA Place does not include the whole furniture inventory in this application and this cause many users cannot find the desired furniture that is available in the IKEA physical store.

This brings a lot of inconveniences to the user, and may cause them to uninstall the application because it is no longer useful for them. Besides, I realize that this application does not allow users to save the project after they place all the desired furniture and items. If the user exits the application, the whole design will disappear. It does not make sense because when the user wants to show the planning to others, he cannot refer back and needs to replace the furniture again.

Resolve solution

The solution to overcome this limitation is to update the inventory of the AR furniture more frequently. Once IKEA has new arrival furniture, the IT department needs to collect the details such as width, height and shape of that furniture. Next, they need to update the AR furniture inventory as soon as possible because many people are interested in the new arrival products. Besides, Ikea Place should allow the user to save the design for their reference in the future.

2.1.6   AR furniture using Marker and Makerless tracking

Based on the research [2], Augmented Reality (AR) is a technology that allows users to place virtual objects in the actual world in real time and turn their surroundings into a digital interface. The principle of the AR furniture application is first using a marker tracking approach to display the details of the products from the rear camera of a smartphone. A 3D model can be shown over the real-world image by using markerless tracking technique which will track the features and calculate the positions. In short, AR display virtual items that are registered in 3D which need tracking technology [3].

Augmented Reality Technology

Basically, the AR system has a camera, display unit and a processor. After the image is capture by the camera and the AR system will superimpose virtual objects. The tracking module in AR software calculates the exact position and direction for virtual overlay. The original image and the virtual object will be combined through a rendering module and rendered on the display.
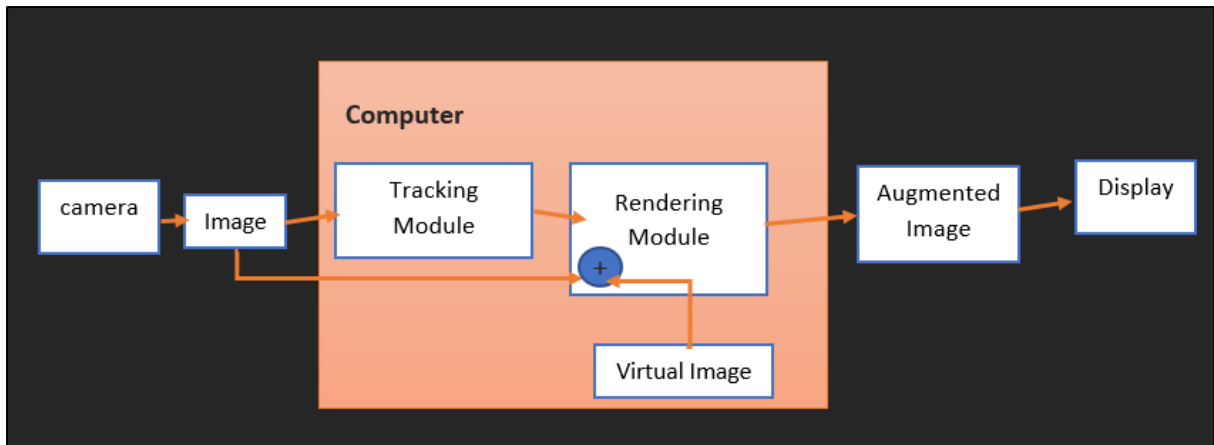
Figure 2.21: Flow chart for an AR system

AR Furniture

Strengths
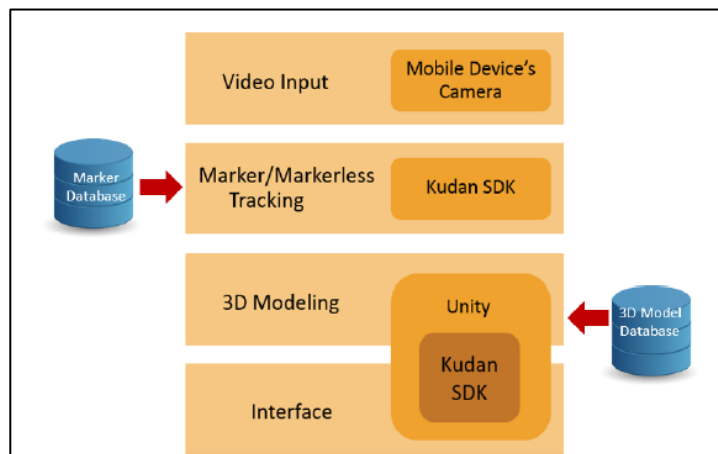
Figure 2.22: System overview of AR-Furniture from [2]

This AR furniture is using Kudan as the AR SDK because it makes augmented reality development very easy. It uses SLAM technology which is a technique to construct a map with an unknown environment. The video input is performing colour conversion and sending it to a processing pipeline. Maker or markerless tracking is to detect a feature by analysing the image frames. 3D modelling is selecting 3D model and overlaid in the image frame after calculate the position in 3D. Lastly, interface is the user interface that allow user interact with AR furniture.

The markers used in the system are from KudanAR 1.1.3. The marking tracking uses digital images to identify makers and calculate their relative orientation with respect to the

camera. It converts the physical world captured by camera into grayscale image. Then, the decoded marker ID augments the virtual object into a physical model. This markers-based approach is to let the users see the details of furniture products. It is suitable to be implemented in furniture catalogues that show only the image of the furniture.

Besides, it also used a markerless based approach. It uses all parts of the real-world environment as the base for the placement of superimposed virtual objects. Markerless augmented reality does not use benchmark identification markers, but depends on the natural features of the surrounding environment. The next step is creating 3D models for the virtual furniture by using 3dsMax, then importing them into Unity using the Autodesk as .FBX format which is one of the 3D exchange formats.

The main advantage of this system is that it is easy to use after a few attempts without any instructions. Besides, the system can display 3D objects that satisfy users.

Improvement that can be done

The application can perform well by creating a variety of maker patterns with barcodes or QR codes. Besides, it also can improve by differentiate ceiling and walls show the 3D object can be displayed properly. Lastly, it can make the 3D furniture more realistic by improving the light robustness.

2.2 Comparison between existing system

A simple comparison between the features of the reviewed application is shown in the table below (Table 2.1). recommend.my refers to recommend.my for Service Providers, Houzz refers to Houzz Interior Design Ideas, HomeStars refers to HomeStars and Jobber refers to Jobber.

Table 2.1: Comparison among reviewed application

Features / Application	recommend.my	Houzz	HomeStars	Jobber
Normal User Interface	-	-	-	-
Search function	Yes	Yes	Yes	No
List of service providers	Yes	Yes	Yes	No
Requirement form	Yes	Yes	Yes	No
Request quote	Yes	Yes	Yes	No
Review function	Yes	Yes	Yes	No
Shopping menu	No	Yes	No	No
Photo book	No	Yes	No	No
AR furniture feature	No	Yes	No	No
Payment function	Yes	Yes	No	No
Service Provider Interface	-	-	-	-
Provider dashboard	Yes	Yes	Yes	No
Company validation checking	Yes	No	No	No
3D Floor plan	No	Yes	No	No
Quotation template	No	No	No	Yes
Invoice template	No	No	No	Yes
Scheduling features	No	No	No	Yes
Sales summary report	No	No	No	Yes

Chapter 3

System Methodology/Approach

This chapter outlines the methodology used in this project which is the Agile Software Development Methodology. Besides, it also includes the proposed solution of this project along with the comparison between the existing system and the proposed system, highlighting the key advantages and features of the proposed application. Furthermore, the project timeline for both FYP1 and FYP2 will be presented in detail to provide a comprehensive overview of the project schedule.

3.1 Methodology Used

The House Renovation Service Application will be developed using the Agile Software Development Methodology, which is highly suitable for mobile app development. This is because mobile applications require constantly updates for bugs and new features to fulfil the requirements of the users. Additionally, since the application will be used by end-users, rapid feedback can be obtained, enabling constant improvement of the application over time. Therefore, Agile approach is considered a suitable methodology to develop this application. The stages of Agile SDLC are concept, inception, development, release, maintenance.
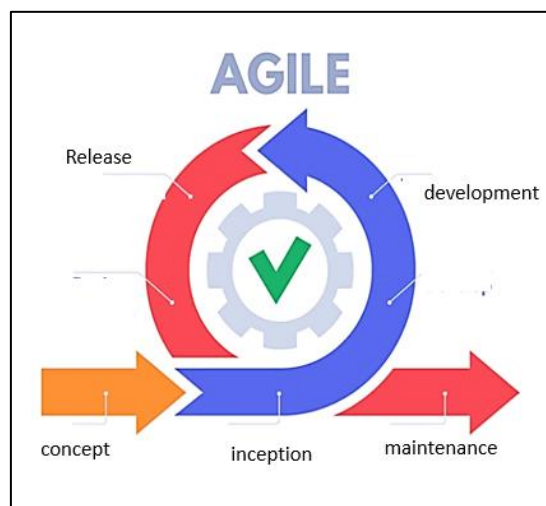
Figure 3.1: Agile Software Development Life Cycle (SDLC)

Agile Software Development

Concept is the first stage of agile development. In this phase, it is required to determine the objective of the software. Next, the requirements for the software will be determined in the inception stages. The iteration or development stage is the longest phase because the programmer needs to perform coding and needs to deliver small functional parts of the software. After that, the release stage involves testing and ensuring the software's overall functionality. Besides, this stage also involves users' feedback to promote consistent release and improvement. The maintenance stage requires developers to give regular support to ensure the software can run smoothly without any bugs. The last stage of agile SDLC is retirement. This stage will occur if new software is introduced and replaces the system [4].

1. Concept

During the concept phase, the objective of this project is identified which is to solve the problems faced by house owners who want to reconstruct and renovate their house. To achieve this objective, it is essential to consider the viewpoints of both homeowners and service providers in order to develop a solution that meets the needs of both parties.

2. Inception

During the inception phase, it is important to identify all the essential features that can be implemented in this application. The main functions in the house owner interface such as searching for nearby providers feature and requesting the quotation feature should be completed first. For the service provider interface, the main functions should be viewing all requests from house owners and based on the conditions, giving an estimate quotation to them.

Besides, it is also necessary to determine the timeline for each task based on factors such as the level of difficulty, workload and resources available. This will help ensure that the development process will go smoothly and on schedule. For instance, more complex features such as the augmented reality functionality may require additional time and effort to develop. Additionally, it is important to identify the necessary tools and software needed for the development of the application.

Not only that, some diagrams need to be constructed such as use case diagram and sequence diagram. These diagrams will be used to illustrate the interactions and relationships between

different components of the system, and help to provide a clearer understanding of how the system functions. Use case diagrams will provide an overview of the system's functionality from the user's perspective, while sequence diagrams will show the interactions between different objects and components in the system over time. Overall, the creation of these diagrams will be an important part of the project's design and development process.

3. Development

After identifying the requirements of this application and completing the initial planning, now is the time to begin the development phase. All the modules that were mentioned before will be created at this stage. For example, the quotation request module, the find providers module and so on. This process requires a lot of time and effort to complete. However, good planning and setting realistic objectives might make the development process much simpler. In this stage, it requires having creative ideas to solve the bugs that might arise during the development process. Furthermore, it is critical to create a user-friendly application for the users. It is important to ensure that users can easily navigate and utilize the application. This stage is also the longest as it involves continuous coding and delivering small working parts of the software.

4. Release

Once the application is built, it will undergo testing either by testers or by direct distribution to users. During this phase, feedback will be collected from customers and testers, which may include opinions, user experiences, error reports, and more. This feedback will be analyzed and used to make improvements to the application. If new features are planned to be implemented in the House Renovation Service application, the SDLC cycle will begin again.

5. Maintenance

As a responsible developer, it is important to provide ongoing maintenance and support to the users to ensure that the application is running smoothly and efficiently. This includes addressing any issues or bugs that may arise and providing timely updates to improve the overall user experience. It is important to establish a reliable communication channel with the users to receive their feedback and promptly address any concerns. Consistent and reliable support can help build a positive reputation for the application and foster user loyalty.

3.2 Proposed solutions / application

The House Renovation Service Application is designed with the aim of providing users with an easier and more efficient way to find reliable service providers. This application offers a combination of different features that enable users to manage the renovation procedure with greater precision. It offers two distinct interfaces: the user interface and the service provider interface, both of which provide unique functionality to their respective users.

To enhance the user experience, the House Renovation Service Application will feature a carousel that showcases highlighted or newly updated features before users enter the main page of the application. Upon first-time launch, the user will be prompted to register an account, which can be done via a Google account or manual entry of their email. The application offers two different interfaces: the user interface for house owners and the service provider interface. Users must choose which type of account they wish to register for. Upon successful registration, the user will be redirected to the login page, where they can log in with their email and password details.

Normal User Interface

In a normal user interface, the user can perform many actions. After setting up their profile, including details such as their username, phone number, and address, they will be directed to the home page. At the top of the home page, there is a search bar that enables users to easily find and request a quotation for a specific service. The application offers four types of services: kitchen, plumbing, electrical and wiring, and interior design. Once a user selects a service, they will be prompted to choose a more specific scope of jobs within that service category. For example, if a user selects "electrical and wiring" services, the system will ask for more specific information, such as whether the job involves installing lights or wiring extensions. This is to let the service providers know more about the house owner's requirements.

After that, the system will ask users some related questions in order to let the service provider give a more precise quotation based on the requirements and conditions. Relate to the previous example, if the users choose to install fan/lights/15A point, the system may ask questions such as 1. What do you want to install? 2. Do you already have the parts? 3. What

type of building does the electrician need to work in? Besides, users also need to choose the preferred appointment date and time. In addition, they can also talk more about their requirements. All of this information will be submitted and made available to service providers on the service provider interface. Then, the providers who have the interest with user's project will give the quotation to them. Interested providers will then be able to give the user a quotation, allowing them to easily hire a service provider within a short period of time.

On the home page, a list of service providers is displayed below the search bar. Users can click on the "see all" button to view a list of service providers for each of the four service types: kitchen, plumbing, electrical & wiring, and interior design. If a user selects "kitchen," for instance, the system will display all providers offering kitchen-related services. Within the app, users can send direct messages to providers for additional information. Clicking on a provider's profile image will display their company description, contact number, reviews and ratings. Besides, users can also see reviews and ratings within the provider's profile. This feature allows users to easily compare providers and find reliable ones, reducing the risk of encountering fraudulent providers. The "providers list" feature provides a convenient way for users to compare providers side-by-side.

On the home page again, there is also a section showcasing various furniture and products available on the platform. When the users click on the 'see all' button it will show the categories of the furniture and product such as furniture, bedroom, lighting, bathroom. Upon selecting a category, all related products will be displayed. Users can click on individual products to view more details such as the product description and price. From this page, users can choose to add the product to their shopping cart if they are interested in purchasing it. Additionally, the application features an augmented reality (AR) function that allows users to visualize how virtual furniture or products would look in their real-world space. This feature provides users with a convenient and efficient way to identify whether the furniture or product will fit well with their home decor.

The application also features a "History" page, which allows users to keep track of the status of their requested quotations. If service providers respond to the user's request with a quotation, it will be displayed on the History page along with "Accept" and "Decline" buttons to enable users to make a decision. Users can easily compare prices and choose the best

quotation. Users can delete the quotations of providers who do not provide them with a better quotation from the history page. Once the job is completed, users can mark it as "Complete" and receive an invoice from the provider to make the payment. In addition, users can provide a review and rating for the service provider based on their professionalism, attitude, and customer service.

The last part is the drawer menu that exists in the top-left region of this application. This menu consists of some functions that can be performed by users. The first function is users can edit the profile, such as changing the username, phone number and address. This will ensure the communication between the user and the constructor is effectively handled because the details provided are correct. The chat room features which allow the real communication between the house owner and service provider will also available in this drawer menu. User can also log out their account by pressing 'Log Out' button in this drawer menu.

Service Provider Interface

When a user registers as a service provider, they will use the service provider interface to interact with users directly. If the provider is new to the system, they will be prompted to set up their profile by providing their company description, uploading a profile picture, and indicating their company region. However, the most important detail for providers to input is the service type they offer. This categorization allows users to find relevant service providers more easily.

Once providers have set up their company profile, they will be directed to the dashboard. Within the dashboard, providers can view all the requests made by users through the normal user interface. By clicking on a specific request, providers can access the request details, which include the user's responses to the questions asked by the system. If providers are interested in a particular project, they can use the application's quotation template function to calculate the base price and create a quotation to the house owner. Providers can fill in details such as the product or service description, while the system will auto-fill other relevant information. Once the information has been provided, the system will automatically generate a quotation in PDF format that can be sent to the user through the app's chatting function.

In addition to generating quotations, providers can also use the application's invoice template to bill their clients. This feature enables providers to easily fill in the necessary details and have the system automatically generate a PDF invoice, saving them time and effort. Furthermore, providers can keep track of their clients by using the "client list" feature, which allows them to store and organize all customer details in one place. This feature can be particularly useful for providers who want to monitor their company's sales for a given month.

In the navigation menu on the top left of the dashboard, providers can easily access and modify their company profile. It is very important to include all the information of the company and must make sure the details providers are correct. Providers have the ability to update their profile picture, company name, and company description to ensure that their profile reflects accurate information. In addition to this, the menu will also include a sales report summary that allows providers to visualize their sales for a specific time range. Additionally, the platform includes a chat room function that allows providers to communicate with the house owner in real-time. Lastly, it has the sales report feature which allow the service provider view their business record. They will see how much of their revenue is generated in a given period, and the number of projects that have made significant profits.

3.3 Comparison between existing system and proposed solution

A simple comparison between the features of the reviewed application is shown in the table below (Table 2.1). recommend.my refers to recommend.my for Service Providers, Houzz refers to Houzz Interior Design Ideas, HomeStars refers to HomeStars and Jobber refers to Jobber. Besides, proposed solution refers to the proposed application, which is House Renovation Service application.

Table 3.2: Comparison among reviewed application and proposed solution

Features / Application	recommend.my	Houzz	HomeStars	Jobber	Proposed Solution
Normal User Interface	-	-	-	-	-
Search function	Yes	Yes	Yes	No	Yes
List of service providers	Yes	Yes	Yes	No	Yes
Requirement form	Yes	Yes	Yes	No	Yes
Request quote	Yes	Yes	Yes	No	Yes
Review function	Yes	Yes	Yes	No	Yes
Shopping menu	No	Yes	No	No	Yes
Photo book	No	Yes	No	No	No
AR furniture feature	No	Yes	No	No	Yes
Payment function	Yes	Yes	No	No	No
Service Provider Interface	-	-	-	-	-
Provider dashboard	Yes	Yes	Yes	No	Yes
Company validation checking	Yes	No	No	No	No
3D Floor plan	No	Yes	No	No	No
Quotation template	No	No	No	Yes	Yes
Invoice template	No	No	No	Yes	Yes
Scheduling features	No	No	No	Yes	No
Sales report	No	No	No	Yes	Yes

3.4 Project Timeline
3.4.1 FYP1 Timeline
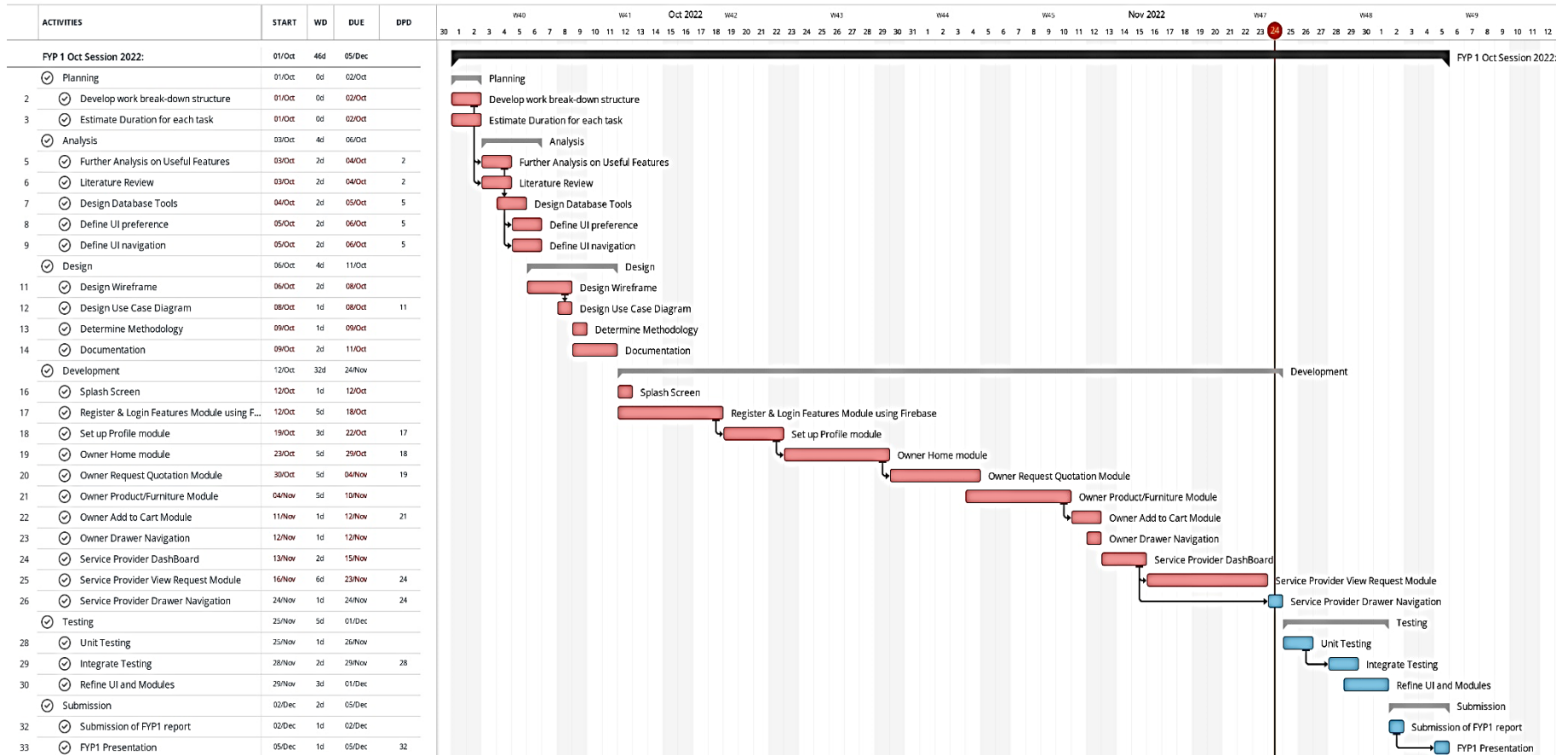
Figure 3.2: FYP1 timeline

3.4.2 FYP2 Timeline

The following timeline provides details on the tasks that need to be completed, the duration of each stage, and the dependencies of each task.
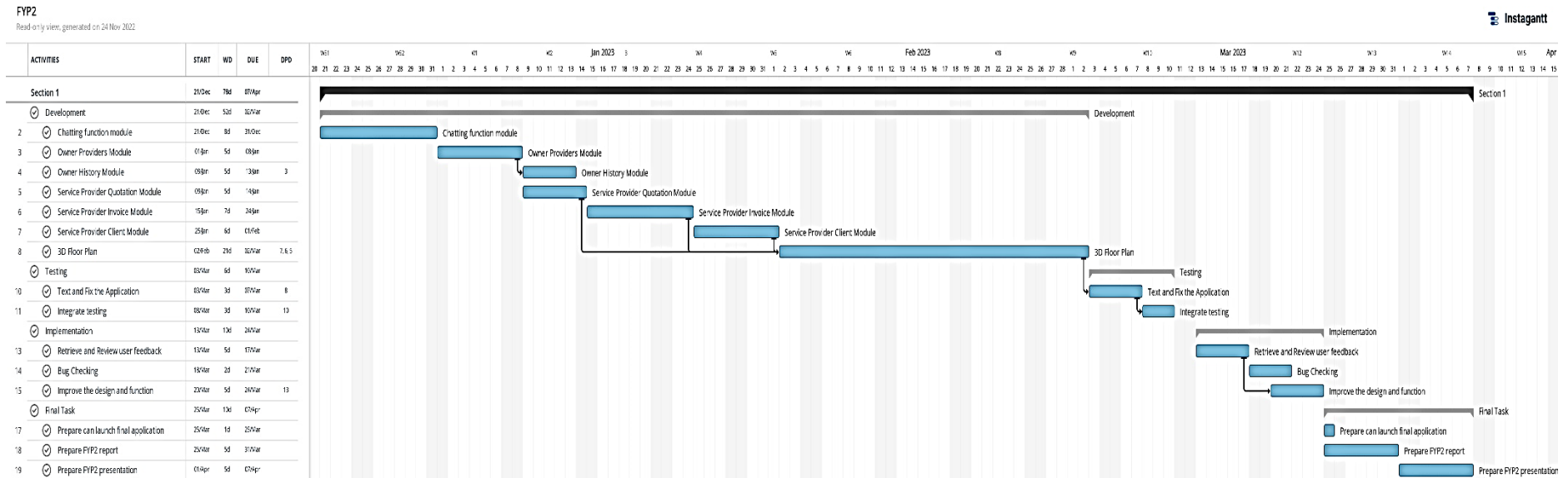
Figure 3.3: FYP2 timeline

Chapter 4

System Design

This chapter will present various design aspects of the application, including the wireframe, use case diagram follow by the use case description and sequence diagram.

4.1 Wireframe of the application
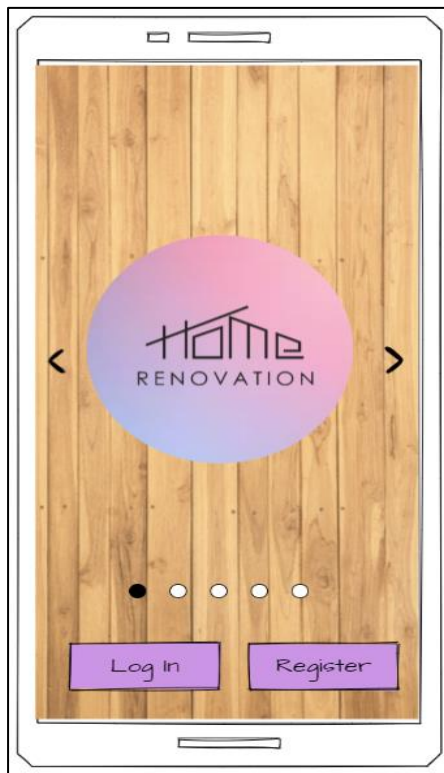
Figure 4.1: Carousel features

Figure 4.2: Login Page
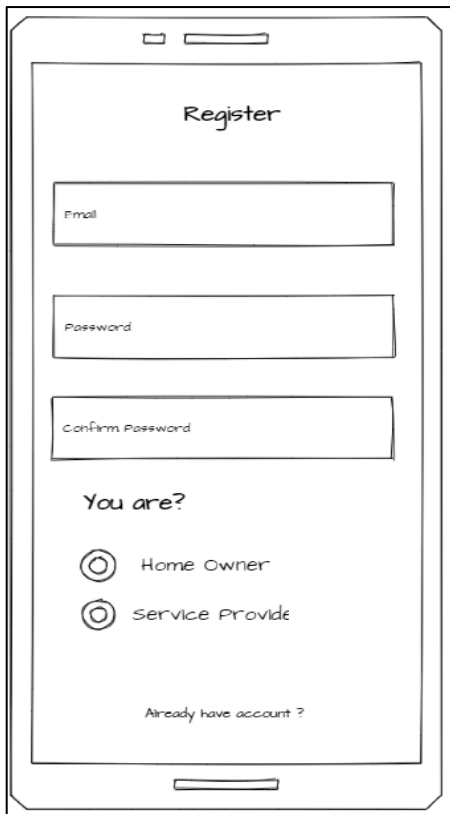
Figure 4.3: Register Page

House Owner Interface
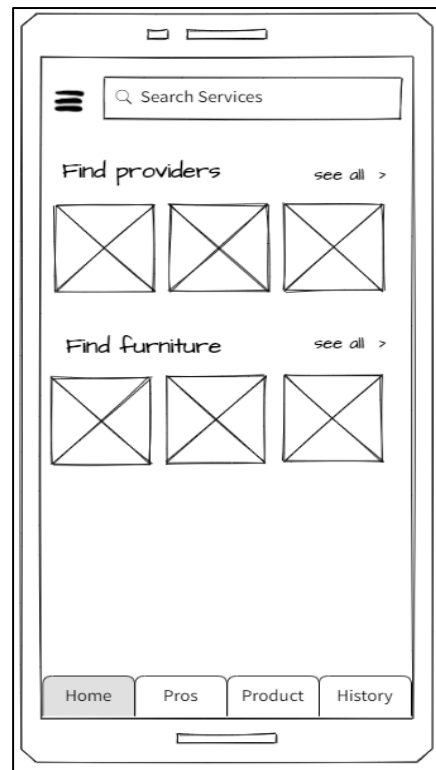
Figure 4.4: Home page
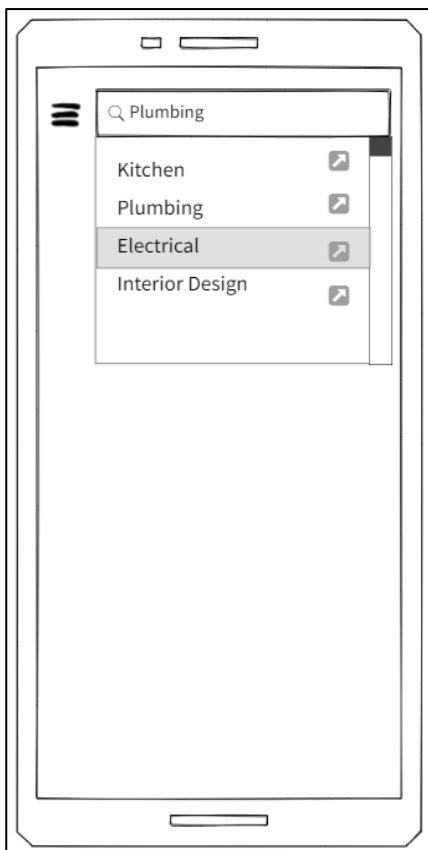
Figure 4.5: Search service provider function

Figure 4.6: The page that let user choose more specific service
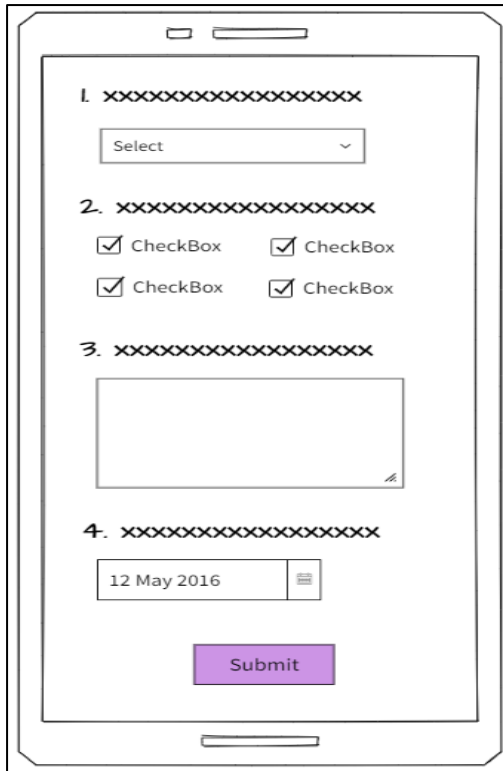
Figure 4.7: Requirement form page
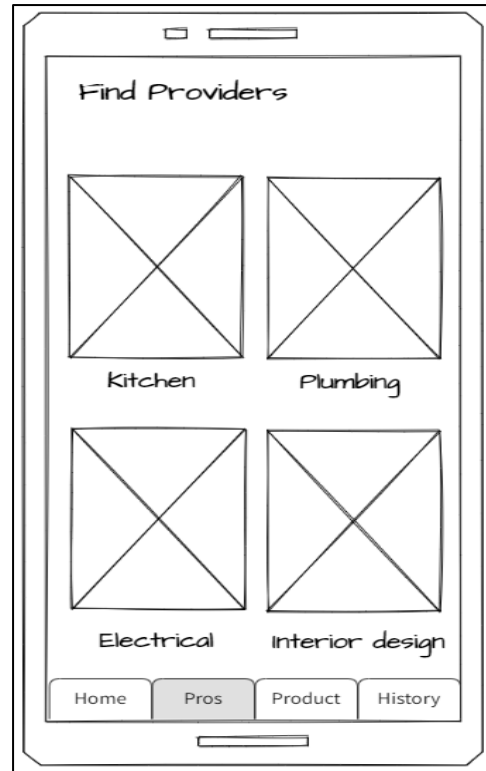
Figure 4.8: Provider category page
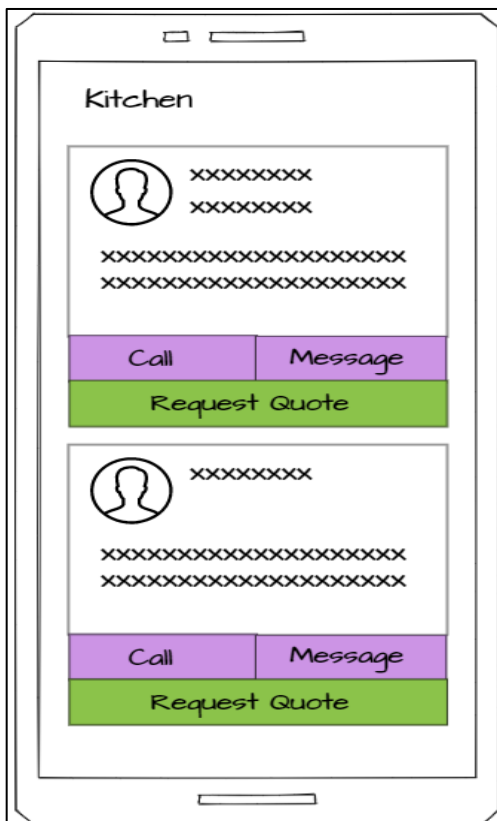
Figure 4.9: Provider List Page that also allow user to request the quotation

Figure 4.10: Profile of the service provider.

Figure 4.11: Furniture/Products category page

Figure 4.12: Furniture list page with brief description and price.

Figure 4.13: Furniture/products details and the AR furniture view.

Figure 4.14: History page which show the status of the quotation
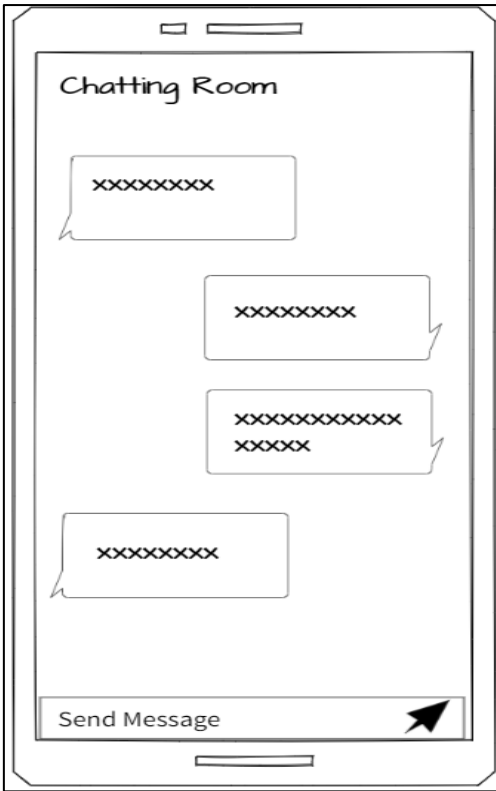
Figure 4.15: Chatting room function.

Service provider interface
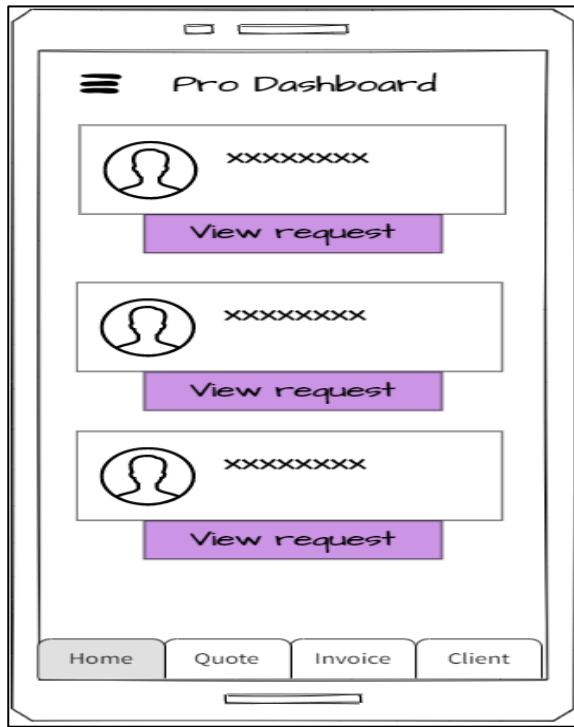
Figure 4.16: Service provider dashboard that show the list of requests from users
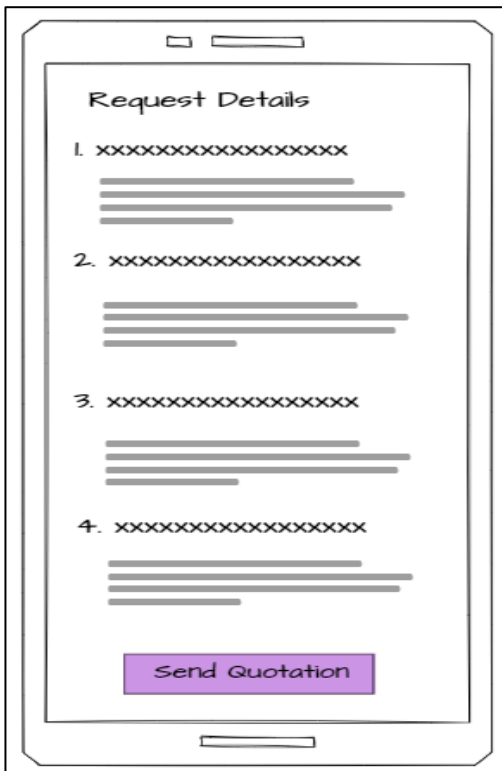
Figure 4.17: Request detail of the user and provider can accept the request from user in this page
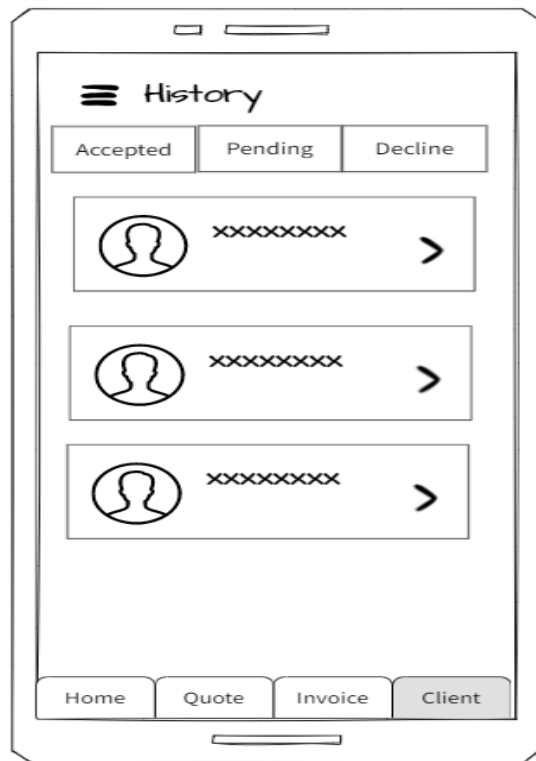
Figure 4.18: List of clients
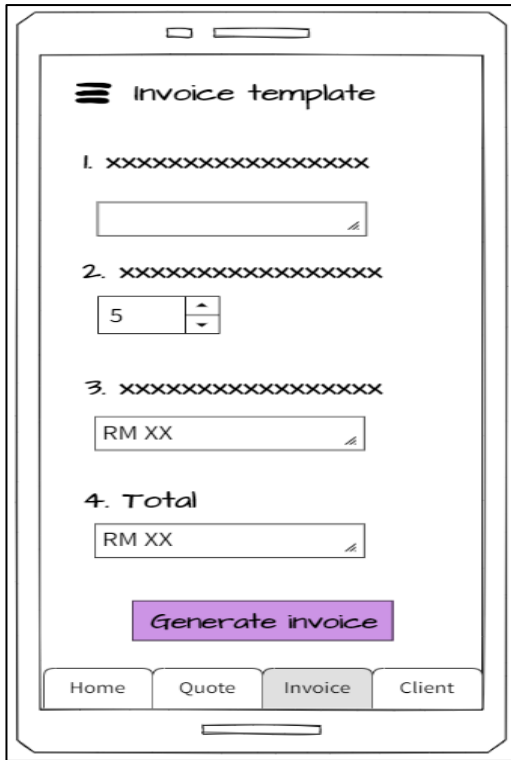
Figure 4.19: Invoice template page
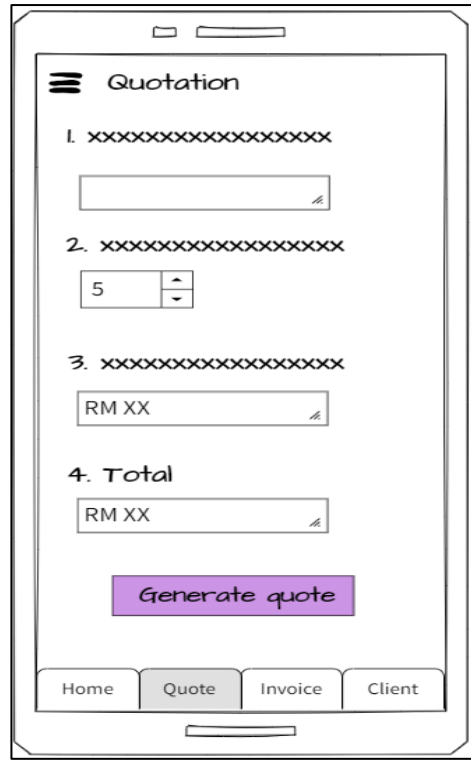
Figure 4.20: Quotation template page

Figure 4.21: Sales report summary

4.2 Flow chart of the overall system

4.2.1 House owner Interface Flow Chart
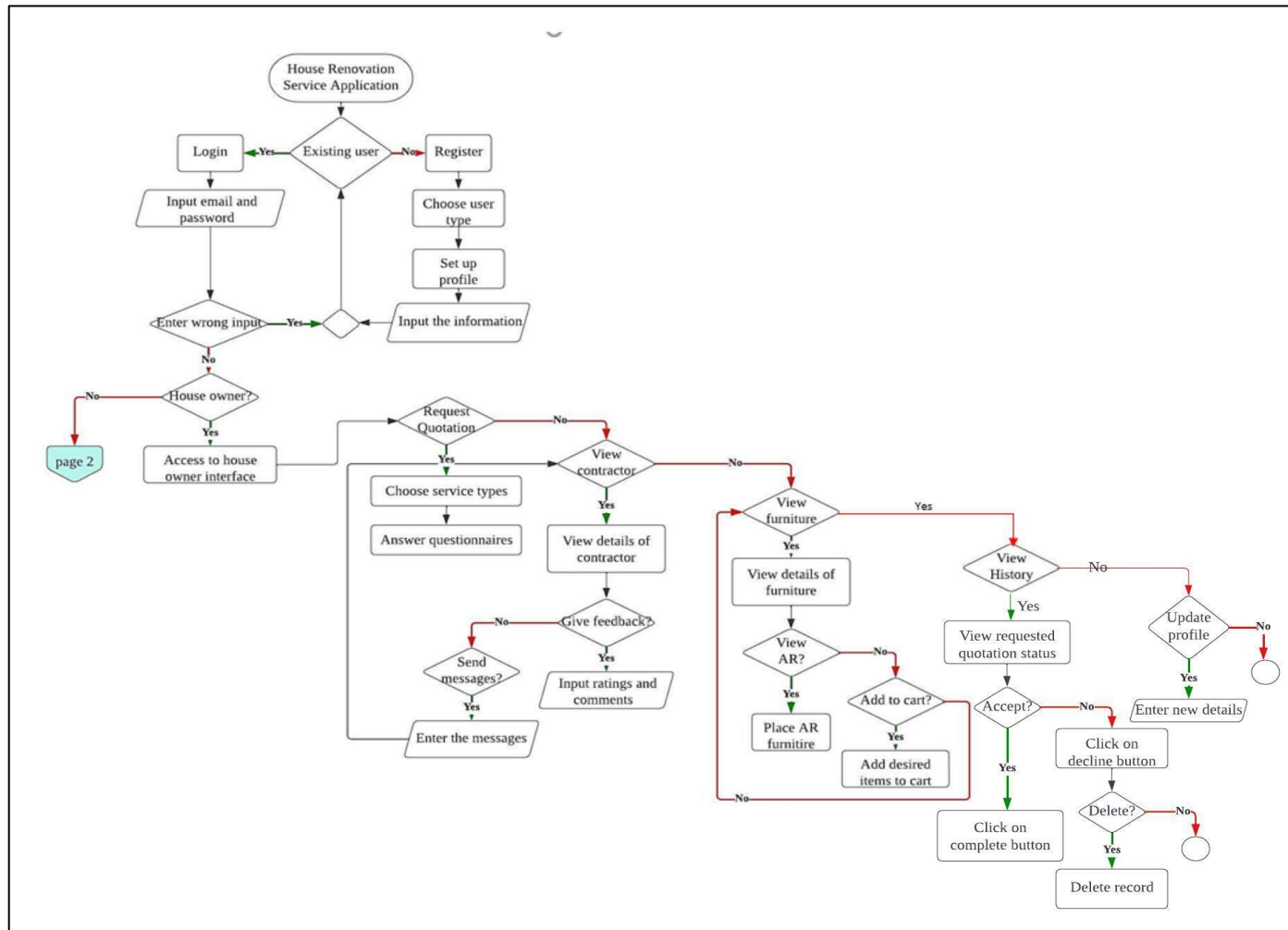
Figure 4.22: House owner interface flowchart

4.2.2 Service Provider Interface Flow Chart
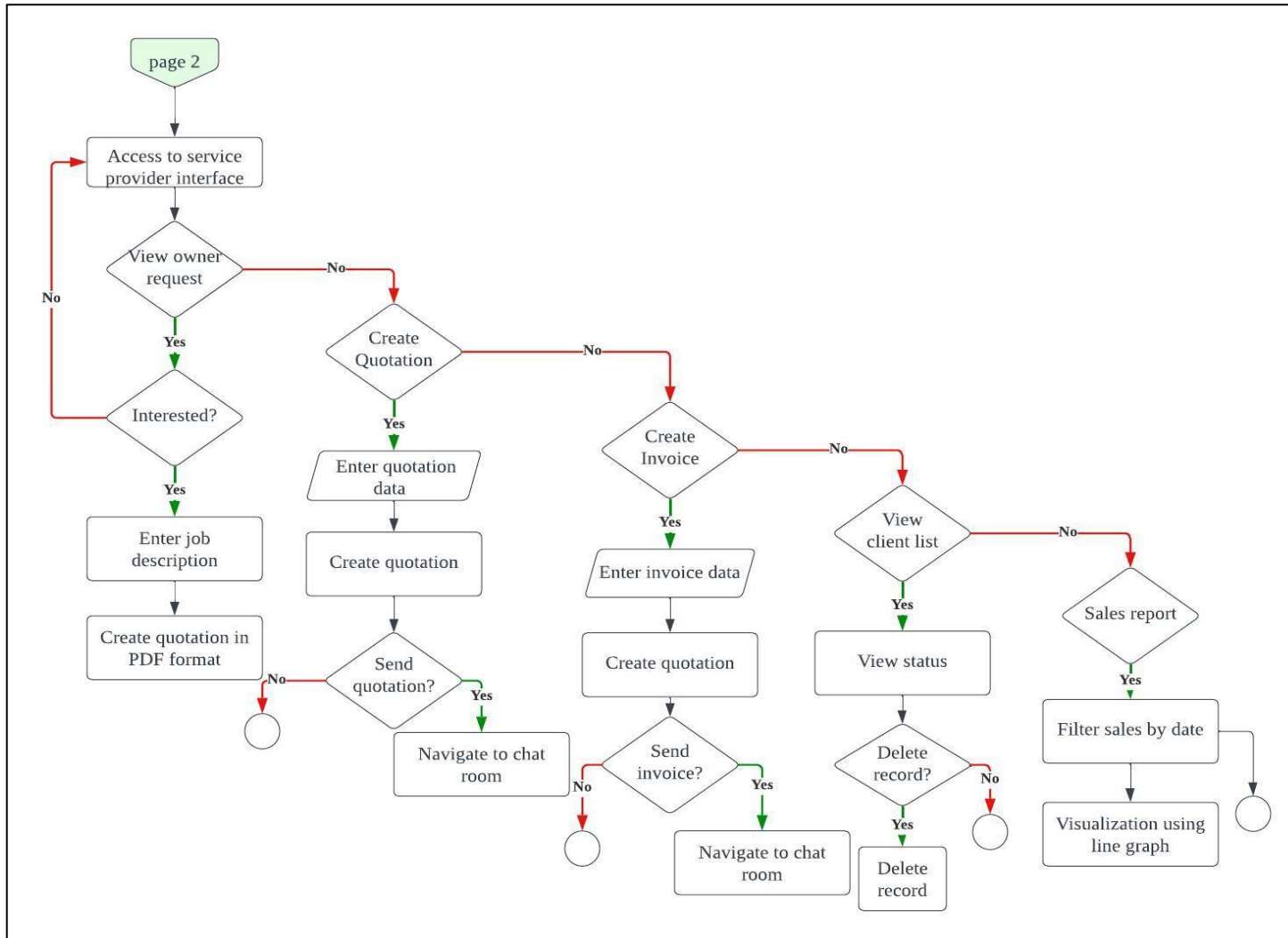
Figure 4.23: Service provider interface flowchart

4. 3 Use Case Diagram
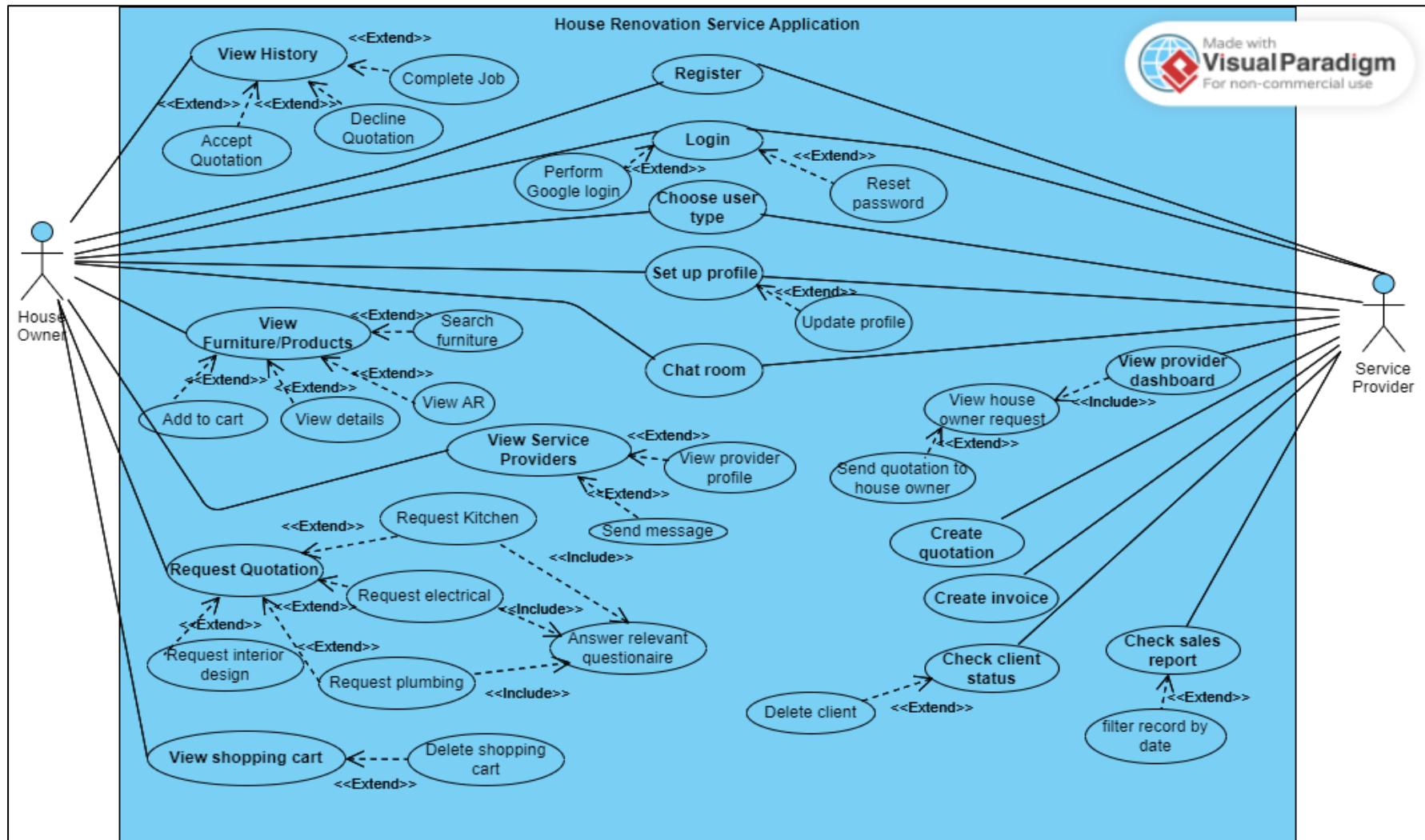
Figure 4.24: Use Case diagram

4.3.1 Use Case description

4.3.1.1 Register Use Case Description

Table 4.1: Register Use Case Description

Use Case ID	**H001**
Use Case	Register
Purpose	To allow the users to register a new account.
Actor	House Owner and Service provider.
Trigger	The users click on the 'Create a new account' button in Login page.

Main Flow

1. Users click 'Create a new account' button in Login page.
2. Users enter the email, password and confirm password and click 'Register'.
- If users click 'Already have account', then sub flow H-2a will be performed.
- If users enter the email that already registered, then the alternative flow H-2b is performed.
3. The registered data will be stored in Firebase.

Sub Flow

Log in	H-2a	1. Users click 'Already have account'.
		2. Users will be directed to Login Page.

Alternative Flow

Invalid input	H-2b	1. The system will prompt out an error message to show the email have been registered
		2. Back to Main Flow step 2.

4.3.1.2 Login Use Case Description

Table 4.2: Login Use Case Description

Use Case ID	H002	
Use Case	Login	
Purpose	To allow the users to login to their account.	
Actor	House Owner and Service provider.	
Trigger	The user first enters the application.	

Main Flow

1. Users enter the registered email and password to login to their account.
- If users want to login with their Google account directly, sub flow H-1a will be performed.
- If users forget the password, sub flow H-1b will be performed.
2. The system will verify the user's authentication.
- If invalid email or password is entered, then alternative flow H-2a is performed.
3. The user will be directed to a page where they can choose their user type.

Sub Flow

Google account Log in	H-1a	1. If user click on the Google icon in the login page, it will login with their Google account directly. 2. Users can select the Google account they wish to use to sign in to the application.
Forget password	H-1b	1. User click on the 'Forget password' button if they forget the password to log in. 2. Users can reset their password by following the steps provided. 3. Redirect the user back to Main flow step 1.

Alternative Flow

Invalid input	H-2a	1. If the email and password entered is invalid, the system will show the error message. 2. Redirect the user back to Main flow step 2 and enter the credentials again.

4.3.1.3 Choose User Type Use Case Description

Table 4.3: Choose User Type Use Case Description

Use Case ID	H003
Use Case	Choose User Type
Purpose	To allow users choose the user type.
Actor	House Owner and Service provider.
Trigger	After the user register a new account successfully.

Main Flow

    1. Users are prompted to select their user type, either house owner or service provider.

    - If the house owner user type is selected, sub flow H-1a is executed.

    - If the service provider user type is selected, sub flow H-1b is executed.

    2. The users need to set up their profile.

    - If any required fields are left blank, alternative flow H-2a is executed.

    3. The users are redirected to their respective interface.

Sub Flow

House owner user type	H-1a	1. If user choose house owner user type, they need to set up the house owner profile. 2. The house owner profile details will be stored in Firebase.
Service Provider user type	H-1b	1. If user choose service provider user type, they need to set up the contractor profile. 2. The contractor profile details will be stored in Firebase.

Alternative Flow

Invalid input	H-2a	1. If the users do not enter all the required details, the system will display an error message.

4.3.1.4 House Owner – Request Quotation Use Case Description

Table 4.4: Request Quotation Use Case Description

Use Case ID	H004
Use Case	Request Quotation
Purpose	To allow house owners to request the quotations from the service provider.
Actor	House Owner
Trigger	Select the type of the service provider in the drop-down menu located on the home page.

Main Flow		
1. The users can request the quotation from different service providers by selecting the type of service provider on the drop-down menu.		
- If the users choose kitchen service provider, sub flow H-1a is performed.		
- If the users choose plumbing service provider, sub flow H-1b is performed.		
- If the users choose electrical service provider, sub flow H-1c is performed.		
- If the users choose interior design service provider, sub flow H-1d is performed.		
2. Users need to answer the relevant questions ask by the system.		
3. Users can submit their answers by clicking on the submit button.		
4. If the answer submitted is left blank, alternative flow H-4a is executed.		
4. The answer is then stored in Firebase and will display in the service provider interface.		

Sub Flow		
Kitchen	H-1a	1. The users need to choose the specific job in kitchen renovation.
Plumbing	H-1b	1. The users need to choose the specific job in plumbing renovation.
Electrical	H-1c	1. The users need to choose the specific job in electrical and wiring renovation.
Interior design	H-1d	1. The users need to choose the specific job in interior design service.

Alternative Flow		
Invalid input	H-4a	1. If the user submits a blank answer, an error message will be displayed by the system.

		2. The system redirects the users to Main Step 2 to complete the missing details and click the submit button again.

4.3.1.5 House Owner – View Furniture / Products Use Case Description

Table 4.5: View Furniture / Products Use Case Description

Use Case ID	H005	
Use Case	View Furniture / Products	
Purpose	To allow house owners view the furniture and products.	
Actor	House Owner	
Trigger	Click 'Furniture' button on the bottom navigation menu	

Main Flow

1. Users can select furniture categories to view products.
- If the users want to search for the specific type of furniture, sub flow H-1a is performed.
2. The users click on the furniture item to see the details about it.
- If the users want to add the furniture item to their shopping cart, sub flow H-2a is performed.
- If the users want to view the furniture item in AR mode, sub flow H-2b is performed.
3. The users click on the back button.
4. The system will navigate the users to 'Furniture/Products' page.

Sub Flow

Search furniture	H-1a	1. If the user clicks on the search bar, they can search the furniture by types such as chair, table and so on. 2. The system will show the relevant furniture or products based on the search query.
Shopping cart	H-2a	1. If users want to add the furniture to shopping cart, select the quantity of the furniture items and click 'Add to Cart' button. 2. The shopping cart data will be stored in Firebase.
AR furniture	H-2b	1. If the users want to see the AR furniture, click on the 'AR' button. - If the user's device does not support the AR Core, sub flow H-2b-a will be performed. 2. Users need to grant camera permission to view AR furniture.

		3. The users need to scan their surrounding in order to place the AR furniture correctly.

Alternative Flow

Invalid action	H-2b-a	1. If the user's device doe not support AR Core, the system will show an alert message to the user.
		2. The user will be directed back to the furniture details page.

4.3.1.6 House Owner – View Service Provider Use Case Description

Table 4.6: View Service Provider Use Case Description

Use Case ID	H006
Use Case	View Service Provider
Purpose	To allow house owners view the list of contractors.
Actor	House Owner
Trigger	Click 'Contractor' button on the bottom navigation menu

Main Flow

1. The users view the contractor by selecting the type of service they required.
2. They can then filter the contractors by region to find relevant ones.
3. Click on the contractor profile to view the details of the contractor.
- If the users want to give the feedback to the contractor, sub flow H-3a is performed.
- If the users want to send the message to the contractor, sub flow H-3b is performed.
4. Clicking the back button will navigate users back to the filtering page.

Sub Flow

Give feedback	H-3a	1. If the users want to give the feedback to the contractor, they need to enter the comments and give the rating.
		2. Click the submit button.
		- If the users do not enter the comments or give the rating, alternative flow H-3a-a is executed.
		3. The feedback will be stored in Firebase.
Send message	H-3b	1. If the users want to send the message to the contractor, click the 'Send Message' button.
		2. The system will navigate to the chat room.

		3. The users can enter the messages or send the files to each other.
		- If the message is empty, but the users click the 'Send' button, alternative flow H-3b-a is performed.
		4. The messages will be stored in Firebase and display in the service provider interface.

Alternative Flow

Invalid input	H-3b-b	1. If the users attempt to submit feedback without entering comments or giving a rating, the system will display an error message
		2. Redirect the user to step 3 in the Main flow to provide valid feedback.
Invalid input	H-3b-a	1. If the users attempt to send an empty message, the system will display an error message
		2. The system will redirect the user to Main flow step 3 and the users need to enter the message again.

4.3.1.7 House Owner – Owner History Use Case Description

Table 4.7: View Service Provider Use Case Description

Use Case ID	H007
Use Case	Owner History
Purpose	To allow house owner view the status of the requested quotation.
Actor	House Owner
Trigger	Click 'History' button on the bottom navigation menu

Main Flow

1. The users can view the status of their requested quotation with the price given by the service provider by selecting the appropriate option.
- If the users click 'Kit' button, sub flow H-1a is performed.
- If the users click 'Plum' button, sub flow H-1b is performed
- If the users click 'Elec' button, sub flow H-1c is performed
- If the users click 'Interior' button, sub flow H-1d is performed

2. The user can perform certain functions by clicking on the appropriate button.		

- If the users click on 'Accept' button, sub flow H-2a is performed.
- If the users click on 'Decline' button, sub flow H-2a is performed.

3. The user can delete the record if they want.

Sub Flow

Kitchen	H-1a	1. If the users click 'Kit' button, the system will show all the quotation provided by the kitchen provider.
Plumbing	H-1b	1. If the users click 'Plum' button, the system will show all the quotation provided by the plumbing provider.
Electrical	H-1c	1. If the users click 'Elec button, the system will show all the quotation provided by the electrical provider.
Interior design	H-1b	1. If the users click 'Interior button, the system will show all the quotation provided by the interior design provider.
Accept		1. If the users click on 'Accept' button, the system will send this response to the service provider interface to inform them the user already accept the quotation. 2. the user can click on the 'Complete' button to indicate the completion of the project after the renovation job done.
Decline		1. If the users click on 'Decline' button, the system will send this response to the service provider interface to inform the user already decline the quotation.

Alternative Flow

-

4.3.1.8 House Owner – Shopping Cart Use Case Description

Table 4.8: Shopping Cart Use Case Description

Use Case ID	H008
Use Case	View Shopping Cart
Purpose	To allow house owner view the shopping cart items.
Actor	House Owner
Trigger	Click 'Cart' button on the left navigation menu.
Main Flow	

1. The users review the items in their shopping cart.
2. The users can delete any unwanted items from the shopping cart by clicking the delete button below the item.
3. The users click back button, the system will navigate the users back to the home page.

Sub Flow

-

Alternative Flow

-

4.3.1.9 Service provider – View Owner Request Use Case Description

Table 4.9: View Owner Request Use Case Description

Use Case ID	S001
Use Case	**View Owner Request**
Purpose	To allow service providers to view a list of quotation requests from house owners.
Actor	Service Provider
Trigger	Click 'Dashboard' button on the bottom navigation menu
Main Flow	

1. The contractor can select the job types to view the relevant request.
2. Click on the 'View request' button to view the details of the job.
- If the contractor wishes to create a quotation and send it to the house owner, sub flow S-2a is performed.

3. Click on back button, it will navigate the contractor back to the dashboard.		

Sub Flow

Create quotation	S-2a	1. If the users want to create the quotation and send to the house owner, the user must fill in the job description. - If any required details are missing, alternative flow S-2a-a is performed. 2. The quotation details will store in Firebase and display in the history page in house owner interface 3. The quotation will be stored in the local storage of the user's device.

Alternative Flow

Invalid input	S-2a-a	1. If the submitted details are not complete, the system will prompt out error message.

4.3.1.10 Service provider – Create quotation Use Case Description

Table 4.10: Create quotation Use Case Description

Use Case ID	**S002**
Use Case	Create quotation
Purpose	To allow service provider create the quotation from the empty template.
Actor	Service Provider
Trigger	Click 'Quotation' button on the bottom navigation menu
Main Flow	
1. The contractor can generate the quotation by filling in the required details in the template given. 2. Click 'Create Quotation' button to generate the quotation. - If the contractor not fill up all the required data, alternative flow S-2a-a is performed. 3. The created quotation file can be found in the local storage.	
Sub Flow	
-	
Alternative Flow	

Invalid input	S-2a-a	1. If the contractor not fill up all the required data, the system will prompt out the error message and redirect user to Main Flow step1 to enter the valid data.

4.3.1.11 Service provider – Create Invoice Use Case Description

Table 4.11: Create Invoice Use Case Description

Use Case ID	S003
Use Case	Create invoice
Purpose	To allow service provider create the invoice from the empty template.
Actor	Service Provider
Trigger	Click 'Invoice' button on the bottom navigation menu

Main Flow
1. The contractor can generate the invoice by fill in the details in the template given.
2. Click 'Create Invoice' button to generate the invoice.
- If the contractor not fill up all the required data, alternative flow S-2a-a is performed.
3. The created invoice file can be found in the local storage.

Sub Flow

Alternative Flow

Invalid input	S-2a-a	1. If the contractor not fill up all the required data, the system will prompt out the error message and redirect user to Main Flow step1 to enter the valid data.

4.3.1.12 Service provider – Check Client Status Use Case Description

Table 4.12: Check Client Status Use Case Description

Use Case ID	S004
Use Case	Check Client Status
Purpose	To allow service provider check the status of the client responses.
Actor	Service Provider
Trigger	Click 'Client' button on the bottom navigation menu

Main Flow

		1. The contractors can select the relevant status option to view the client response.

1. The contractors can select the relevant status option to view the client response.
- If the contractors select 'Accepted' option, sub flow S-1a is executed.
- If the contractors select 'Pending' option, sub flow S-1b is executed.
- If the contractors select 'Declined option, sub flow S-1c is executed.
2. The contractors can delete the unwanted records from the client list.

Sub Flow

Accepted	S-1a	1. If the contractors choose 'Accepted' option, the system will display all the jobs that have been accepted by the house owner. 2. The contractors can then contact the house owner to begin the renovation job.
Pending	S-1b	1. If the contractors choose 'Pending' option, they can view all the pending job that have not reply by the house owner yet. 2. They need to wait until the house owner give the reply.
Declined	S-1c	1. If the contractors choose 'Declined' option, they can view all the decline job which are rejected by the client 2. They can delete those unwanted record from the client list.

Alternative Flow

-

4.3.1.13 Service provider – Check Sales Report Use Case Description

Table 4.13: Check Sales Report Use Case Description

Use Case ID	**S005**
Use Case	Check Sales Report
Purpose	To allow service provider check the sales report of their business
Actor	Service Provider
Trigger	Click 'Sales report' button on the left navigation menu
Main Flow	

1. The contractor can filter the sales record by specifying a date range.
- If the contractors select the invalid date range, sub flow S-1a is performed.

Sub Flow

Alternative Flow

Invalid date range	S-2a-a	1. If the contractors select an invalid date range, the system will display an error message indicating that no data is available

		for the selected range and prompt the user to select a valid date range.

4.4 Sequence Diagram (House Owner)
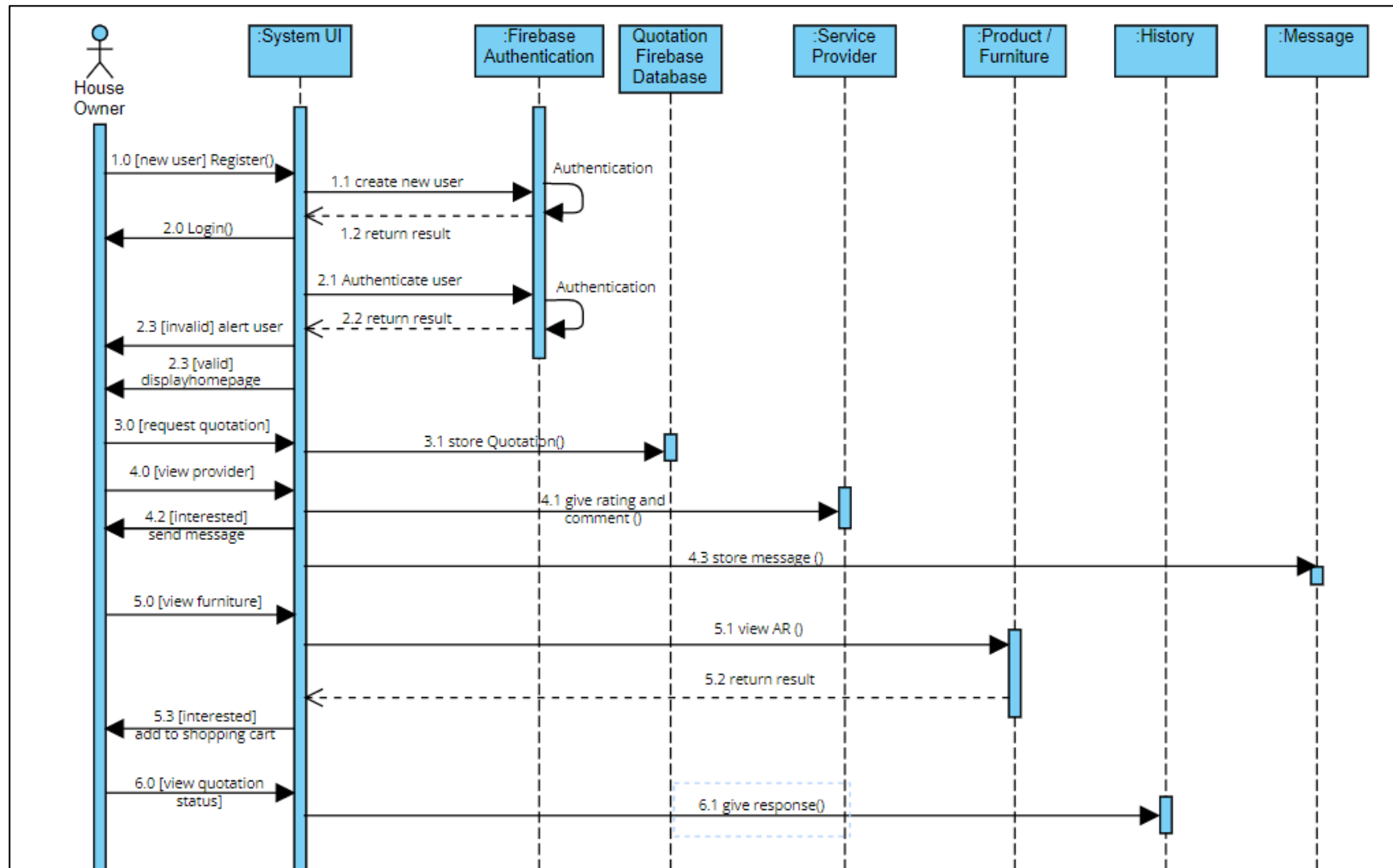
Figure 4.25: Sequence Diagram (House Owner)

4.5 Sequence Diagram (Service Provider)
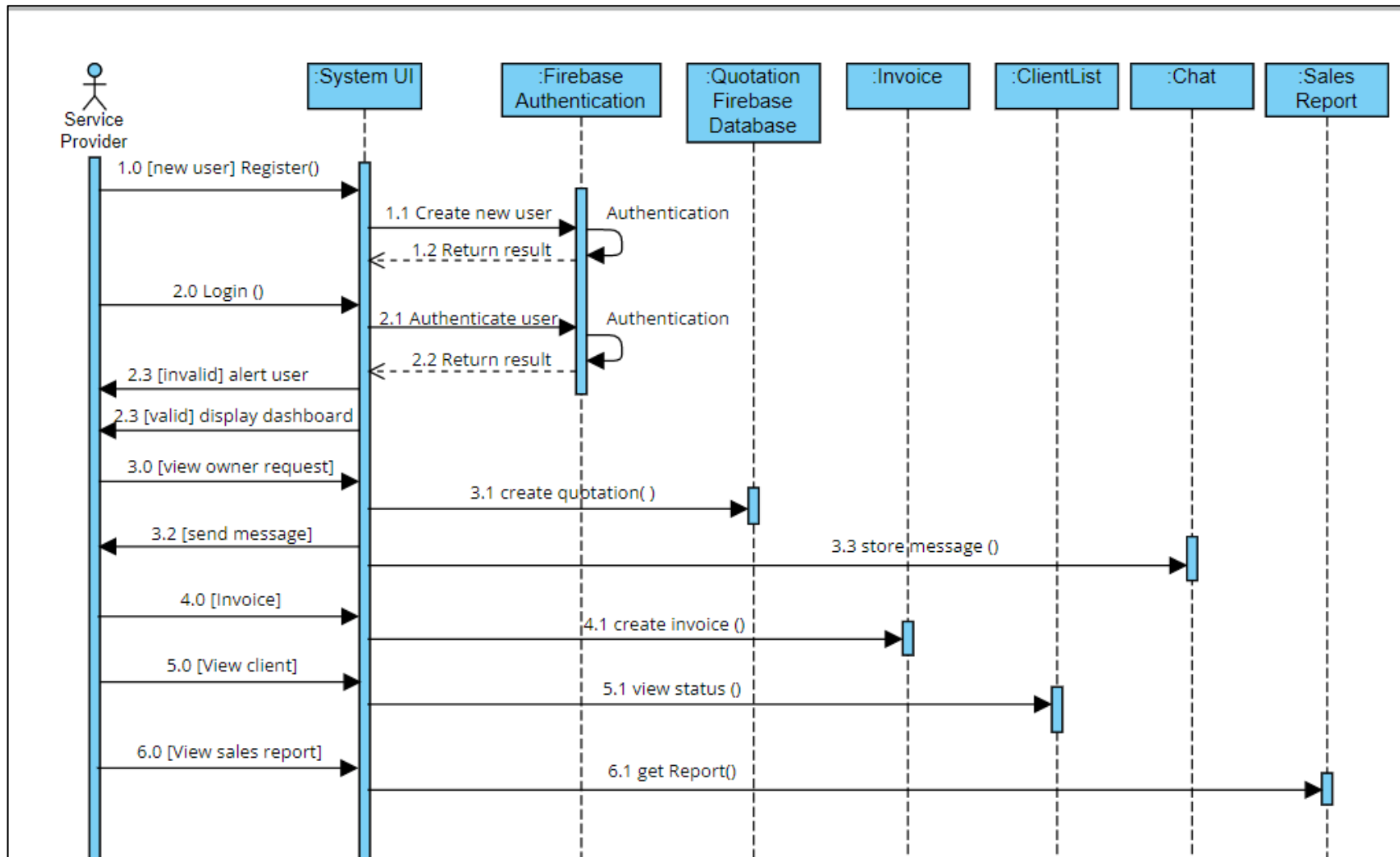
Figure 4.26: Sequence Diagram (House Owner)

Chapter 5

System Implementation

This chapter will provide an overview of the hardware and software used for the development of this project. It will cover the necessary steps to set up and configure the required software before the development process began. The chapter will also present the preliminary work, including UI screenshots of completed work up to FYP2 with corresponding descriptions. Furthermore, the chapter will highlight the implementation challenges and issues faced during the development process.

5.1 Hardware used

The hardware involve in this project is a computer.

Table 5.1 Specifications of laptop

Description	Specifications
Model	Acer Aspire A315-55G
Processor	Intel ® Core ™ i5-8265U CPU @ 1.60GHz, 1800 Mhz, 4 Cores
Operating System	Microsoft Windows 11
Graphic	Intel® UHD Graphics 620
Memory	16GB DDR4 RAM
Storage	1TB HDD

5.2 Software Used

Before starting to develop the house renovation service application, there are three software that need to be installed and set up in the laptop. The following is a brief overview of each software.

1. Android Studio

   In this project, Android Studio Chipmuck Version will be used. It is a mobile application development software. Features development and UI design will be done by using Android Studio.

2. Firebase

   Firebase implemented a cloud-hosted database and synchronized the data to each associated client. This allows for real-time interaction between users and the service provider. Besides, Firebase provides efficient back-end services, user interface libraries and SDKs to authenticate the user on the application including authentication methods such as Facebook, Twitter, phone number, email, and password. Not only that, Firebase also provides cloud storage to enable the user to store pictures and videos on the cloud. This will free up the users' device memory [13]. The Firebase Realtime Database is capable of storing the large amount of data required for this application.
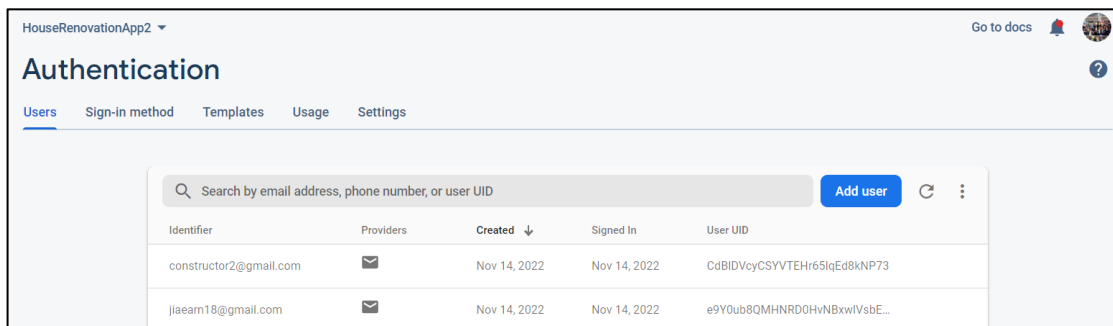
Figure 5.2: Firebase authentication console
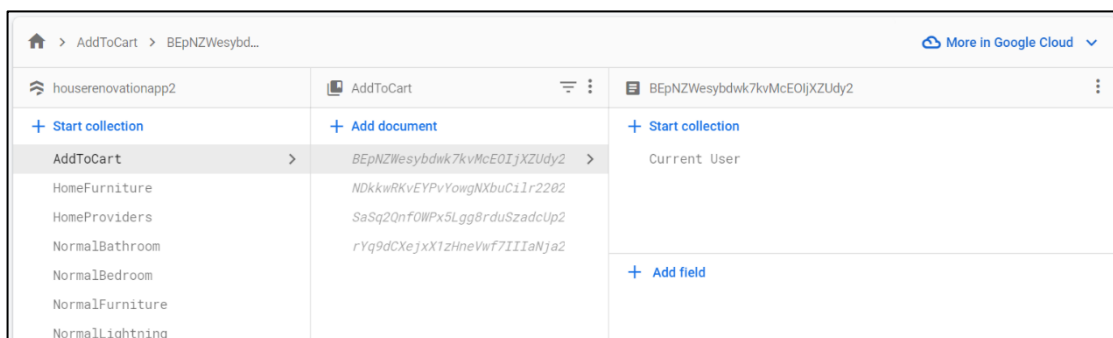
Figure 5.3: Firestore Database console

Figure 5.4: Firebase Realtime database console
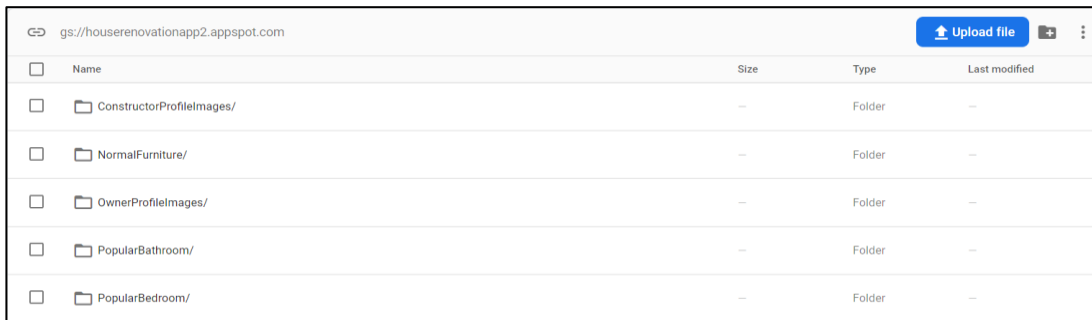
Figure 5.5: Firebase Storage console

3. Blender

Blender is a powerful software tool used to generate 3D computer graphics. As an open-source software tool, it is available for free and has gained increasing popularity over the years. It offers a wide range of functions including the creation of animated films, 3D-printed models, visual effects, motion graphics, virtual reality, and video games. Blender enables users to create a diverse range of 3D visualizations, from still images to 3D animations and VFX shots. Additionally, Blender is equipped with video editing capabilities. It is a cross-platform application and can be used on macOS, Windows, and Linux systems. Blender is an excellent choice for professionals, studios, hobbyists, and students worldwide, due to its versatility in almost any media production. With its active community and continuous development, Blender has become a reliable and accessible choice for digital content creation and editing.

5.3 Software Set Up and Configuration

The software set up act as a reference and a brief guideline for those who want to build a similar system or project.

5.3.1 Android Studio Setup

1. Download Android studio installer from the official website (https://developer.android.com/studio). Run the installer after the download is complete.

2. Configure the Android Studio once it installed. Open Android studio and follow the steps given to set up the Android Studio environment. This includes the AVD (Android Virtual Device) Manager and Android SDK (Software development kit).

3. After the configuration, can create a new Android project. In order to create a new project, go to File -> New –> New project. Choose the empty activity template to start to develop of the project.

4. Enter the project name, select the location of the project, the language and the minimum SDK.
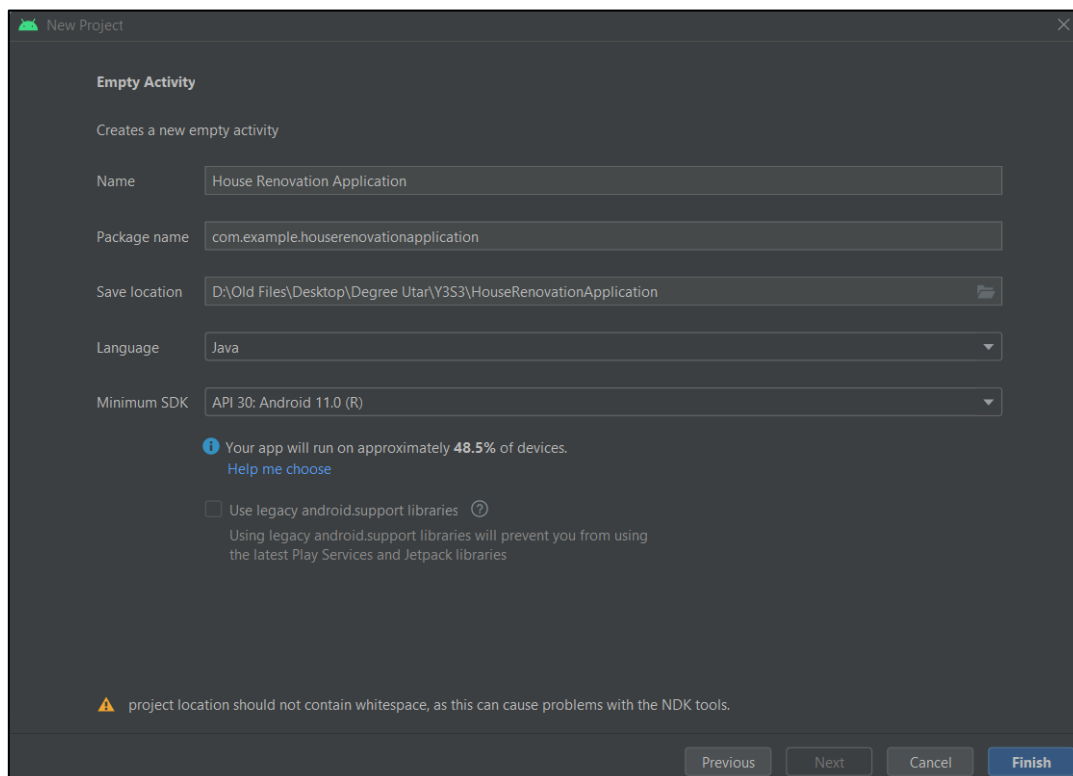
Figure 5.6: Android Studio Setup interface

5.3.2 Firebase Setup

Firebase need to connect with Android Studio to perform their functions. This can be done by using Android Studio Firebase Assistant. Below are the steps to configure this:

1. Select 'Tools' and choose 'Firebase'. It will prompt out a Firebase assistance window on the left side.

2. The project requires several services, such as Authentication for sign-in and sign-out functionality, Realtime Database and Cloud Firestore for storing and retrieving data, and Cloud Storage for storing image files.

3. Connect Firebase with the Android Studio project by following the instructions provided by Firebase.
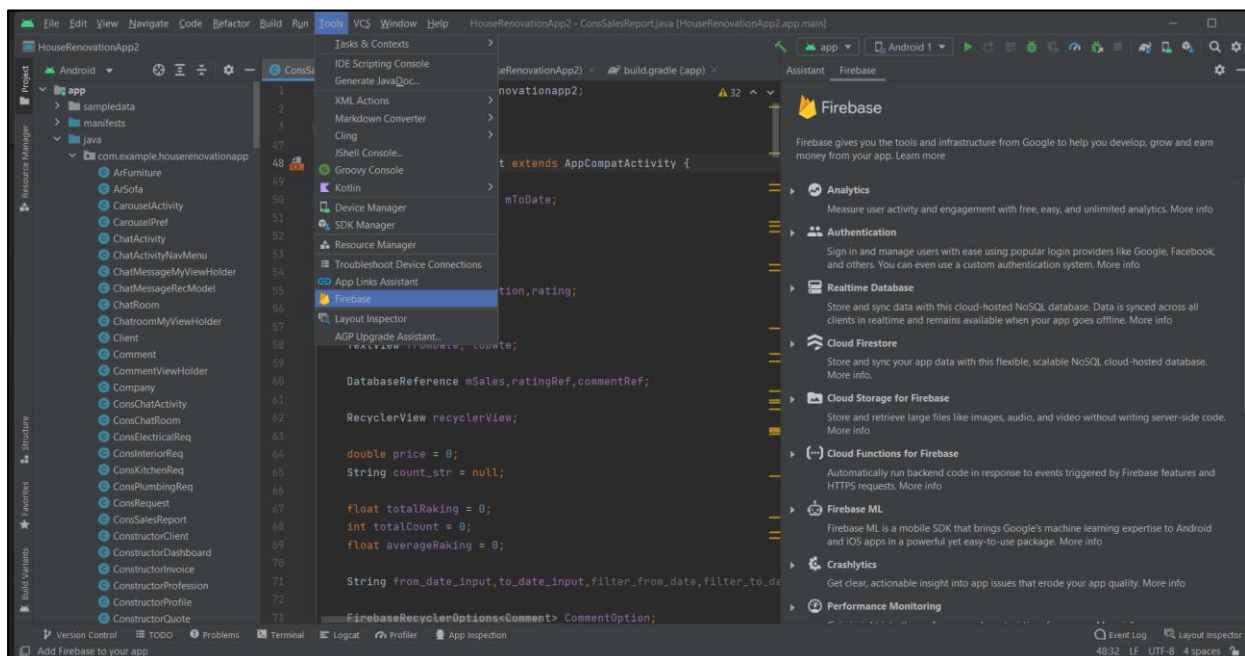
Figure 5.7: Firebase assistance in Android Studio
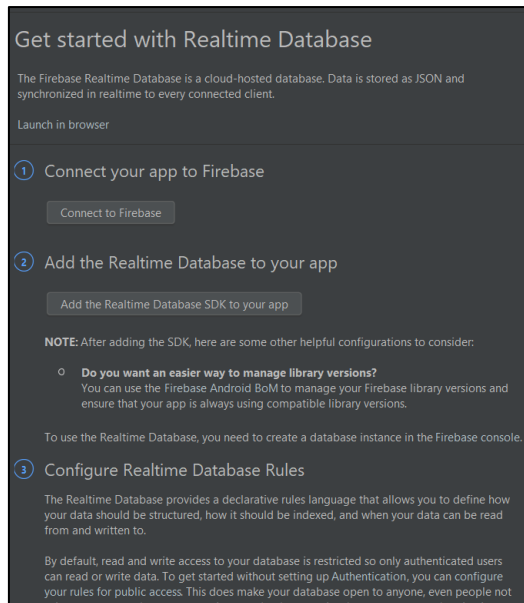
Figure 5.8: Steps to configure Realtime Database

5.3.3 Blender Setup

1. Download the blender on Blender website (https://www.blender.org/) and download the version that is compatible with the operating system.

2. After the Blender installer is downloaded, run it and follow the installation wizard to install Blender on the computer.

3. Once Blender is installed, launch the software and familiarize yourself with its various features and tools.
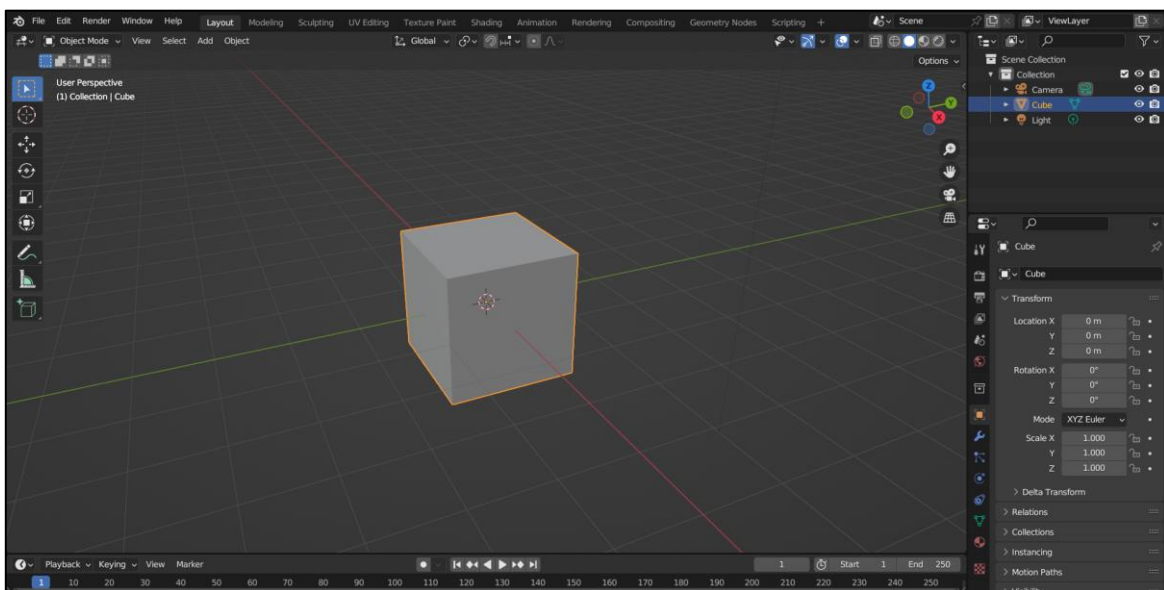
Figure 5.9: Blender workspace

5.3.4 Import the 3D model from Blender to Android Studio (AR feature implementation)

1. First, need to create the 3D furniture model in Blender.

2. Use the component and tools such as 'Add the cube', scaling, rotation to create the 3D model of the furniture in Blender.

3. Assemble all the individual parts of the sofa and adjust their angles to create the desired 3D model.
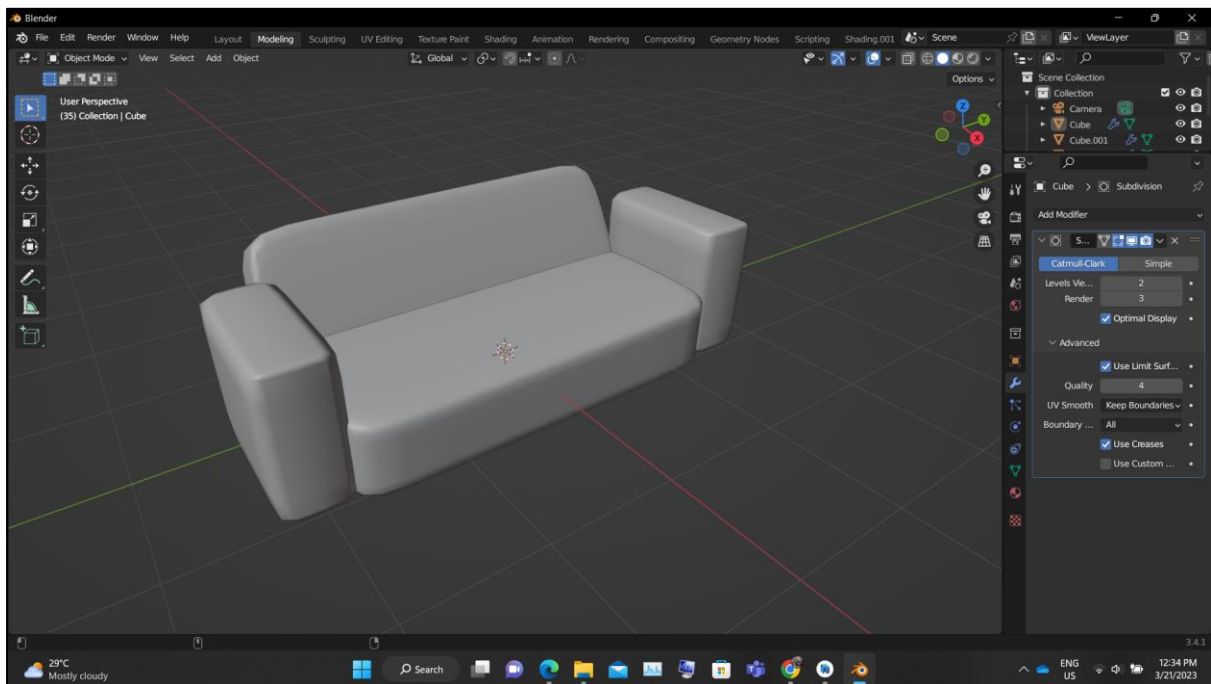
Figure 5.10: 3D model of the sofa

4. In the "General" menu, select "Shading". Then, add an image texture to the 3D model and adjust the scale of the image using the "Mapping" node to achieve the desired output.
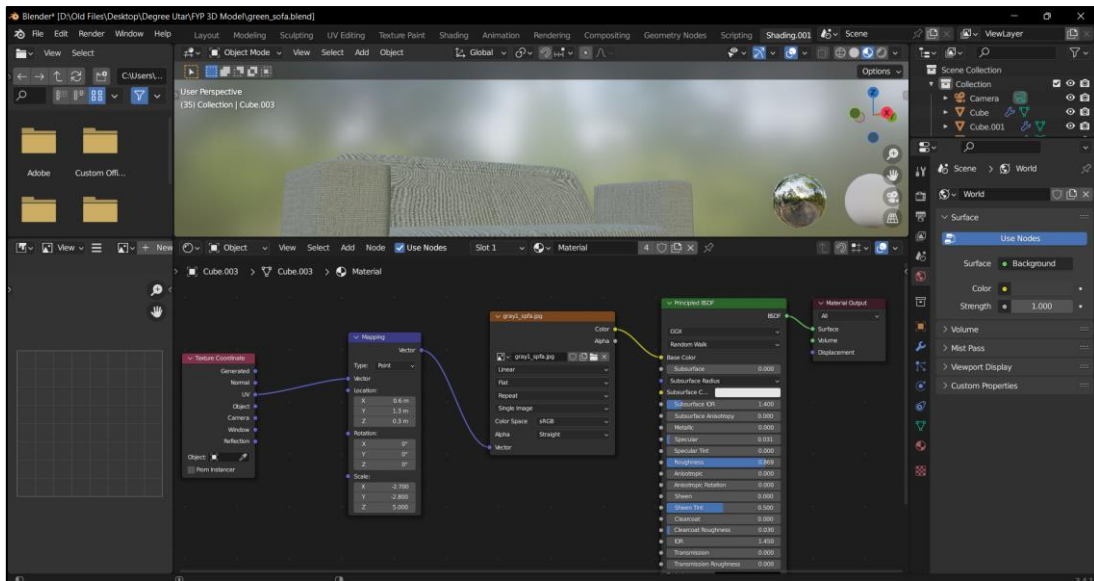
Figure 5.11: Shading workplace

5. Blender has many other features to create a more complex and realistic 3D model. Add shading and shadows is one of the tools to generate a more realistic 3D model. Additionally, Blender also provides different functions such as texturing, sculpting and animation, allowing users to create a more realistic object.

6. After complete the creation of 3D furniture model, go to File > Export and choose a compatible file format such as .obj file.
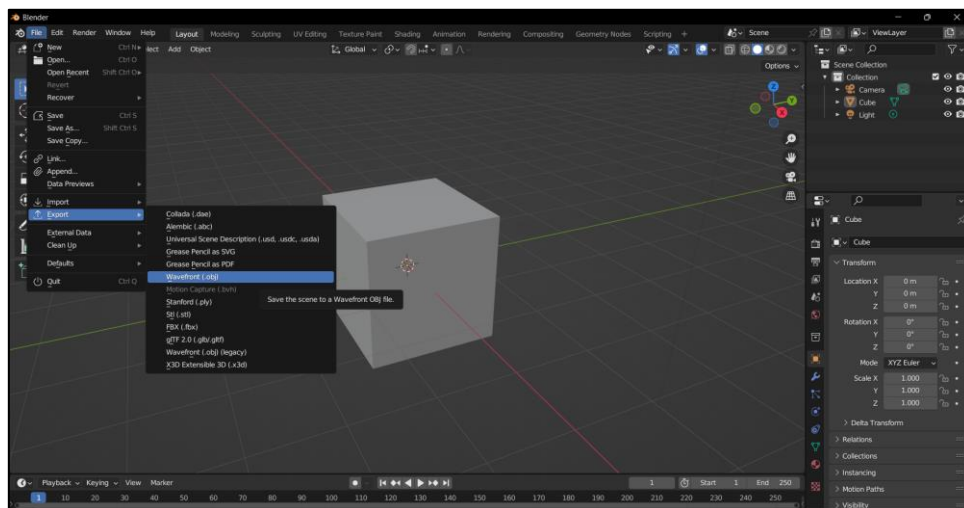
Figure 5.12: Export 3D model as .obj file

7. In Android Studio, add the necessary dependencies to activate the AR function. The dependencies are including Sceneform and ARCore.

```
implementation 'com.google.ar.sceneform.ux:sceneform-ux:1.17.1'
implementation 'com.google.ar:core:1.27.0'
```

Figure 5.13: Dependency of the Sceneform and ARCore

8. Create a new folder in the project, name the folder name as 'raw'. Copy the exportes 3D model obj file into the 'raw' folder.

9. Add the sceneform function to import the 3D model of a sofa into Android Studio.

```
101     sceneform.asset('sampledata/sofa1.obj',
102             'default',
103             'sampledata/sofa1.sfa',
104             'src/main/res/raw/sofa1')
```

Figure 5.14: Sceneform configuration in Gradle project file.

10. After the 3D model has been important, it can be loaded into the ARCore session in Android Studio and can displayed in AR mode.

```
39      arFragment = (ArFragment) getSupportFragmentManager().findFragmentById(R.id.ux_fragment);
40      arFragment.setOnTapArPlaneListener(
41          (HitResult hitresult, Plane plane, MotionEvent motionevent) -> {
42              if (plane.getType() != Plane.Type.HORIZONTAL_UPWARD_FACING)
43                  return;
44
45              Anchor anchor = hitresult.createAnchor();
46              placeObject(arFragment, anchor, R.raw.ikea);
47          }
48      );
49
```

Figure 5.15: Code snippet of AR furniture implementation

5.4 ARCore

Google's ARCore is a platform for creating an augmented reality experience. ARCore uses different APIs so that the mobile device can detect the surroundings, communicate with information and understand the world. In order to create a common experience of augmented reality, some APIs are available for Android and iOS. The key capabilities to integrate the real world with virtual content which allow users to see through the phone's camera are motion tracking, light estimation and environmental understanding. Motion tracking tools monitor the mobile device's position relative to the world while light estimation tools can estimate the real world's current lighting conditions; Environment understanding is very powerful as it allows the phone to detect the location and size of all type of surface which allows the AR model placed accurately in the real world [13].

In principle, ARCore does two things: it tracks the position of the mobile device as it moves, and it develops its own understanding of the real world. The motion tracking tools use the camera of the mobile phone to identify interesting points called as features. It will also track how these points move over time. Motion tracking will give the user the ability to move around and view these objects from different angles. Even if the users leave the room and come back later, the AR model will still be in the same position in the real world. This contributes to enhancing the overall experience of augmented reality, by creating a sense of persistence and continuity [13].

The main advantage of using ARCore as the AR toolkit in this application is its platform compatibility. ARCore is compatible with both iOS and Android platform and make it more accessible to a wider audience. Moreover, ARCore also makes it possible for several users to enjoy the same AR content concurrently on various devices which enables them to engage in a common web of experiences.

The Sceneform plugin, which is an Android Studio plugin for viewing, importing and building 3D assets. In this project, it is used to import the 3D assets that were created in Blender and saved in OBJ file format. Sceneform plugins make the rendering of 3D scenes straightforward in AR and non-AR applications, without having the knowledge of OpenGL. It uses Java and Android Studio to create and display the 3D model in the application. It is built

on top of the ARCore framework, providing more features to make the creation of augmented reality apps easier. This framework simplifies the creation of high-quality AR experiences on Android devices and offers a user-friendly approach to using them.

The main difference between Sceneform and ARCore is that Sceneform provides a high-level Scene Graph API, which can be used to import and render 3D models, while ARCore is primarily used for understanding the environment and doing tracking, but cannot render 3D models. Therefore, Sceneform and ARCore work together to enable the AR features in the application.

5.5 User Interface of House Renovation Service Application

This section will show all the user interface (UI) screenshots in this project along with the description. This application can be implemented in the mobile device through the apk file that created in Android Studio.

1. Splash Screen

After 5 seconds, the splash screen will disappear and the application will either direct the user to the carousel page (for first-time users) or the login page (for non-first-time users).

Figure 5.16: Splash screen.

2. Carousel Feature

The carousel screen consists of three pages that highlight the useful features of the application to the user. The splash screen is only displayed to users who are installing the application for the first time. Once the user has viewed all three pages, they can press the start button, and the application will direct them to the login page.
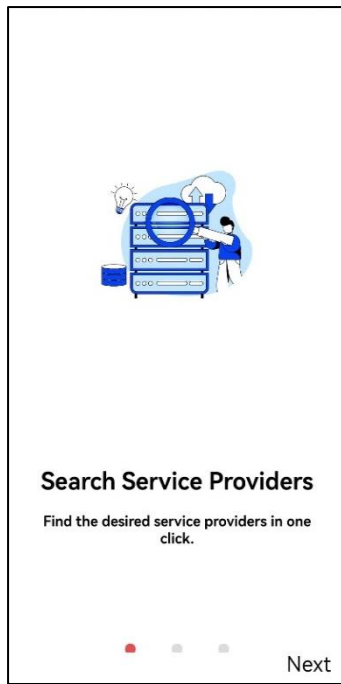
Figure 5.17: Carousel 1   Figure 5.18: Carousel   Figure 5.19: Carousel
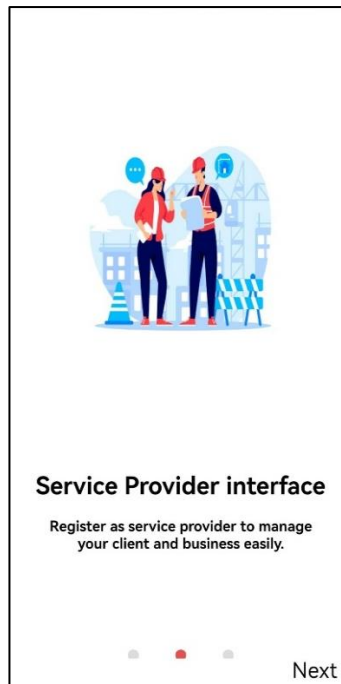
3. Login Page

On the login page, users are required to enter their registered email address and password. Alternatively, users can choose to log in using their Google account. If the user does not have an account, they can create a new account by clicking on the 'create new account' button. In case the user forgets their password, they can select the 'forgot password' option and enter their registered email. Once the user submits their email, they will receive a message with instructions on how to reset their password. After resetting the password, the user can log in with their new credentials.
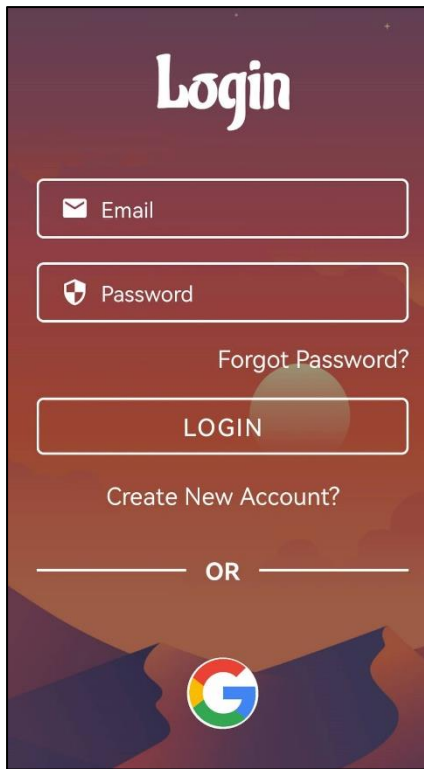
Figure 5.20: Login page.
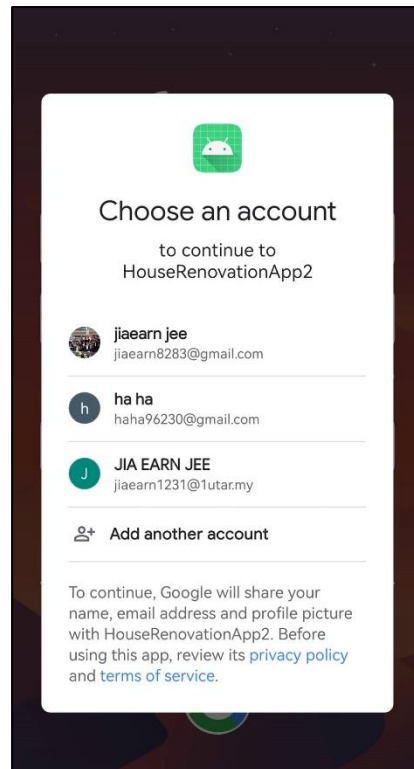
Figure 5.21: Login with Google account.
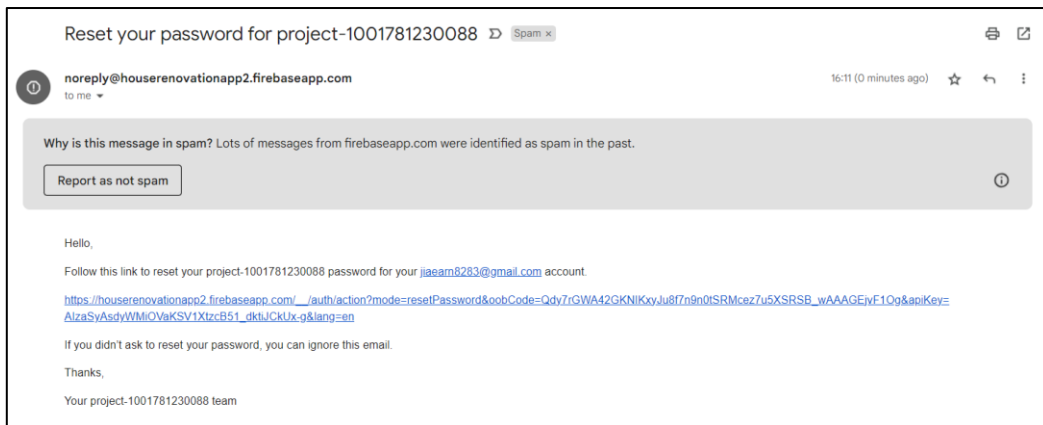
Figure 5.22: Email which allow user to set new password.

4. Register Page

On this page, users can register for an account by providing their email address, password, and confirming the password. Once the registration is successful, the user will be directed to the login page to complete the login process. Alternatively, the user can select the 'already have an account' button to log in.
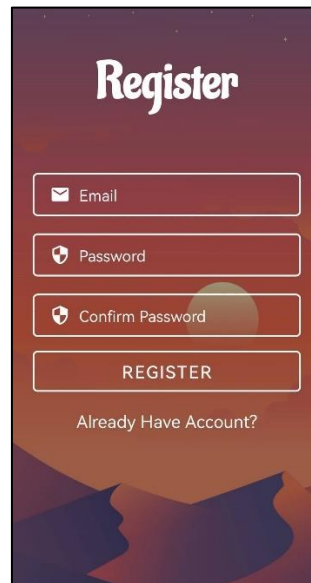
Figure 5.23: Register page.

5. User Type Page

After logging in with a newly created account, the user will need to select whether they are a house owner or a service provider. If the user chooses to be a house owner, they will be directed to set up their house owner profile, whereas, if the user chooses to be a service provider, they will be directed to set up their service provider profile. In the house owner profile setup page, users must provide their name, phone number, address, and city information.

Figure 5.24: User page type.
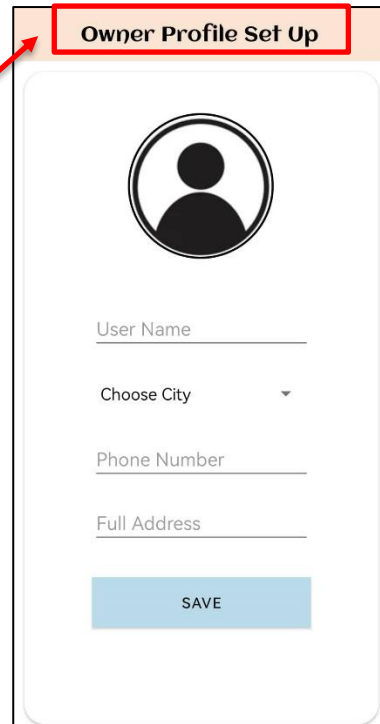
Figure 5.25: House owner profile set up page

On the service provider profile setup page, the user is required to enter the company name and phone number, as well as select the city and profession. The profession options include kitchen, plumbing, electrical, wiring, and interior design.
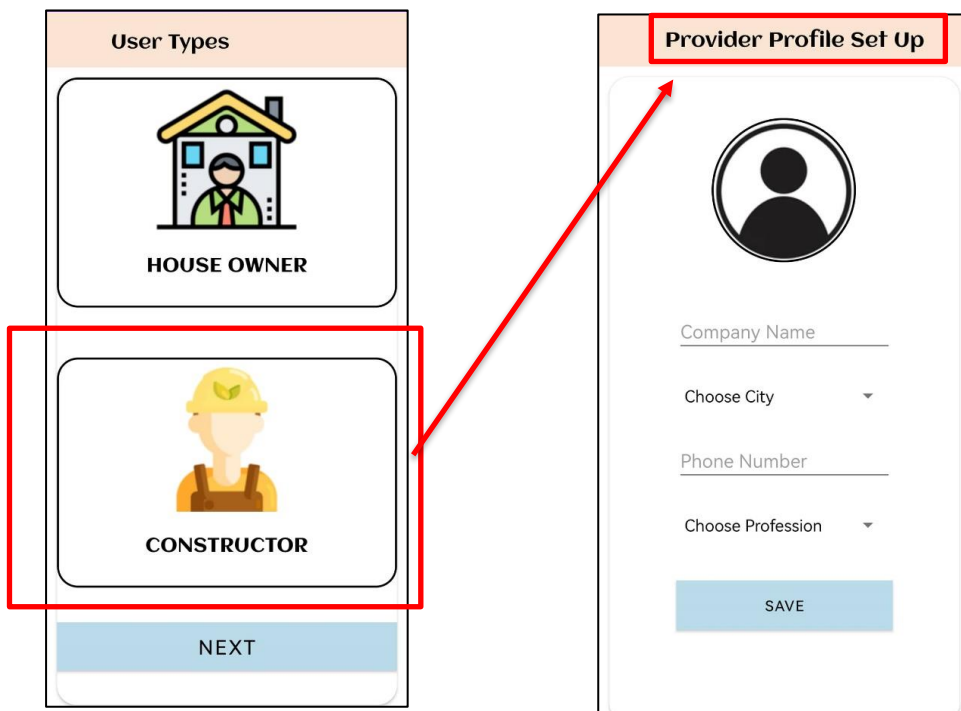
Figure 5.26: Service provider profile set up page

6. Owner Home Page

The house owner can request a quotation from a service provider by clicking on the 'request a quotation from the provider' drop down menu on the home page. This menu displays four service categories: kitchen, plumbing, electrical installation, and interior design. Below the search bar, the user can view some providers and furniture. If the user wishes to see more, they can click on the 'view more' button, which will direct them to the providers and furniture pages.
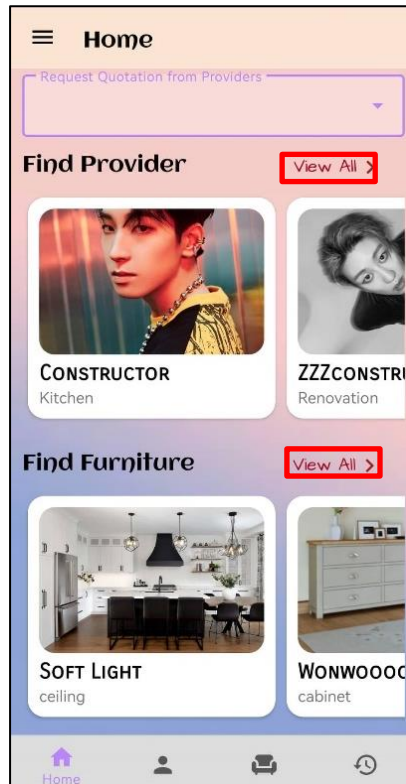
Figure 5.27: Owner home page.
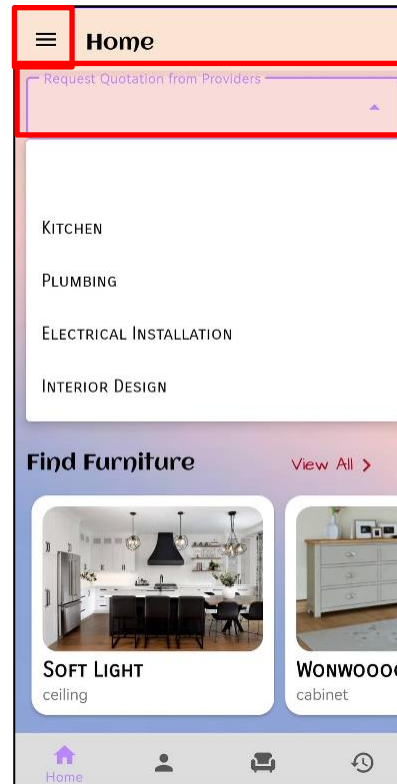
Figure 5.28: Request quotation.

In addition, there is a navigation menu that enables users to perform various actions such as modifying their profile, accessing their shopping cart, and logging out.
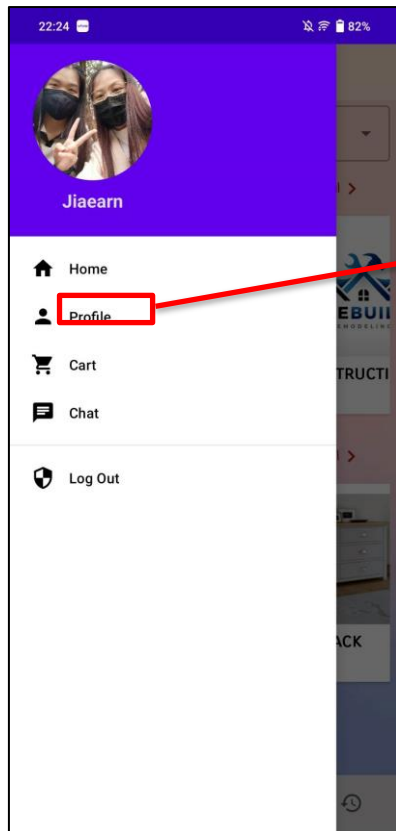
Figure 5.29: Navigation menu   Figure 5.30: Update profile page
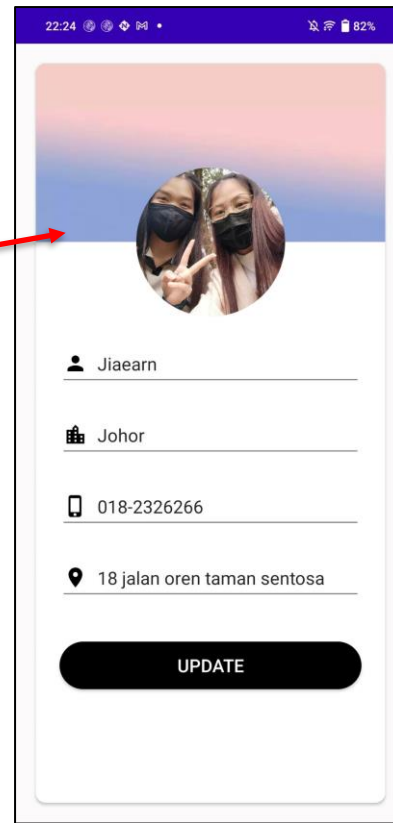
7. Request Quotation from Service Provider

Below are the four interfaces after the user clicks on the 'request quotation' section. In each interface, the user can choose the specific service they want and answer all the required questions. These questions are designed to provide the service provider with information to enable the application to calculate the estimated base price for the house owner.
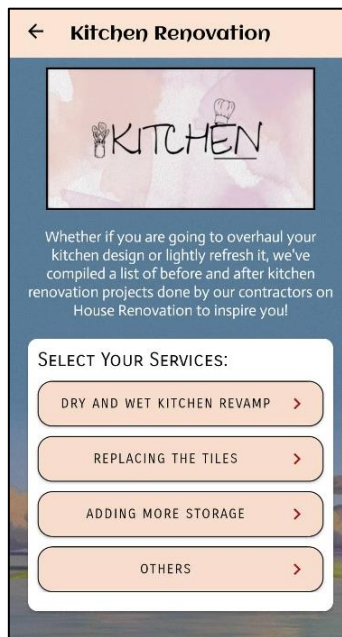
Figure 5.31: Kitchen quotation
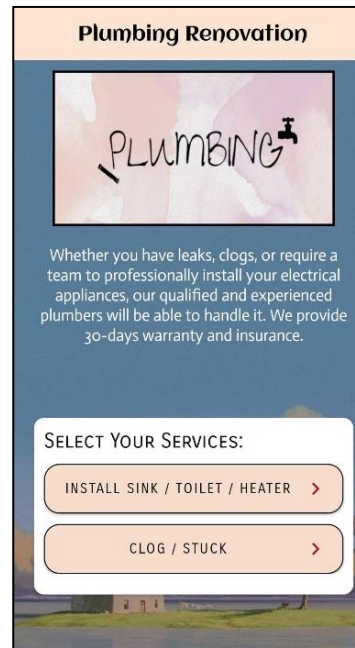
Figure 5.32: Plumbing quotation
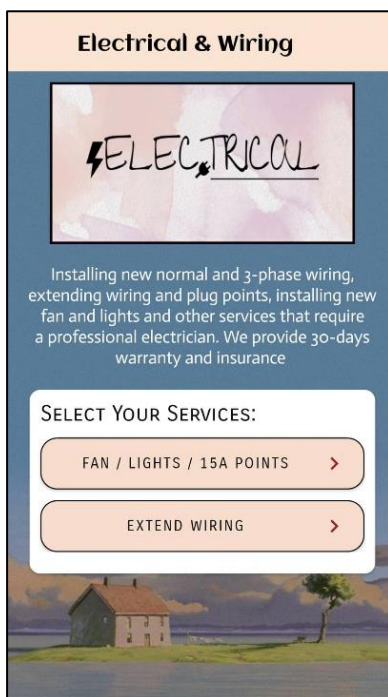
Figure 5.33: Electrical and wiring quotation
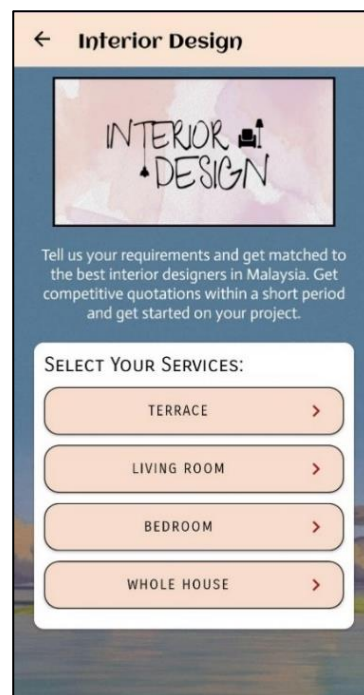
Figure 5.34: Interior design quotation

For example, if user click on the 'dry and wet kitchen revamp' in kitchen service, the questions asked will be shown as below:
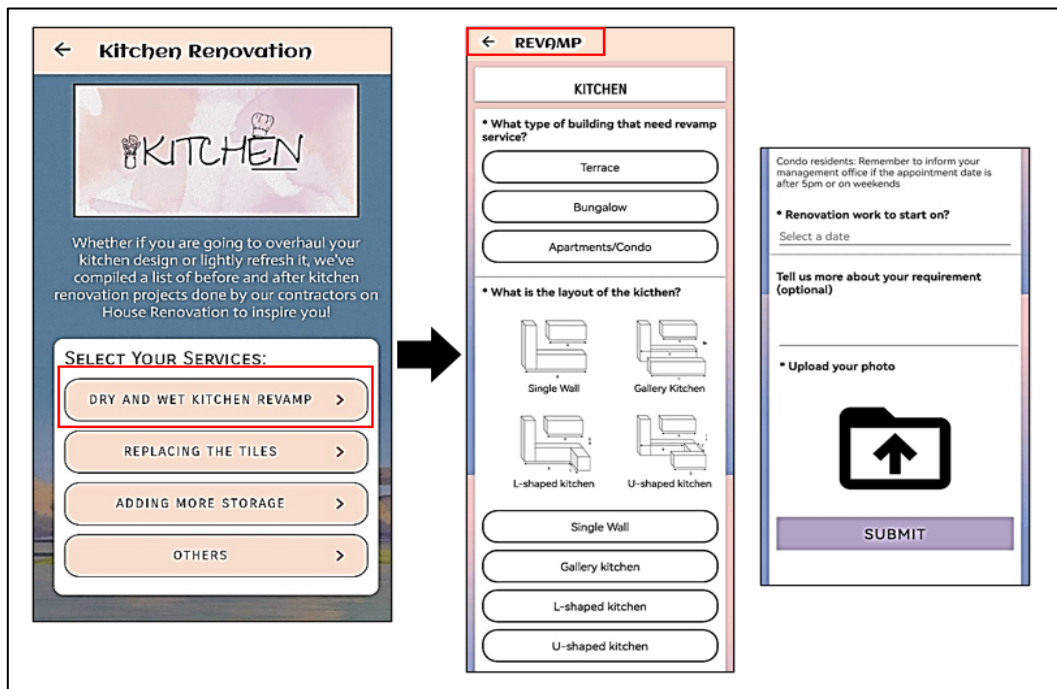
Figure 5.35: Question asked in 'dry and wet kitchen revamp' in kitchen

If user click on the 'replacing the tiles' in kitchen service, the question asked will be shown as below:
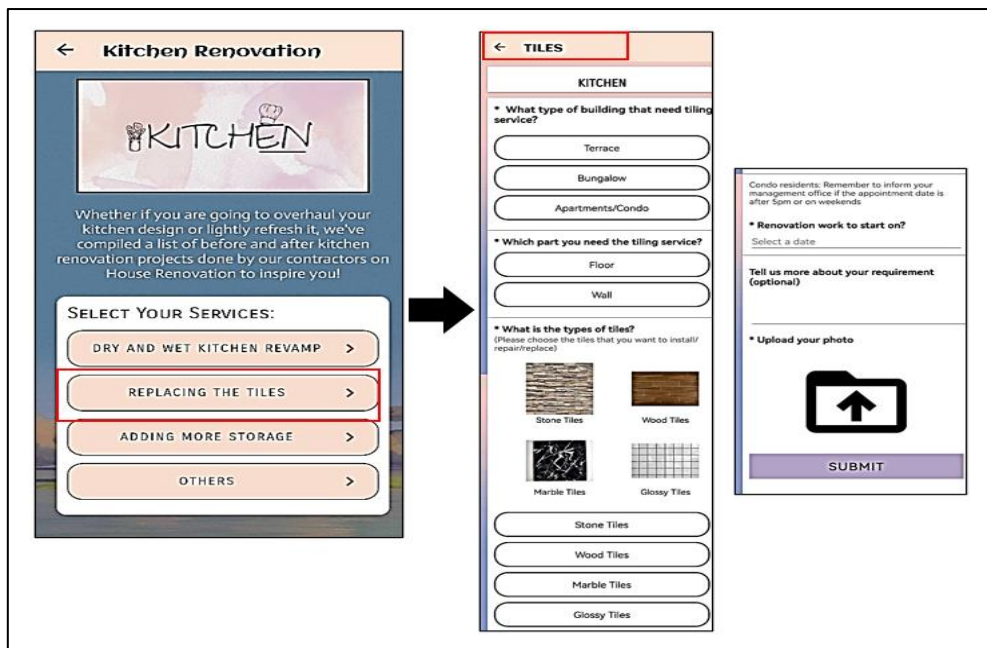
Figure 5.36: Question asked in 'replacing the tiles'

If user click on the 'adding more storage' in kitchen service, the question asked will be shown as below:
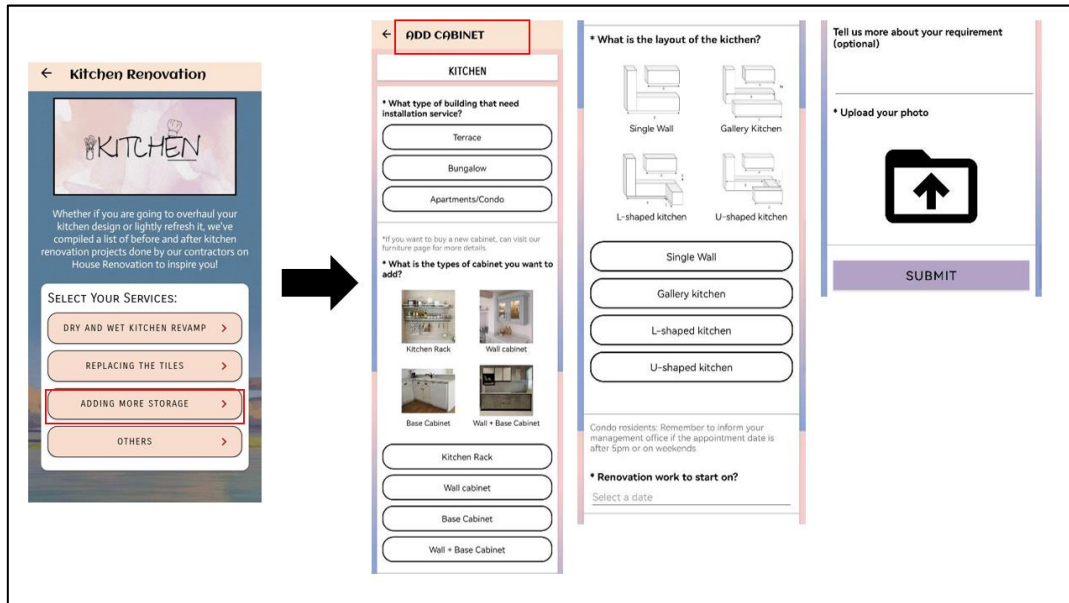
Figure 5.37: Question asked in 'adding more storage'

If user click on the 'other' in kitchen service, the question asked will be shown as below:
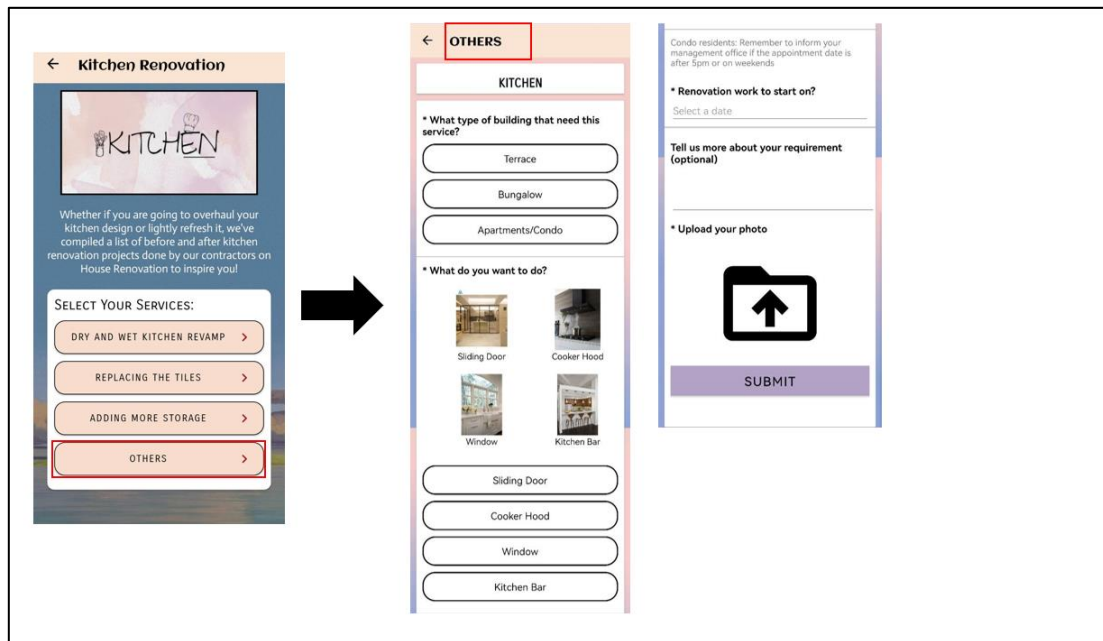
Figure 5.38: Question asked in 'adding more storage

If user click on the 'install sink / toilet / heater' in plumbing service, the question asked will be shown as below:
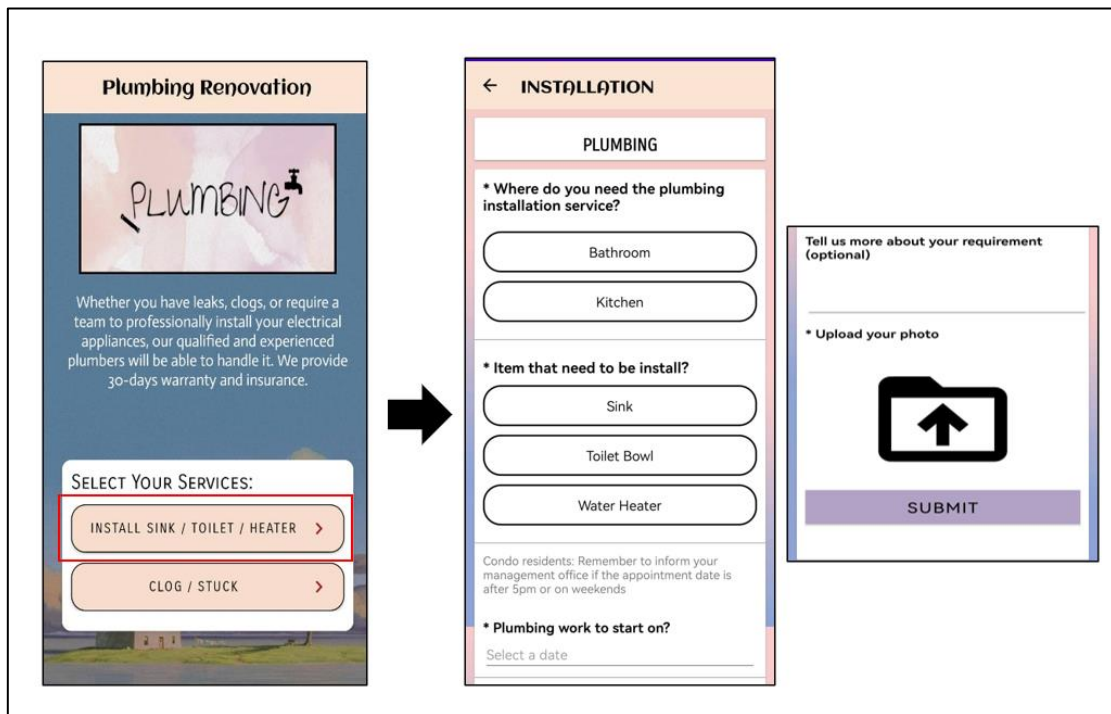
Figure 5.39: Question asked in 'install sink / toilet / heater'

If user click on the 'clog/stuck' in plumbing service, the question asked will be shown as below:
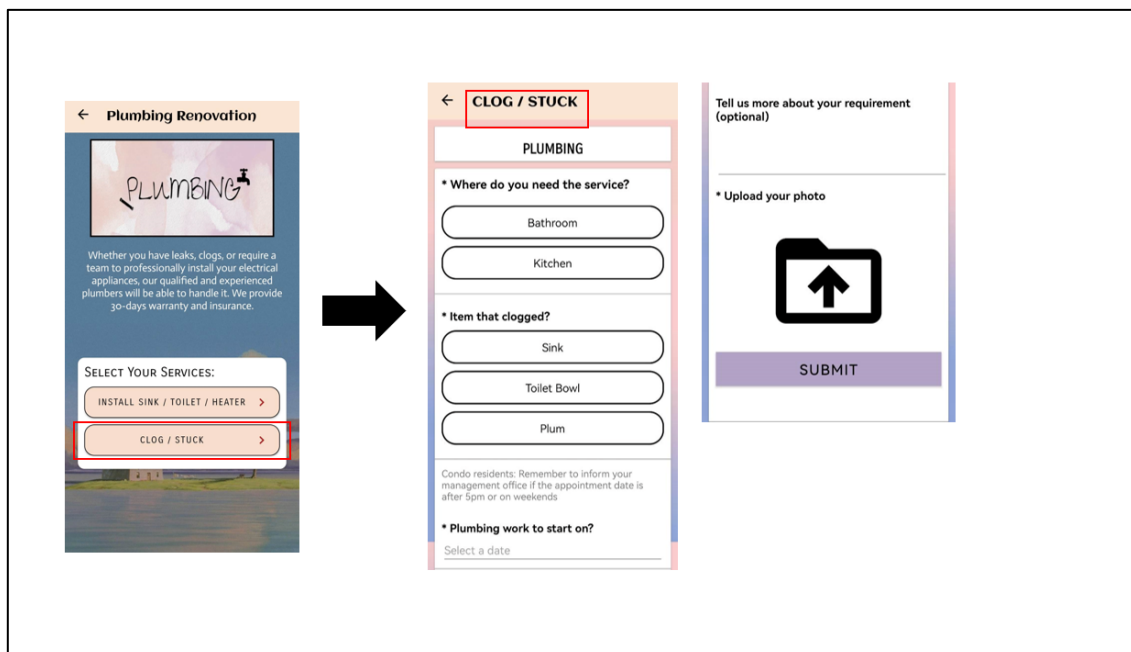
Figure 5.40: Question asked in 'clog/stuck'

If user click on the 'installation' in electrical & wiring service, the question asked will be shown as below:
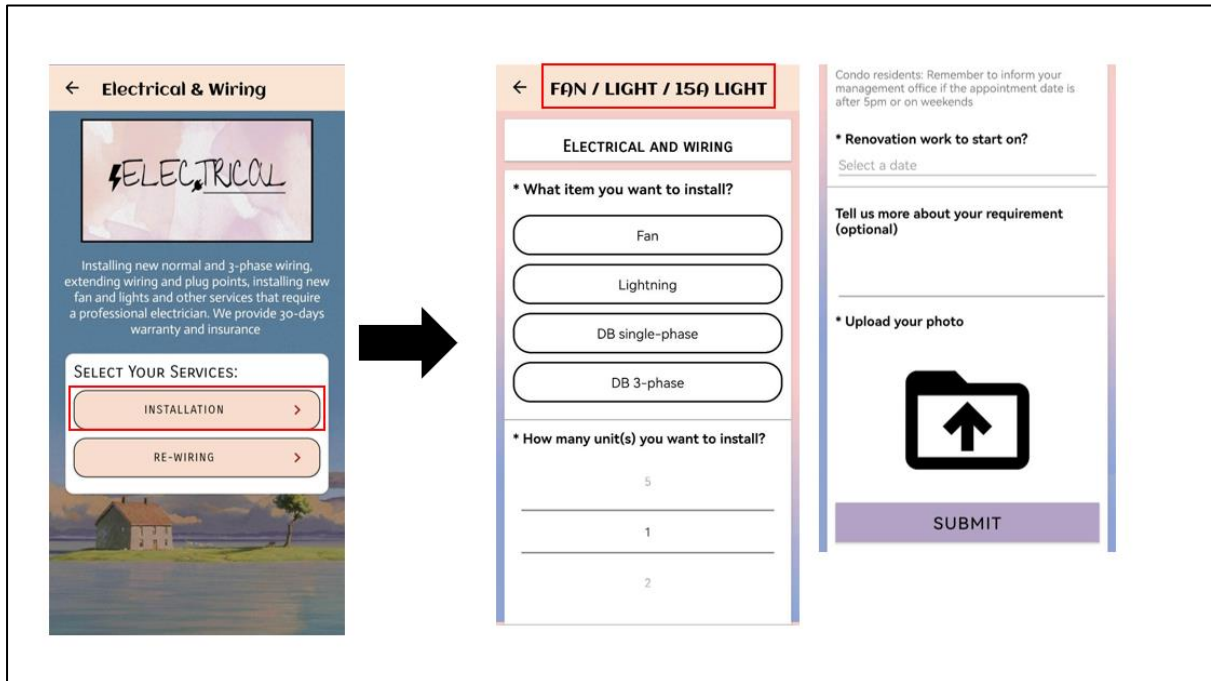
Figure 5.41: Question asked in 'installation'

If user click on the 're-wiring' in electrical & wiring service, the question asked will be shown as below:
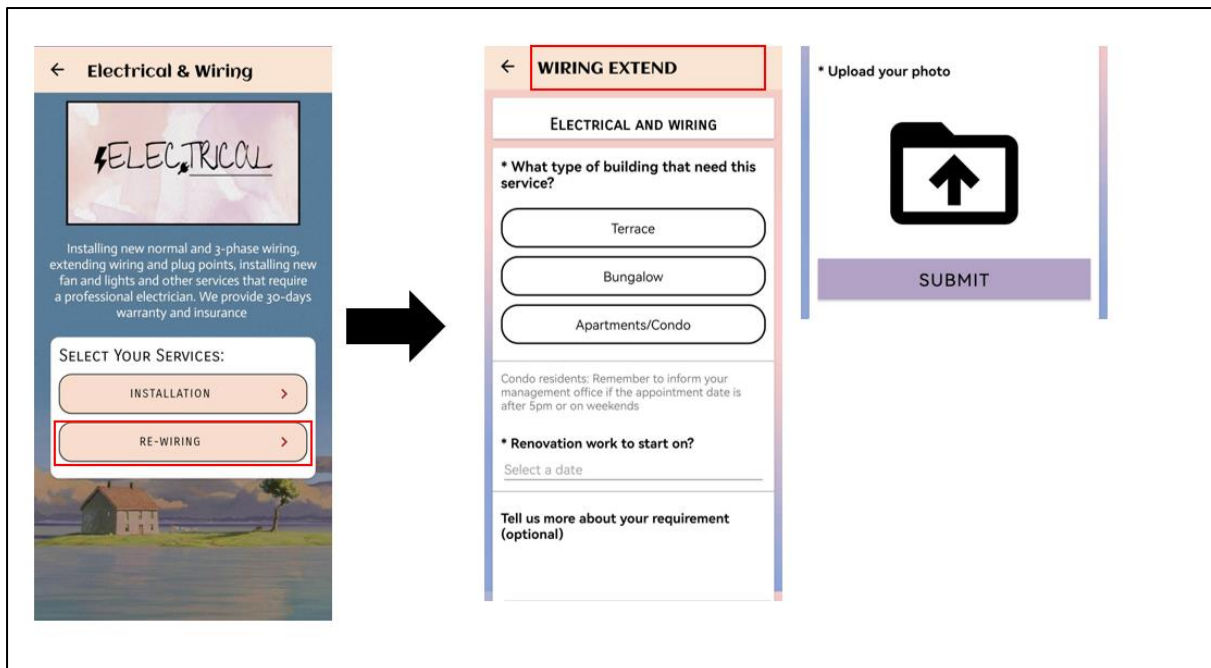
Figure 5.42: Question asked in 're-wiring'

If user click on the 'living room', 'bedroom' or 'whole house' in interior design, the question asked will be shown as below:
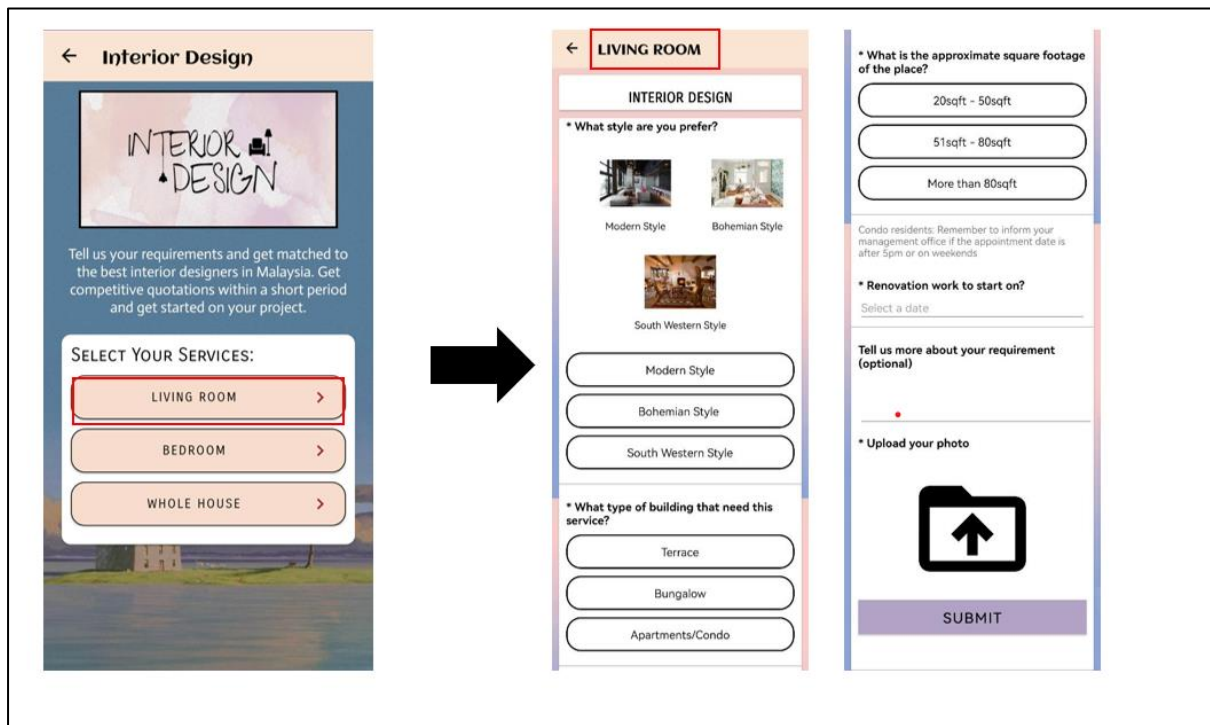
Figure 5.43: Question asked in 'living room', 'bedroom' or 'whole house'

When the house owner clicks the 'submit' button, all the entered data will be sent to the Firebase and display in the service provider interface for their review.

8. Service Provider Page

This page divides the providers into four main categories: kitchen, plumbing, electrical and interior design. In each category, it will show the related provider for the user to review. Users can also filter the providers by region, such as "Johor," "Kedah," and "Sarawak," to find providers located near their home. This feature helps users to hire a service provider who is conveniently located.

Figure 5.44: Service Provider Page

Figure 5.45: Filter providers by region

For example, if a user filters by 'Kedah', relevant providers in that region will be displayed. When a user clicks on a service provider, they can view details about that provider, including their profile picture, name, contact number, description, and rating. Users can also rate and leave comments for service providers. Below the comment and rating section, there is a section to show all the comments from other users. At the bottom of the page, there is a 'send message' button which allows users to send a message to the provider to ask any questions or queries.
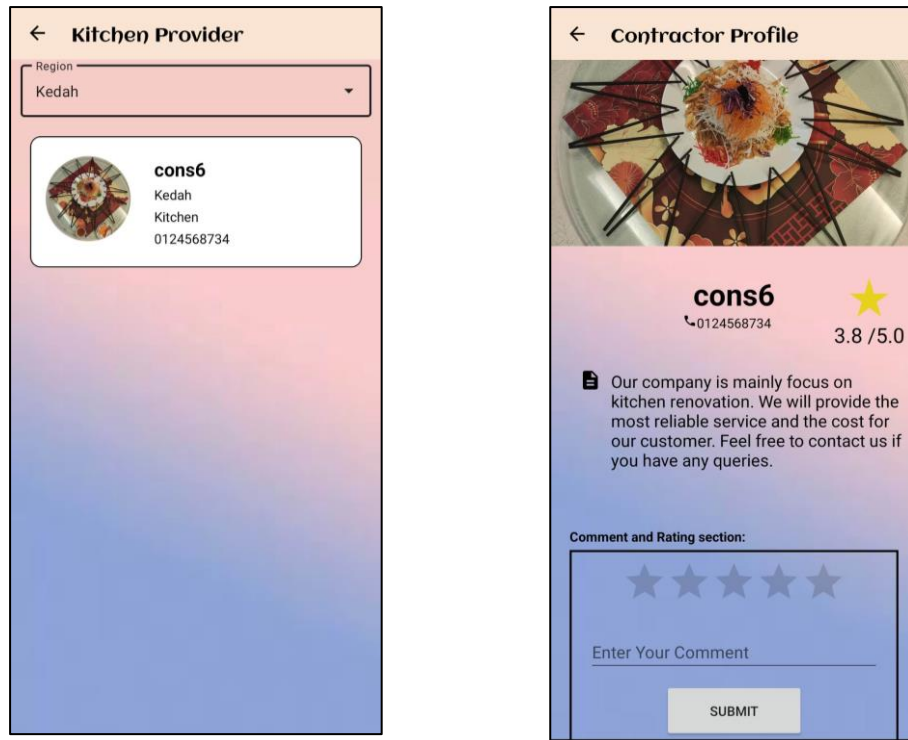
Figure 5.46: Detailed service provider page

9. Product/Furniture Page

On this page, users can browse furniture items divided into four main categories: furniture, bedroom, lighting, and bathroom. Each category has two sections, popular and other furniture. The popular furniture section displays the top-rated furniture, while the other section allows users to scroll down for more options. By clicking on a furniture item, users can view the details of the product, such as its picture, description, and price. Besides, the AR feature of the furniture will also be available on this page. AR feature will be available for users to visualize how the furniture would look in their home. Additionally, users can add furniture to their shopping cart if they are interested, and the shopping cart can be accessed via the navigation menu on the home page. Users can also perform a search through the search bar at the top of the page to find furniture and products by type.

Figure 5.47: Products/Furniture page
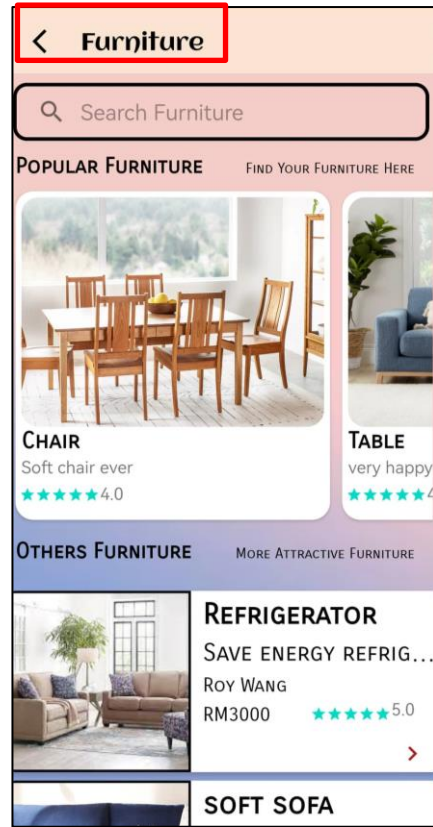
Figure 5.48: Product/Furniture subpages
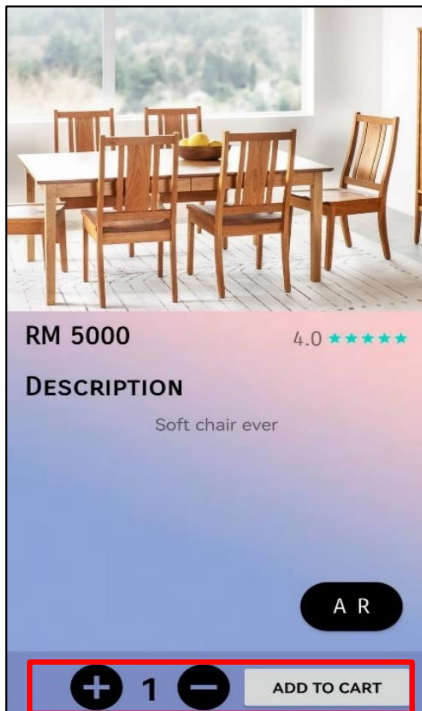
Figure 5.49: Detailed page of the furniture
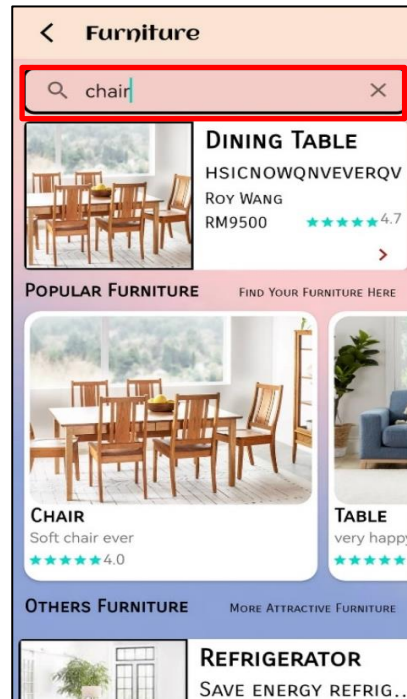
Figure 5.50: Search function by type
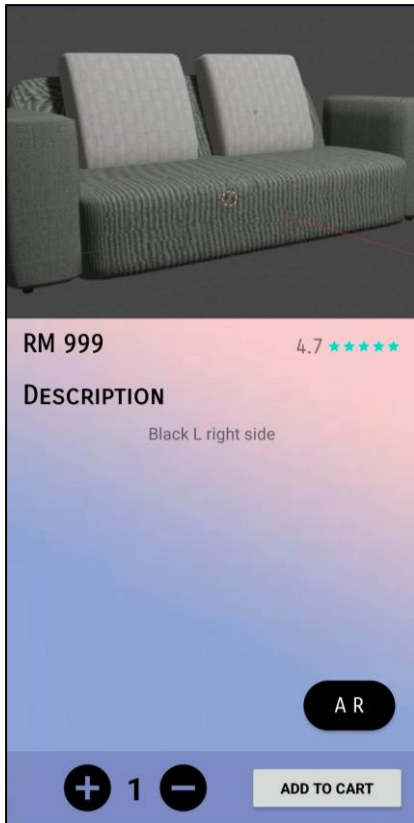
Figure 5.51: AR features

Figure 5.52: AR feature – scan around the real environment

Figure 5.53: AR features – the region to put the AR model.

Figure 5.53: AR model place in the real world

10. History Page

This page allows users to filter between four categories: kitchen, electrical and installation, plumbing, and interior design. The page displays the responses to the requested quotations from each of the service providers along with the price of the jobs. The data displayed on this page is generated based on the actions performed by the service provider on their interface.

Users can compare prices from different service providers. The system will display the prices in ascending order to help users choose the most affordable service provider. Once the user has made a decision, they can either accept or decline the quotation provided by the service provider by clicking the respective buttons. If the user click 'accept' button, it will display the 'complete' button. This button allows the user to verify whether the job has been completed or not. If the user clicks the 'decline' button, they can delete the record from their history by clicking the cross icon at the top left corner. Additionally, the system will display the total number of records for each service provider category.
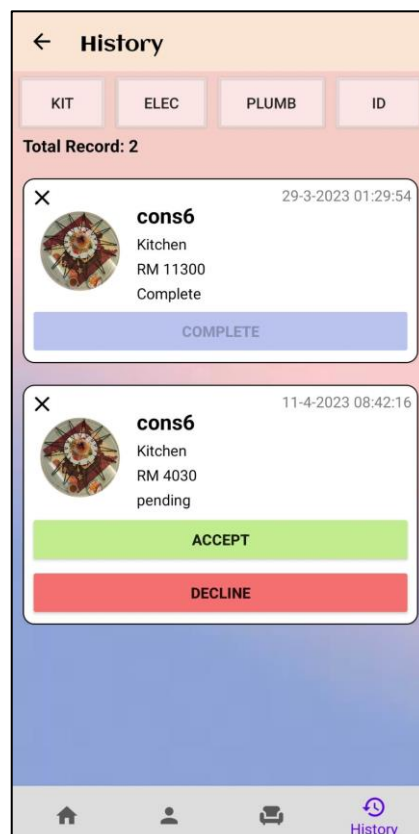
Figure 5.54: History page

11. Update Profile

Users can update their profile (username, address, phone number) by click on 'Profile' in the navigation menu. After enter the updated details, user only need to click on the 'Update' button to update their profile.
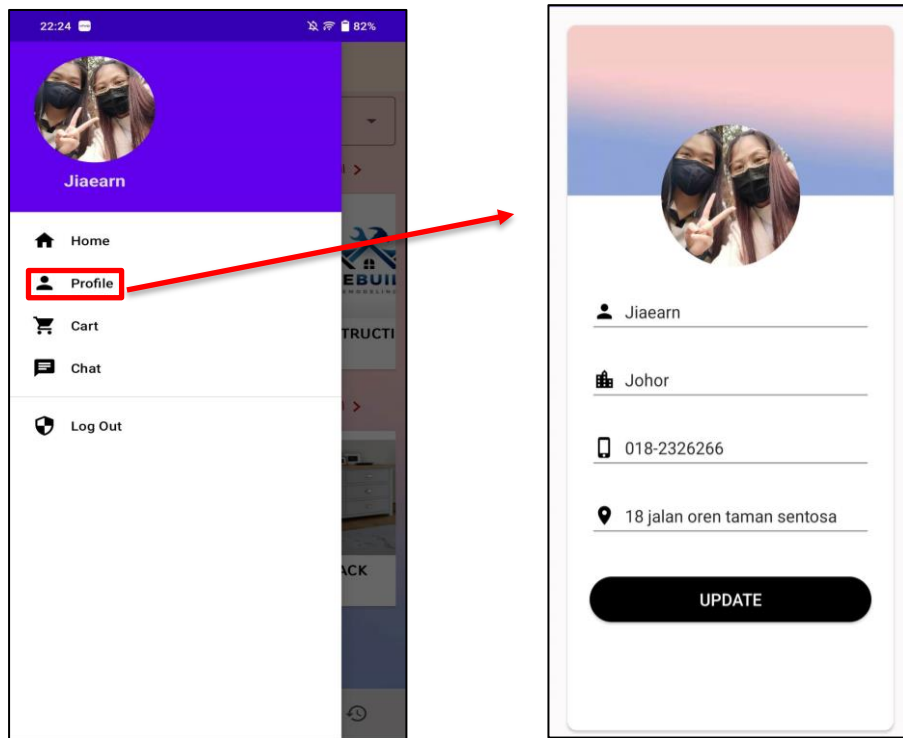
Figure 5.55: Update profile interface.

12. Owner Shopping Cart

The owner's shopping cart will display all of the house owner's interested furniture. If the user wants to delete the items, they can just click on the 'trash' icon. Besides, the shopping cart will show the total amount that the user needs to pay. The payment function will continue to develop in FYP2 later.
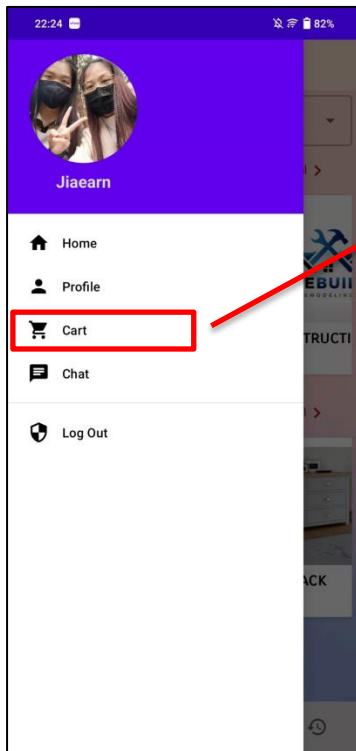
Figure 5.56: Cart Navigation   Figure 5.57: Owner shopping cart

13. Chatting room

Users can easily communicate with contractors by utilizing the chat function, which can be accessed by clicking the 'Chat' button located in the navigation menu. Once clicked, the user will be directed to a chatting room where a list of contractors who have previously sent a quotation or received a message.
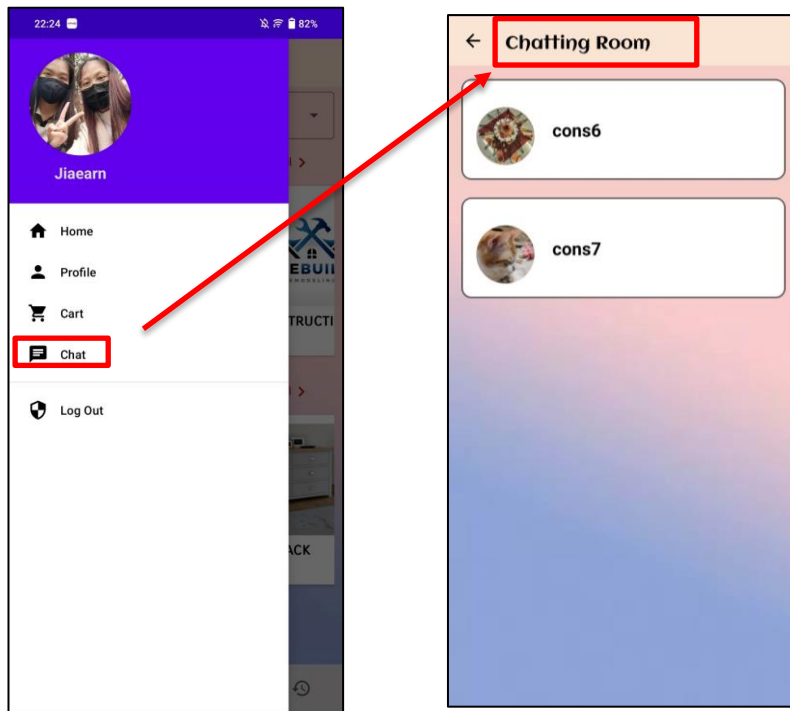
Figure 5.58: Chatting room list

After selecting the desired contractor, the user will be directed to a chat interface where they can communicate via a text box located at the bottom of the page. Additionally, users can attach files to send to the contractor, and can also open PDF files by clicking on the URL link provided by either themselves or the contractor. This allows the user to review and download the PDF file for local storage on their device. The chat feature enables two-way communication, allowing contractors to receive messages sent by house owners and respond in real-time.
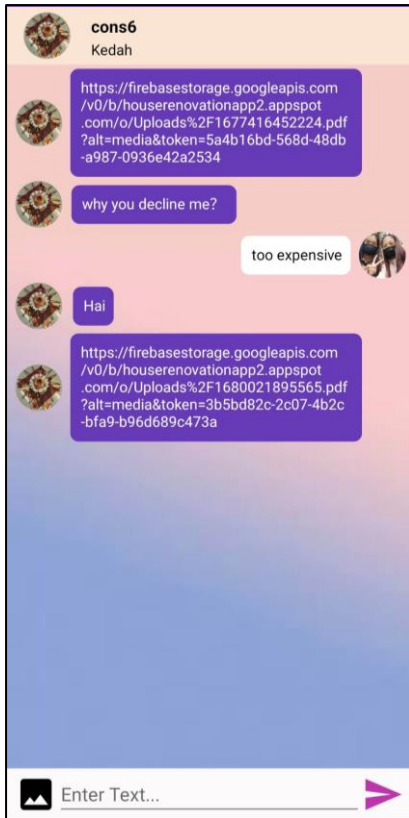
Figure 5.59: Chat interface
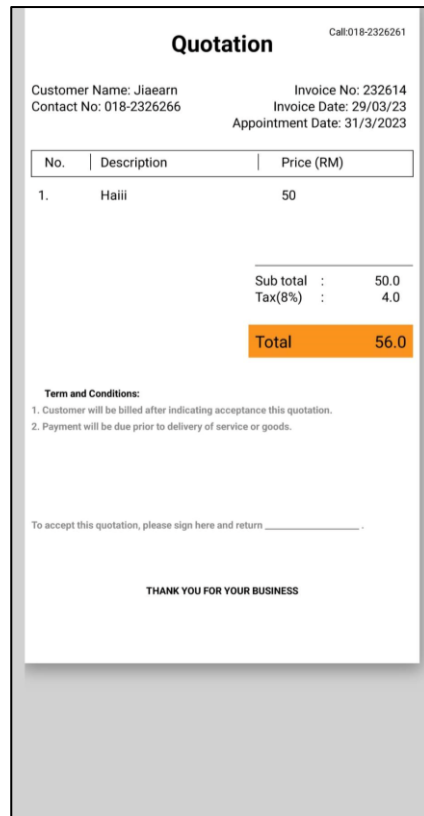
Figure 5.60: PDF file review
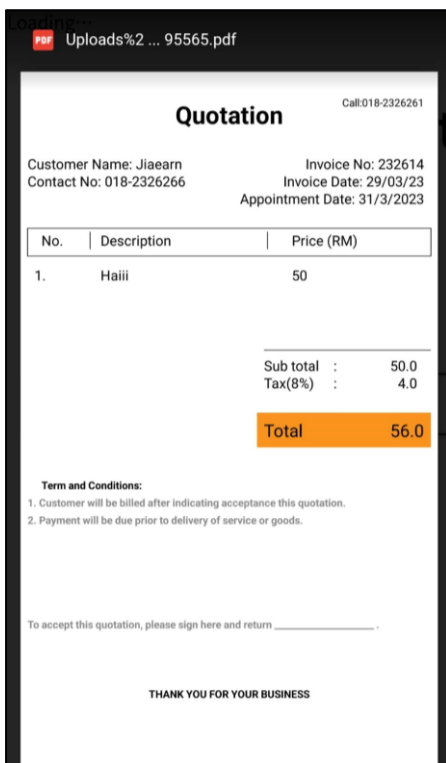
Figure 5.61: Download PDF file

Figure 5.62: Confirmation Dialogue Box for downloading the file

Service Provider Interface

14. Service Provider Dashboard

The service provider interface is a separate interface designed for contractors. In dashboard, contractors can view quotations requested by homeowners, which are categorized by service type such as plumbing, electrical, interior design, and kitchen.

Figure 5.63: Service provider dashboard

15. View House Owner Request

As an example, if a contractor wishes to view requests related to kitchen work from the house owner, they can browse through all the requests listed under the category of kitchen. By clicking on the 'View Request' button, they can access the details of the request. If the contractor is interested in the project, they can simply click on the 'Send Quotation' button to send a quotation to the house owner. In case the contractor has already sent the quotation, the button text will change to "Already Sent Quotation," and it will be disabled to prevent the contractor from sending duplicate quotations to the house owner.

Once the contractor clicks on the 'Send Quotation' button, they will be directed to the 'Quotation' interface. The system will automatically fill in the basic information such as the name, address, phone number, and appointment date. Additionally, the system will also calculate the estimated base price based on the requirements stated by the house owner. However, the contractor is not bound to follow the base price and can modify it according to their own requirements. If necessary, they can simply make changes to the price before sending the quotation to the house owner. In summary, the contractor is only required to provide a job description when filling out the quotation. After completing the description, the contractor can click on the 'Create and Send PDF' button to automatically generate a complete PDF containing all the necessary information. The PDF will be stored in the contractor's local device and can be sent through the chat interface to the house owner.
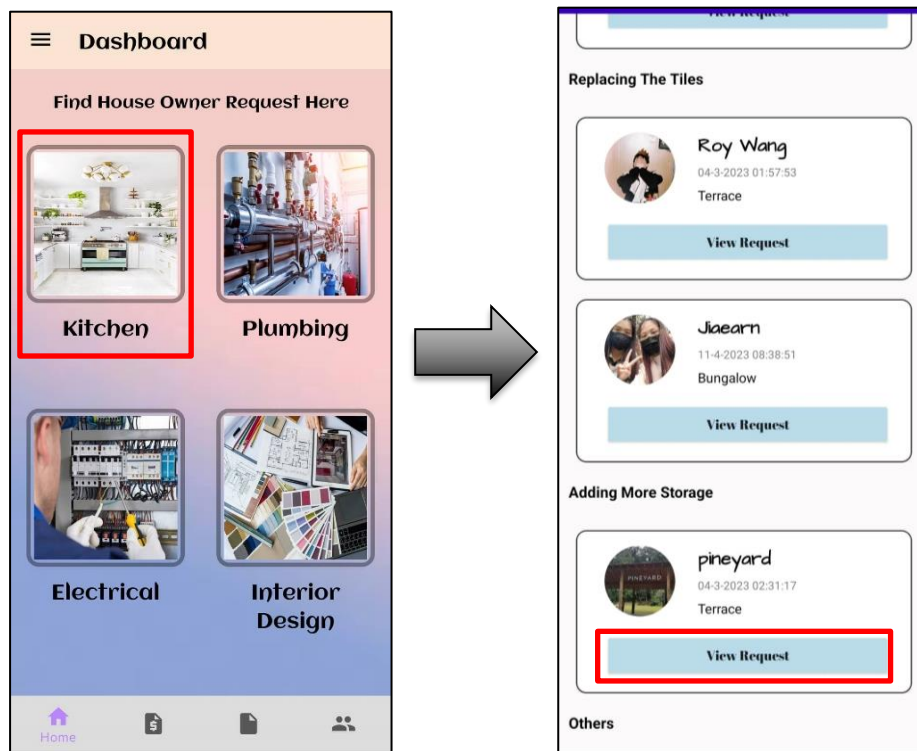
Figure 5.64: House owner quotation request list.
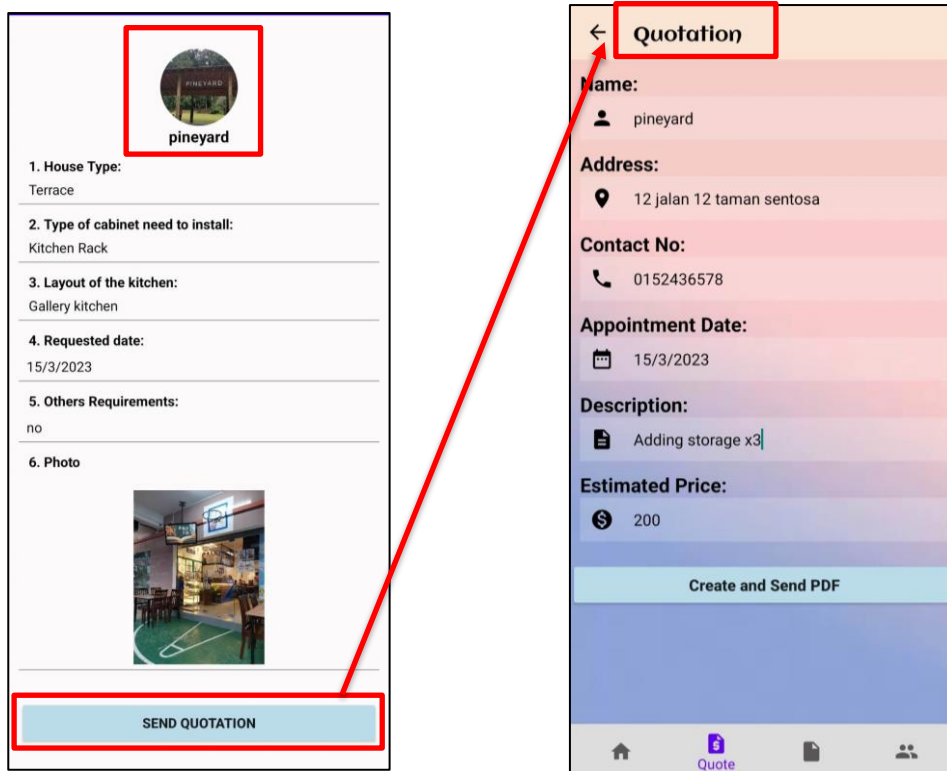
Figure 5.65: Quotation page with
auto filled feature

Table 5.2: Dry and wet kitchen revamp work base-price estimation

The kitchen size is based on the standard size of different type of house: Terrace kitchen – 10ft x 8ft Apartment kitchen – 7ft x 9ft Bungalow kitchen – 10ft x 16ft		
House Type	**Kitchen layout**	**Estimate based price**
Terrace	Single wall	RM 7200
Terrace	Gallery kitchen	RM 11300
Terrace	L-shaped kitchen	RM 9200
Terrace	U-shaped kitchen	RM 11800
Bungalow	Single wall	RM 10600
Bungalow	Gallery kitchen	RM 17000
Bungalow	L-shaped kitchen	RM 12600
Bungalow	U-shaped kitchen	RM 15900
Apartments/Condo	Single wall	RM 6500
Apartments/Condo	Gallery kitchen	RM 10200

Apartments/Condo	L-shaped kitchen	RM 7700
Apartments/Condo	U-shaped kitchen	RM 9400

Table 5.3: Install sink / toilet / heater work base-price estimation

Location	Item to be install	Estimate based price
Bathroom	Sink	RM 400
Bathroom	Toilet bowl	RM 1500
Bathroom	Water heater	RM 340
Kitchen	Sink	RM 1000

Table 5.4: Installation of fan / light work base-price estimation

The price below is the price for a single item.	
Item	**Estimate based price**
Fan	RM 280
Lighting	RM 190
DB single-phase	RM 400
DB 3-phase	RM 800

The table above shows the calculation for three different services, and each service has its own unique method of calculation. The estimated base price for the "Replacing Tiles" category is determined by the type of house, whether it's for the wall or floor, and the type of tile material. For the "Adding More Storage" category, the estimated base price is based on the type of house, the kitchen layout, and the type of cabinets to be used. Lastly, for the "Other" category, the estimated base price is determined by the type of house and the specific work that needs to be done.

16. Create Quotation

This page fastens the quotation process for contractors, allowing them to quickly generate a quotation by simply inputting the client's name, address, contact number, appointment date, job description, and price. Once the contractor clicks the "Create PDF" button, the quotation in PDF format will be stored in the contractor's local storage. This feature saves contractors valuable time and enables them to concentrate on their core business.

Figure 5.66: Create quotation page

Figure 5.67: Quotation PDF file

17. Create Invoice

The feature allows contractors to quickly generate invoices by simply inputting the client's name, billing address, due date, job description, and price. Upon completing all the necessary details, the contractor can click the 'Create Invoice' button, and the invoice will be generated in a matter of seconds. Contractors can view the PDF of the created invoice in their local storage.

Figure 5.68: Create quotation page   Figure 5.69: Dialogue box
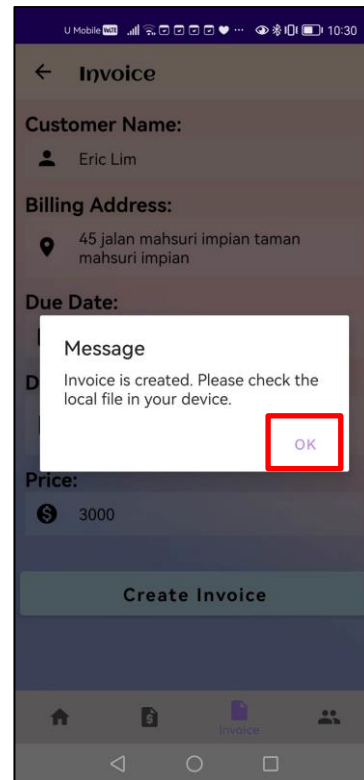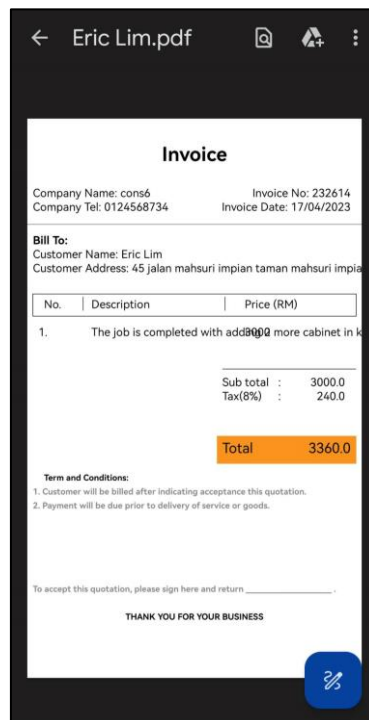
Figure 5.70: Invoice PDF file

18. Client History Page

This page allows contractors to view all of their jobs categorized as accepted, pending, or declined. An accepted job means that the client has approved the quotation provided by the contractor, and the contractor can proceed with the renovation works for that client. A pending job means that the client has not yet decided whether to accept or decline the quotation, and the contractor must wait for their response. A declined job means that the client did not accept the quotation provided by the contractor. The contractor can also delete a record by clicking the cross icon located at the top left corner of the record.

Figure 5.71: Client Record page   Figure 5.72: Accepted job
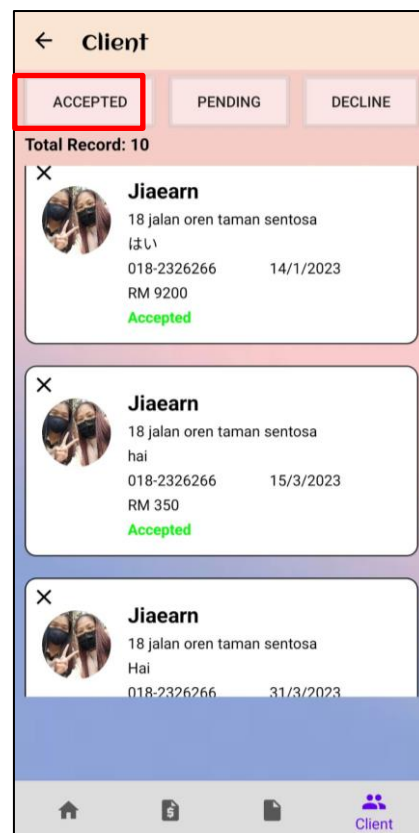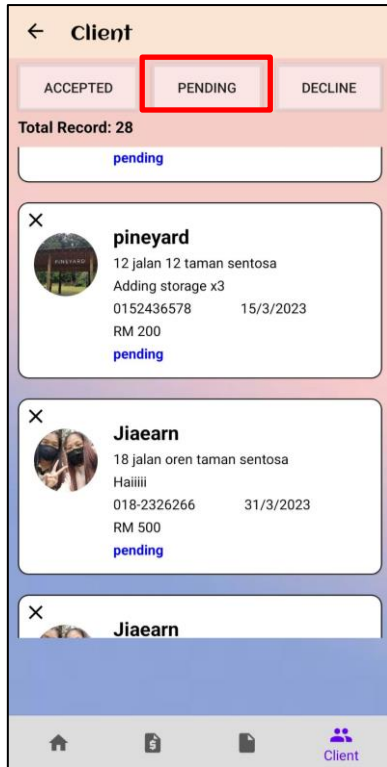
Figure 5.73: Pending job　　　Figure 5.74: Declined job

19. Update contractor profile

Contractors are able to update their profile by modifying their company name, region, contact number, and adding a company description. These details will be displayed to the house owner, so it is crucial that contractors provide accurate and up-to-date information
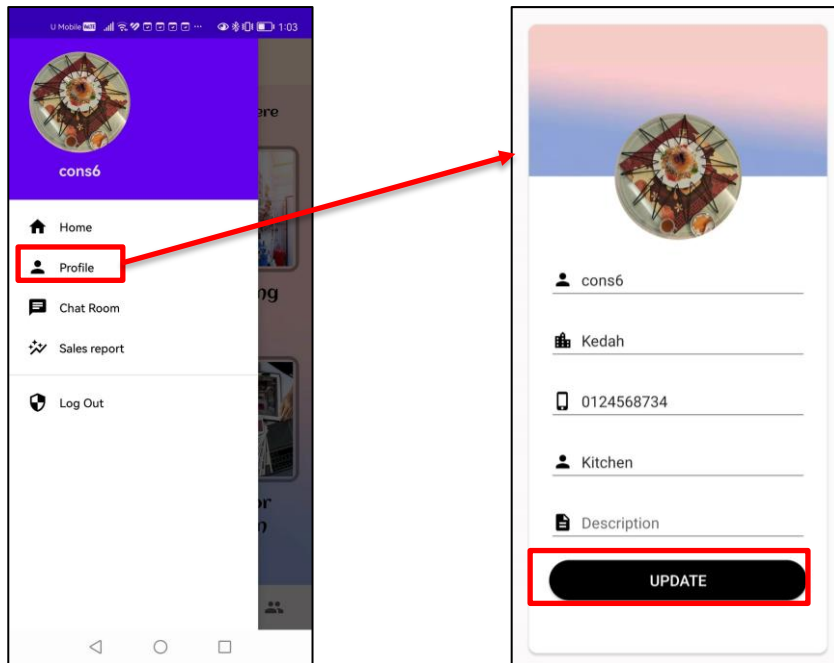
Figure 5.75: Update
contractor profile

20. Chatting function

The service provider interface includes a messaging feature that allows contractors to communicate directly with the house owner. Contractors can send and receive messages to and from the house owner. Additionally, they can send quotations to the house owner using the "send file" function within the chat room. The quotation PDF will be shared as a URL link in the conversation, which the house owner can click to download the file directly.
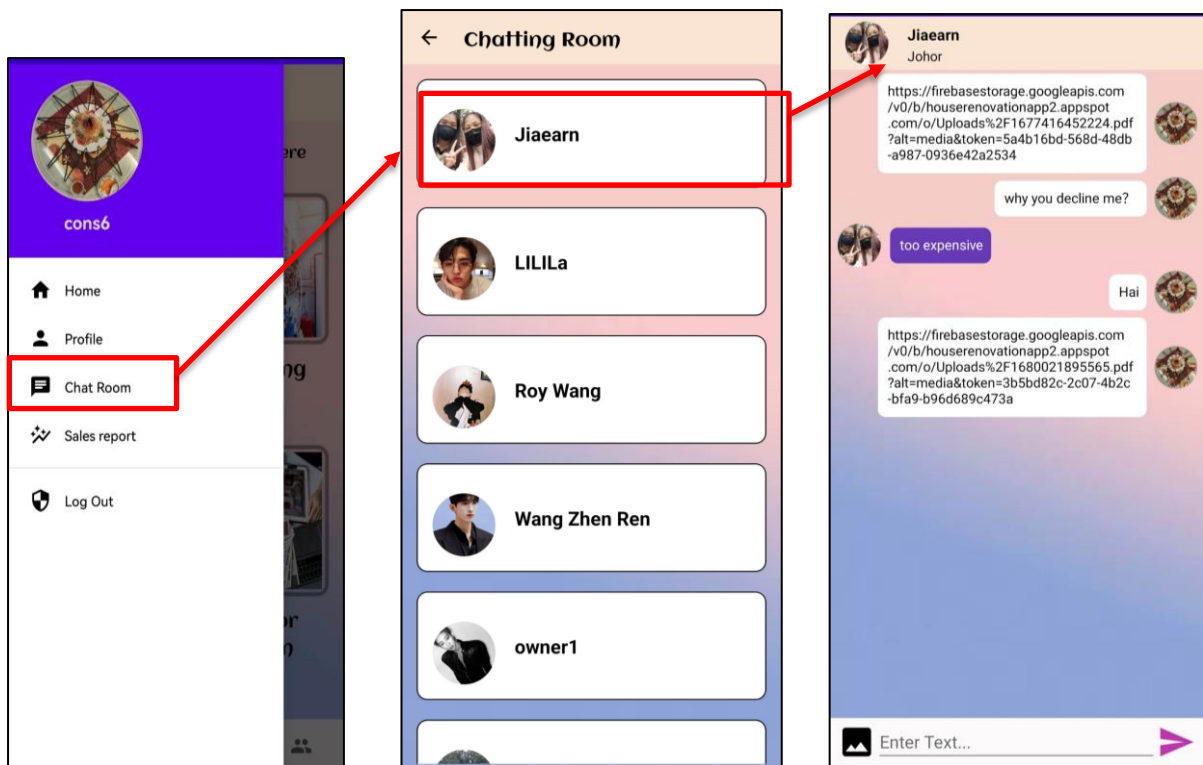
Figure 5.76: Chatting
room with a list of clients

Figure 5.77: Chatting
interface

21. Sales Report

The sales report provides contractors with a comprehensive overview of their total sales, number of transactions, rating given by the house owner, and comments from the house owner. Contractors can filter this information by date to see a summary of their sales within a specific period. Additionally, the report includes a graph that helps visualize trends in sales, enabling contractors to identify whether sales are increasing or decreasing over time.
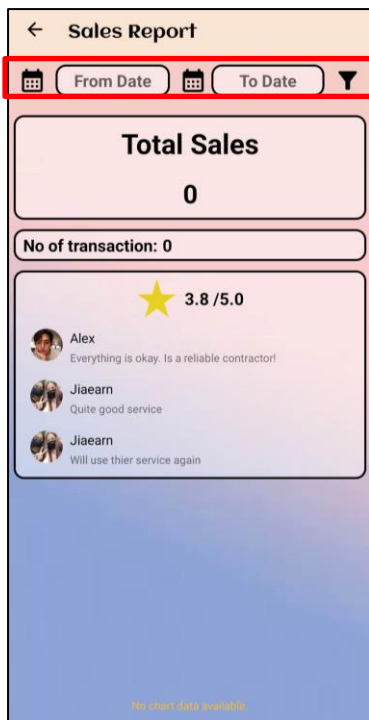
| Figure 5.78: Sales report without apply date filter | Figure 5.79: Sales report with date filter | Figure 5.80: Graph for the sales |
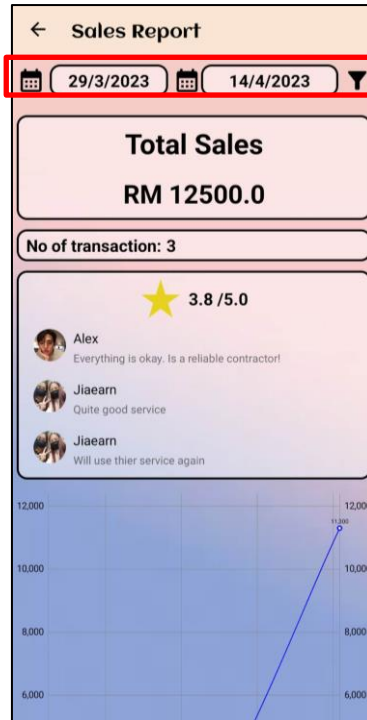
5.6 Details of the methods and technologies used in each feature

The brief description of how to develop each module in this application is shown below:

House owner interface

a) Splash Screen

The splash screen serves as the initial screen that appears when users launch the application. It is the first point of contact between the user and the application, and as such, it needs to be well-designed and informative. The screen will last for 5 seconds by using handler postDelayed function.

b) Carousel page

For the carousel page, it needs to create three different layouts (xml file) for three pages of carousel activity. Besides, a CarouselPref java class is created. This class is to store the carousel preference, which will determine whether the application is launched for the first time. This is done by using the isFirstTimeLaunch function, which will return a boolean

value. If the boolean value returned is false, indicating that the app was not launched for the first time, the app will launch the login screen rather than the carousel activity. Besides, the three layouts will be stored in the array. When the user clicks on the 'next' button or swap to the left and right, the user can see the different layouts of carousel activity. Once users navigate to the third page, they will be able to access the start button, which will allow them to begin using the application.

c) Login Page

The user needs to enter the registered email with the correct password. The application will check the data with Firebase authentication. If the data matches, the user can go to the home page of this application. If the user forgets the password, Firebase will then send an email to the user's email address with instructions on how to reset their password. By following the steps provided in the email, the user can successfully reset their password and regain access to their account. Users can also login with their Google Account by using the GoogleSignInAccount function, but each account can only login once.

Figure 5.81: Firebase login with email and password

Figure 5.82: Firebase login with Google account

d) Register Page

After the user fills in all the details and hits the 'registered' button, the data will be sent to Firebase and stored for authentication by using the FirebaseAuth function (createUserWithEmailAndPassword). Firebase will store the user's email, the date they created the account, and the user's UID. Every user has a different user UID to differentiate them from other users in the app.

Figure 5.83: Firebase registration data

e) User Type Page

The user will be presented with the option to select their user type as either a house owner or a service provider. The selection is made using radio buttons, allowing the user to choose only one option. This page will only appear if the user has not set up their profile. This is done by checking the data in the firebase. If the user data does not include the user type information, the application will redirect the user to the user type page. If the user sets up the profile successfully, the application will not show this page to the user again.
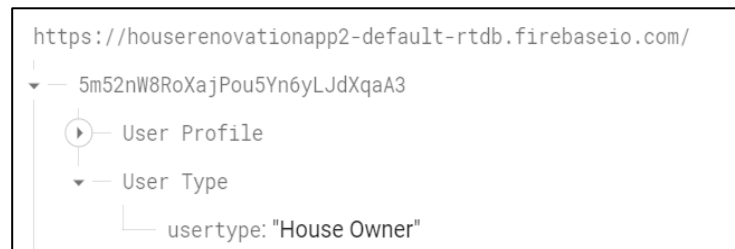
Figure 5.84: User type data in Firebase.

f) Owner Home Page

The 'request quotation from service provider' function is done by using the TextInputLayout, ExposedDropDownMenu features. This drop-down menu requires an adapter to accommodate all of the user's selections. The application will direct users to the specific page according to their actions.

For the drawer menu at the top left corner, it is done by the NavigationView features in Android Studio. Before this, it needs to create the menu items in the menu resource file. All the design work for the menu can be done in this menu resource file. The NavigationView feature has the onNavigationItemSelected function to direct the user to the specific page according to the user's action.

g) Request Quotation from Service Provider

The application presents questions to the house owner using various formats, including single-choice questions, text-based questions, date picker questions, and image-based questions. The application will check whether the house owner filled in the required answer or not; if not, it will prompt out some error messages. After the user answers all the required questions, all the answers will be stored in the Firebase. Besides, the application will store the requested date and time for the quotation by using the Date features in Android Studio. It is useful because it is required to create a unique ID (userID + request date and time) for

each quotation request to ensures each house owner can request multiple quotations without overwriting their previous data.

Figure 5.85: Unique ID (userID + request date and time) for the quotation request for each house owner user.

h) Service Provider Page

Users can filter contractors by region, such as Johor, Kedah, and Sabah. The filtering option is available in a drop-down menu. Users can click on the desired region to view all the relevant contractors. The relevant region can be retrieved using the setQuery() function, which matches the "companyCity" attribute stored in Firebase for each contractor.

Users can provide a rating and comment on the service provider using the RatingBar feature and EditText widgets in Android Studio. The rating can be given using the setOnRatingBarChangeListener() function, and the data will be stored in Firebase along with the comment. To calculate the average rating of the contractor, the application retrieves all the rating values stored in Firebase and calculates the average by dividing the sum of all ratings by the total number of ratings for that contractor. Additionally, a RecyclerView is available at the bottom of the page to display all the comments on that service provider.

i) Product/Furniture Page

This page has been separated into two sections, which are popular items and normal items. Both sections are using the recycle view to show the items to the house owner. This is because the recycle view is more flexible than other components in Android Studio. It must first create a layout as the recycle view's single view, and then adapt the layout with the recycle view via LayoutInflater in the onCreateViewHolder function. All the furniture details and images are uploaded to the Firestore database by the developer. In order to retrieve the data from the Firebase, a model class is needed. All the attributes in the model class must have the same

name as the field in Firebase. Each attribute in the model has a get() method that allows the application to retrieve the data and display it in the recycle view with their corresponding positions. This can be done by using the onBindViewHolder function.
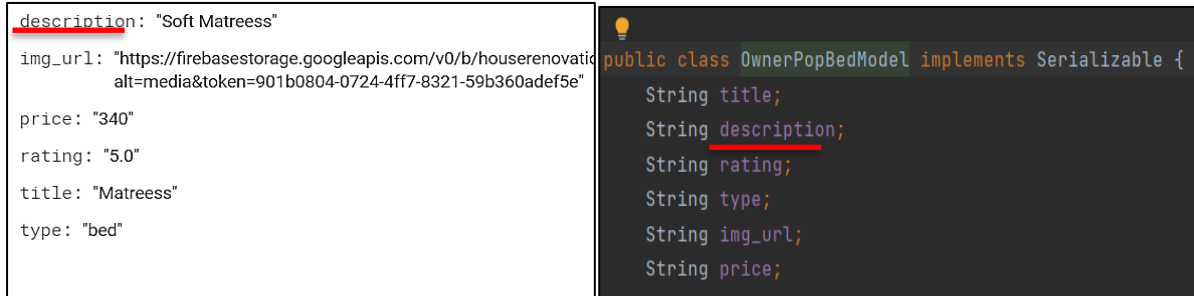
Figure 5.86: The model class attributes (right image) must have the same name with the field in Firestore database (left image).

Once the user clicks on an item in the recycler view, the application will open the corresponding detail page using an Intent. This can be done by using the ViewHolder onClick function. The detail page layout should be created beforehand, and the data for the selected item can be retrieved from the model class using the position value passed in the Intent. The retrieved data can be displayed on the detail page layout using the appropriate views, such as TextViews or ImageViews, using the setText or setImageResource functions.

For the search function on this page, it is done by the SearchView feature in Android Studio. The house owner can search the items by type. The type of each item is assigned by the developer when entering the details of that item in Firebase.

Figure 5.87: Search function by item type.

The implementation details of the AR function in this module are discussed earlier in Chapter 5.4.

j) Owner Shopping Cart

After the house owner clicks on the 'Add to cart' button on 'Furniture Detail' page, the corresponding item details will be stored in the house owner's shopping cart in the firebase, as shown in figure 3.8. The application will calculate the total cost of each item by multiplying the single price by its quantity. This shopping cart page will be shown to the user by using the recycle view. Therefore, it requires a cart adapter to put all the cart items inside the recycle view. In order to retrieve the cart item of the house owner from the Firebase, it requires a cart model. After retrieving the data, the data will be placed in the ViewHolder in the onBindViewHolder function. Besides, the house owner can also delete the cart item. If the user clicks on the 'trash' icon on the cart item recycle view, then the data will be removed from the firebase in real-time.
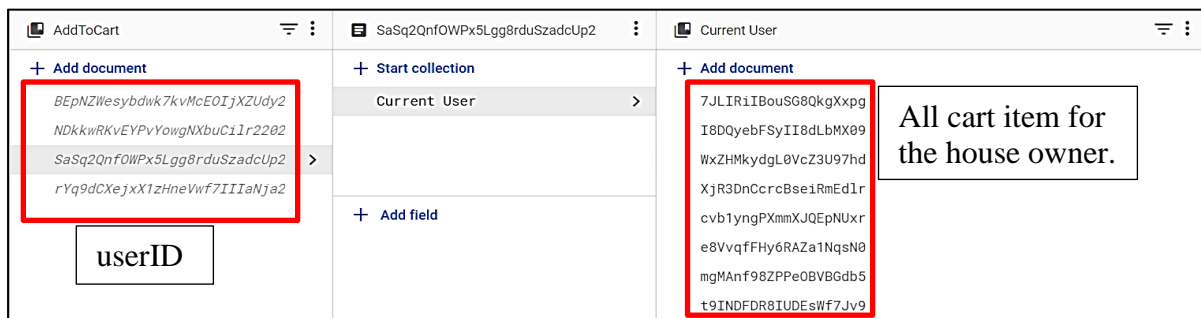
Figure 5.88: Each house owner has own shopping cart.

k) Owner History

The house owner can view the quotation replies from the service provider through a recycler view. The replies are stored in the "Owner History" with a child that corresponds to the user's ID. When the service provider sends the quotation back to the house owner, the data is stored under the respective user ID. Therefore, to retrieve the corresponding user data and show it to the house owner, the application simply needs to retrieve it from the child with the same user ID.

The user can perform three actions on this page. First, they can click the "Accept" button to accept the quotation reply from the service provider. Second, they can click the "Decline" button to decline the quotation reply. Finally, they can click the "Complete" button to indicate that the contractor has completed the renovation job. When the user clicks the "Accept" button, the status of the quotation will change from "Pending" to "Accepted". If the user clicks the

"Decline" button, the status will change to "Declined". Similarly, when the user clicks the "Complete" button, the status will change to "Completed". These changes are made using the setValue() function to update the value of the "status" child in the Firebase database. The behavior of the buttons is dependent on the current status of the quotation. If the status is "Pending", only the "Accept" and "Decline" buttons are visible, and the "Complete" button is set to invisible using the setVisibility(View.GONE) function. If the status is "Accepted", the "Decline" button is invisible, and only the "Complete" button is visible. If the status is "Declined", both the "Accept" and "Complete" buttons are invisible. Finally, if the status is "Completed", none of the buttons are visible.
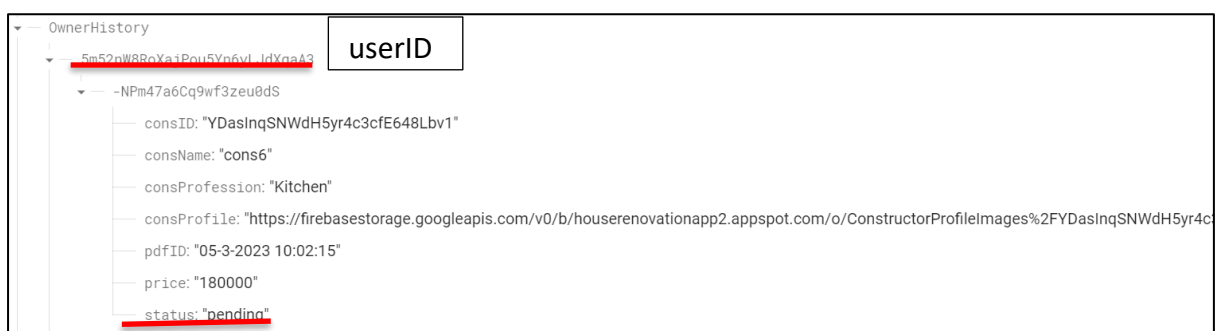
Figure 5.89: Owner history data store in Firebase

To enable filtering between the quotation replies from different types of service providers, the application can use the setQuery() function of the FirebaseRecyclerOptions. This function allows the application to retrieve only the data that matches a specific query. For example, the application can set the query to only retrieve data where the service provider type matches the selected filter option. This can be done by passing the filter option as a parameter to the setQuery() function.

Figure 5.90: Filter function using setQuery( ) function

l) Chatting room

Once a service provider replies to a quotation request, a communication channel is opened between them and the house owner. This is facilitated by displaying the service provider's profile image and name in the chatting list Additionally, the house owner can initiate a

conversation by clicking the "send message" button on the contractor's detailed page. The messages are stored in the "Message" child in Firebase along with the corresponding user ID. The user ID is crucial in distinguishing between messages sent by the house owner and those sent by the service provider. The layout design of the chat activity consists of the service provider's messages on the left and the house owner's messages on the right. To differentiate between the two, the current user ID is compared to the user ID retrieved from Firebase. If they match, the message belongs to the house owner, and the service provider's message section is hidden. Conversely, if the user IDs do not match, the message belongs to the service provider, and the house owner's message section is hidden. This is how the chatting feature operates.
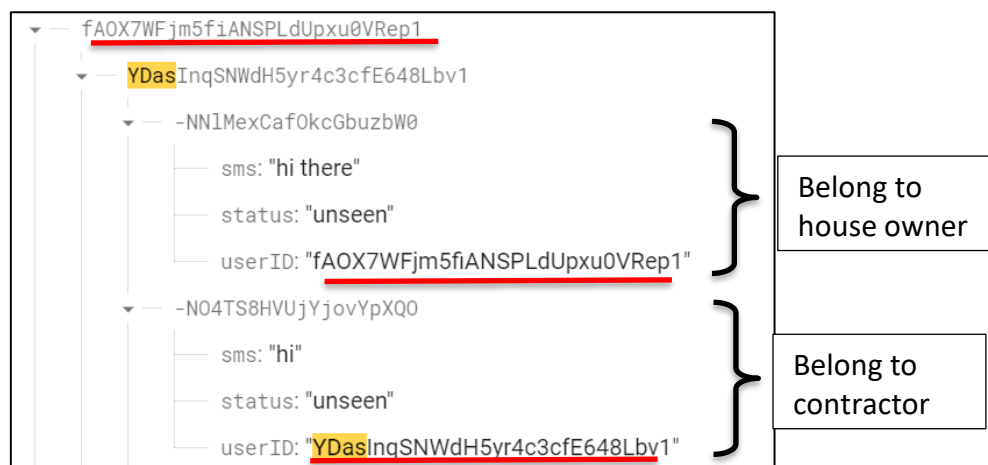
Figure 5.91: The method to differentiate the message belongs to whom
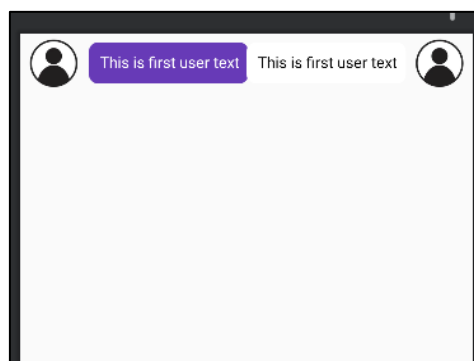
Figure 5.92: Layout design of the chat activity (single item)

The chat function also allows the house owner to send PDF files. To do this, the system first requests permission from the user's device to access their local files using onRequestPermissionResult(). Next, the user selects the desired file using the file manager, with the function setAction(Intent.ACTION_GET_CONTENT). The file is then stored in

Firebase with a URL link. If the user wants to view the PDF, they can simply click on the URL link displayed in the chat, and the PDF will be shown using the WebView function. Additionally, the user can download the PDF using the setDownloadListener() function.

Service provider interface

m) View House Owner Request

This page will show all the house owner requests according to the work type (e.g., kitchen, plumbing, electrical & wiring and interior design). First, it is required to create a single view of the recycler view. The data is retrieved from Firebase and displayed in the RecyclerView using the FirebaseUI database library in Android Studio. To retrieve the data, a model class is required to declare the fields stored in Firebase and provide get methods for data retrieval. The activity class must then use the FirebaseRecyclerAdapter features to connect the model class and the ViewHolder. In the FirebaseRecyclerAdapter, the onBindViewHolder function is used to set and place the data, while the onCreateViewHolder function is used to inflate the single view of the RecyclerView. With this implementation, service providers can view all the requests for work from the house owners.

When the service provider clicks on the "view quotation" button, the application will display the details of that particular request on a new page. To achieve this, the application uses the intent feature to pass the position of the selected item from the RecyclerView to the new page. This ensures that the service provider sees the correct details. If the service provider wants to send a quotation to the user, they can click on the "send quotation" button. The application will calculate the estimated base price of the work based on the user's request details.

n) Create Quotation

After viewing the request details of the house owner, if the contractor wants to send a quotation, they can simply click on the "Send Quotation" button. The estimated price will be passed to another activity using the putExtra() intent method. The system will then fill in all the required information of the house owner automatically including the estimated price. This is done by compare the requestID of the quotation (which contains the userID of the house

owner) to the userID of the house owner. This allows the system to retrieve the correct data of the house owner and automatically fill in the necessary information.

To create the quotation PDF file, the application uses the PDFDocument feature in Android Studio along with Paint and Canvas features to design the layout of the file. The data displayed on the PDF file, such as customer name, date, and description, are dynamic and will vary based on the customer. To save the created PDF file, the application requests permission using the WRITE_EXTERNAL_STORAGE permission. If permission is granted, the file is stored on the local device using the getExternalStorageDirectory() method in the File class. This allows the contractors send the quotation file to the house owner through chat function.

Besides, the contractor can manually enter the details for the quotation, such as the customer's name, date, and description, using EditText fields in the app. The app can then use these details to generate a PDF quotation using the PDFDocument.

o) Create Invoice

The implementation of the create invoice feature is similar to that of the create quotation feature. It uses the PDFDocument feature, along with Paint and Canvas, to design the layout of the file. It also requests external permission by using the WRITE_EXTERNAL_STORAGE permission. Finally, it stores the invoice PDF file in the local device, allowing it to be sent to the house owner through the chatting function.

p) Client Record

The status of the quotations sent by the contractor can be checked on this page. The contractor can filter the status by "Accepted job" if the house owner has accepted the quotation and the job can be started, "Pending job" if the house owner has not yet replied, or "Declined job" if the house owner has rejected the quotation and job. The filter function can be implemented using the setQuery() function, which will compare the job status stored in Firebase.
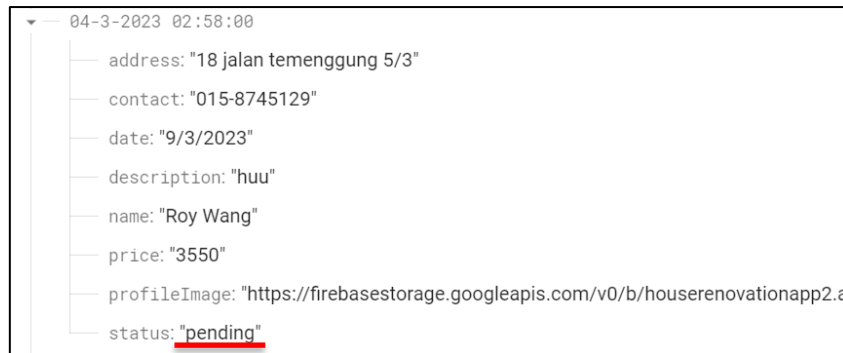
Figure 5.93: Job status store in Firebase

The contractors can also delete the unwanted records by using removeValue() method of DatabaseReference. This method removes the data at the specified database reference, including all child nodes.

q) Sales Report

On this page, contractors can have an overview of their business. They can filter the data by selecting a range of dates, for which they can use the DatePickerDialog feature. The total sales amount is calculated based on the completed jobs during the selected period. Additionally, the average ratings are displayed, which are calculated by dividing the total rating score by the count of the ratings. Feedback from the house owners is also shown in a RecyclerView.

To create a line chart in the contractor business page, the MPAndroidChart library can be used. The x-axis of the graph can represent the date of sales, and the y-axis can represent the amount of sales. The color, label, and pattern of the line graph can be customized based on the developer's preferences. The chart can be updated dynamically by retrieving data from Firebase and setting it to the chart's dataset. This will allow the contractor to visualize their business's performance over time and make informed decisions about their business strategy.

5.7 Implementation Issues and Challenges

The development of this application presents some challenges that must be overcome. Firstly, it requires a significant amount of time to learn and understand the different functions and methods provided by Firebase. To achieve this, it must rely on the Firebase documentation and various tutorials available on platforms such as YouTube to make the learning process more effective. Furthermore, another challenge encountered during the development process was the slow response time of the emulator in Android Studio. Registering a new user, for example, could take more than an hour to complete. It slows down the entire development process because testing is required after each feature is completed to ensure the function works properly. Therefore, the application is run on my telephone instead of an emulator in Android Studio. As a solution, the application was run on a mobile device using the HiSuite application on a Huawei phone.

In addition, there were challenges in implementing the AR furniture feature due to the complexity of 3D modelling. As a beginner, creating a 3D furniture model from scratch required a significant amount of time and effort. The Blender interface was also overwhelming with its numerous buttons, menus, and panels, making it difficult to navigate efficiently. Additionally, Blender uses many keyboard shortcuts to perform various functions, which can be difficult to memorize at first. As a result, extensive practice and dedication were necessary to become proficient with the software and successfully implement the AR furniture feature in the application.

Furthermore, incorporating the Google Sceneform Tools plugins into Android Studio proved challenging as it repeatedly failed to do so. Therefore, alternative methods had to be implemented to work with 3D assets created using Blender. This was a time-consuming task, as most available resources used these plugins to implement AR features in Android Studio applications. However, by implementing the relevant library, the AR feature could still be achieved. To implement the AR feature in this project, trial and error was necessary to find the most suitable methods. Different approaches were attempted and tested to determine which method worked best. This process involved a lot of experimentation, troubleshooting, and testing to ensure that the AR feature was functional and effective.

5.8 Conclusion

This chapter provides an overview of the hardware and software used in the project, as well as the setup and configuration of the necessary software components. Additionally, it details each of the features created for the project and the challenges faced during the implementation.

Chapter 6

System Evaluation and Discussion

6.1 System Testing

In this section, various test cases will be executed to ensure that the application runs smoothly and as per the requirements.

6.1.1 Login module

Test case module: Login Module unit testing

Test description: To test the outcome of different email and password inputs

Table 6.1: Unit testing for login module

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1	Test a valid email and password Email: jiaearn31@gmail.com password: 123456	Data stored in Firebase Authentication	Login successfully and direct to the next page.	If you are a new user, you will be directed to create a new profile, while existing users will be navigated to the home page.	Pass

| 2 | Test a valid email but invalid password. | Data stored in Firebase Authentication | Show an error message. | The user will be prompted to enter the correct password by displaying an error message such as 'Enter the correct password'. | Pass |
| 3 | Test an invalid email and password. | Data stored in Firebase Authentication | Show an error message. | The system will show 'no user data found' | Pass |

6.1.2 Choose User type Module

Test case module: Choose user type unit testing

Test description: To test the outcome when the user type is chosen versus when it is not chosen.

Table 6.2: Unit testing for choose user type

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	A new user who has already chosen their user type in 'Choose user type' page.	Data store in Firebase Realtime Database (user ID > User Type)	Redirected to the user profile setup page.	Users can navigate to the "User Profile Setup" page to create their profile.	Pass

2.	A new user who has not choose the user type in 'Choose user type' page.	Data store in Firebase Realtime Database (user ID > User Type)	Redirect to the 'choose user type' page.	Users cannot create the profile unless they choose the user type in 'User Type' page.	Pass

6.1.3 User Profile Module

Test case module: user profile unit testing.

Test description: To test the outcome of different input to create the user profile.

Table 6.3: Unit testing for user profile

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	Input all the required details to set up the profile.	-	Successfully create the user profile and redirect the user to the home page.	Successfully create the user profile and redirect the user to the home page.	Pass
2.	Enter a user name or company name which is less than 5 characters.	-	Show an error message.	The system will display the error message 'Please enter a valid user name'	Pass
3.	The city in the drop-down menu was not selected.	-	Show an error message.	The system will display the error message 'Please select the city'.	Pass

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
4.	The user profile image is not selected.	-	Show an error message.	The system will display the error message 'Please select an image.	Pass

6.1.4 Service Request Module

Test case module: Service request questionnaire unit testing.

Test description: To test the outcome of different input to request quotation.

Table 6.4: Unit testing for service request module

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	Input all the required details to request the quotation from the service provider.	-	Successfully request the quotation from the service provider.	Successfully request the quotation from the service provider.	Pass
2.	Did not provide an answer for the single-choice question.	-	Show an error message.	The system will display the error message 'Please select the answer.'	Pass
3.	Did not provide the appointment date using the date picker.	-	Show an error message.	The system will display the error message 'Please select the date'.	Pass

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
4.	Did not upload an image of the house part that requires the job to be done.	-	Show an error message.	The system will display the error message 'Please select an image.	Pass

6.1.5 View Contractor Module

Test case module: Contractor's comment and rating unit testing.

Test description: To test the outcome of different input to give the rating and comment to the contractor.

Table 6.5: Unit testing for view contractor module

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	Input all the required details to give the rating and comment.	-	Successfully submit the rating and comments.	Successfully submit the rating and comments.	Pass
2.	Did not provide the rating by using the rating bar.	-	Show an error message.	The system will display the error message 'Please provide the rating.'	Pass
3.	Did not provide the comment in the text box.	-	Show an error message.	The system will display the error message 'Please enter the comment'.	Pass

6.1.6 View Products and Furniture Module

Test case module: AR furniture unit testing

Test description: To test the AR feature of each of the furniture

Table 6.6: Unit testing for AR feature

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	View the AR furniture which have the 3D model.	-	User can place the AR furniture in their real environment.	User can place the AR furniture in their real environment.	Pass
2.	View the AR furniture which does not have the 3D model.	-	Show an alert message.	The system will display the error message 'This model does not have 3D view.'	Pass
3.	View the AR furniture using a mobile phone that does not support the AR feature	-	Show an error message.	The system will display the error message 'Fail to create AR session'.	Pass

6.1.7 History Module

Test case module: Button selection unit testing in history module.

Test description: To test the result of selecting a specific button or option.

Table 6.7: Unit testing for history module

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	Click on the 'Accept' button.	Data (status) store in the Firebase Realtime Database.	The 'Complete' button will be shown and the 'Decline' button will be invisible.	The 'Complete' button will be shown and the 'Decline' button will be invisible.	Pass
2.	Click on the 'Decline' button.	Data (status) store in the Firebase Realtime Database.	The 'Accept' button will be invisible.	The 'Accept' button will be invisible.	Pass
3.	Click on the 'Complete' button.	Data (status) store in the Firebase Realtime Database.	The 'Complete' button will be invisible.	The 'Complete' button will be invisible.	Pass

6.1.8 Chat Module

Test case module: Chat module unit testing

Test description: To test the input of the user in the chatting room.

Table 6.8: Unit testing for Chat Module

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	User enter the message and click submit button.	-	The message is sent successfully.	The message is sent successfully and shown in the chat box.	Pass
2.	User did not enter the message and click submit button.	-	Show an error message.	The system will display the error message 'Please enter the message'	Pass

6.1.9 View Request Module in Service Provider Interface

Test case module: View request module unit testing

Test description: To test the status of the 'Send Quotation' button after a particular action.

Table 6.9: Unit testing for View Request Module

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	Not yet click on the 'Send Quotation button'	Data in the Firebase Real Time Database to	The quotation can be created and sent.	The quotation can be created and sent.	Pass

		indicate whether the quotation has already been sent or not.				
2.	Already click 'Send Quotation' button before this.	Data in the Firebase Real Time Database to indicate whether the quotation has already been sent or not.	The 'Send Quotation' button in unable to click.	The 'Send Quotation' button in unable to click. Therefore, the contractor cannot send duplicate quotation to the same user.	Pass

6.1.10 Create Quotation Module

Test case module: Create quotation unit testing

Test description: To test the outcome of different input to create the quotation.

Table 6.10: Unit testing for Create Quotation Module

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	Input all the required details to create the quotation.	-	The quotation created successfully.	The quotation created successfully and store in user local device.	Pass

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
2.	Did not provide the necessary details to create the quotation.	-	Show and error message.	The system will display the error message 'Please enter the details'	Pass

6.1.11 Create Invoice Module

Test case module: Create invoice unit testing

Test description: To test the outcome of different input to create the invoice.

Table 6.11: Unit testing for Create Invoice Module

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	Input all the required details to create the invoice.	-	The invoice created successfully.	The invoice created successfully and store in user local device.	Pass
2.	Did not provide the necessary details to create the invoice.	-	Show and error message.	The system will display the error message 'Please enter the details'	Pass

6.1.12 Sales Report Module

Test case module: Sales report unit testing

Test description: To test the sales report displays the correct information for a given time period.

Table 6.12: Unit testing for Sales Report Module

Test Set No.	Step Description	Data Utilized	Expected Result	Actual Result	Pass/Fail
1.	Select a date range (28.03.2023 to 03.04.2023) that has sales data.	Data (sales record) stored in the Firebase Real Time Database.	Display a summary of 3 transactions with a total sale of RM 12500.	Display a summary of 3 transactions with a total sale of RM 12500 and display the relevant line graph.	Pass
2.	Select a date range (after 03.04.2023) that do not have sales data.	Data (sales record) stored in the Firebase Real Time Database.	Display a summary of 0 transactions with a total sale of RM 0.	Display a summary of 0 transactions with a total sale of RM 0 and do not display any line graph.	Pass

6.2 Project Challenges

A major challenge of this project was the need to develop the application from scratch. To ensure that the final product meets the needs and expectations of both house owners and service providers, extensive research was conducted to identify the main features required from both perspectives. In addition, it was necessary to know the basic price for each renovation work, because the system will calculate the price of the service provider for reference.

Another challenge in the development process is to ensure real-time communication between service providers and the homeowner. This was particularly difficult because of the need to synchronize messages and accurately display them in the chat box. Nonetheless, various techniques were employed to ensure that the chat feature was functional and user-friendly.

Furthermore, a lack of resources, such as a suitable mobile phone capable of running the AR features is one of the challenges of this project. The AR Core used to develop the AR feature is only compatible with specific devices, making it difficult to test and demonstrate the AR functionality of the application. In order to solve this problem, I had to search different mobile device that supports AR Core to ensure that the AR functions can be developed and tested correctly on the device. In addition to the challenge of finding a suitable equipment to run AR functions, another problem has emerged in the implementation process. The AR feature caused Android Studio to run out of memory and resulted in lagging, which made it difficult to develop the remaining incomplete features. As a result, alternative solutions to solve this problem have been explored.

6.3 Objective Evaluation

1. To develop a mobile application to enhance user's house renovation and remodeling experience.

    The application has successfully achieved this objective by providing users with various modules to enhance the experience of house renovation and remodeling. With the ability to find reliable service providers according to the region, house owners can easily find suitable contractors in a short time. In addition, users can check the feedback from other house owners to determine the reliability of a particular service provider, thus providing a more precise decision-making process. They no need compare one by one by browsing through multiple tabs. The AR function of the application provides users with a new experience, which enables them to virtually place furniture in the real space, thus saving time and money and making the renovation process more enjoyable. Therefore, it can be said that this objective has been achieved very well.

2. To allows real-time interaction between users and service providers

    The request quotation module, view request module, chat room module, view history module, and client module in this application enable real-time interaction between house owners and service providers. The seamless exchange of data, including the synchronization of job status and secure messaging capabilities, allows for convenient and transparent communication between the two parties. The record-keeping aspect of the data exchange helps prevent misunderstandings, making the real-time interaction smoother and error-free. Therefore, it can be concluded that this objective has been successfully achieved.

3. To save the time of the users in house renovation process

    This objective has been successfully achieved as users no longer have to spend time comparing quotation prices among multiple service providers. Instead, they can simply request for a quotation and wait for responses from the service providers. The interface allows them to easily compare the different quotations and select the most reliable service provider. The AR feature also saves time as users no longer have to physically go to furniture stores to find furniture that suits their house. They can simply use the AR feature to visualize the furniture in their space and make a purchase with just one

click. This significantly reduces the time and effort needed for such tasks, making the user experience more convenient and efficient.

4. **To promote the business of service providers to the public and increase their sales**

This objective has been successfully achieved through the service provider interface available in this application. Service providers can easily view requests from potential customers and give a quotation if they are confident in handling the job. They do not need to wait for customers to come to them but can actively approach them through the application. Additionally, service providers can manage their clients easily within one interface, allowing them to focus more on their business rather than handling administrative tasks. Overall, this feature helps service providers increase their sales and exposure to the public.

Chapter 7

Conclusion and Recommendation

7.1 Conclusion

The main goal of this project is to improve the experience of house decoration by enabling house owners to quickly find suitable service providers. This is achieved by collecting all the requests from house owners and allowing service providers to offer quotations. The key feature of the project is the real-time communication ability between the service provider and the house owner, which helps to make decisions smoothly and in time. By simplifying the process of selecting a service provider, the project aims to make house renovation a more pleasant and stress-free experience for homeowners.

The completed application meets the needs of customers by allowing house owners to obtain their desired services and products with a single click while providing service providers with a new platform to advertise their businesses to the wider public. By connecting house owners and service providers on a platform, the application has achieved its goal, and it can be easily completed by using an application on a smartphone. Therefore, both house owners and service providers can enjoy a simpler and more efficient process of house renovation.

Besides, the application aims to contribute to the renovation industry in Malaysia by providing a convenient platform and service for all house owners. The platform provides equal opportunities for all service provider companies, regardless of their size, to promote their businesses or services and acquire new customers. One of the key benefits of this application is that free to use for all service providers, eliminating the need for expensive advertising methods such as social media ads, billboards, or broadcast advertising. This not only lowers business costs but also promotes to a fair and competitive market for service providers, resulting in better services and products for the house owners. Looking ahead, the application may completely change the renovation industry in Malaysia by providing a centralized platform for all stakeholders.

7.2 Limitation

Throughout the development process of House Renovation Service Application, there exists some limitations and issues. Firstly, one of the main limitations was the limited number of 3D models available for AR furniture which only applicable for some furniture. In addition, the AR technology used in this application does not allow the placement of AR wall cabinets, because it is difficult to track the wall area to place furniture on it.

Another issue identified was the lack of push notifications to alert users when they receive messages. This feature is not able to complete in this project timeline. This mean that users require to manually check the application to see if they received any new message from others. This will cause inconvenient and time-consuming, especially if the user is waiting for an emergency reply for others.

Furthermore, one of the limitations of this application is that it does not allow service providers to manually upload their furniture or products to sells in this application. Instead, users must rely on the developers' help to accomplish this. This is because developing a new module for this feature will require additional time and resources. By enabling service providers to upload their own products, they would gain more control over their products and be able to alter information about their products, such as the pricing and description, without needing developer assistance.

Lastly, this application does not have the payment method which allow the user check out their products from their cart directly. Due to time restrictions, this was not included in the current release; nevertheless, it is advised that this feature be included in subsequent versions to improve user experience.

7.3 Future Recommendation

Based on the limitations that discussed above, some recommendation is provided for future development. Firstly, more 3D models can be created for the AR furniture. It can help improve the user experience by providing a wider range of 3D furniture. With more 3D models to choose from, users will be able to visualize their home renovation job more accurately and in more

detail. This can also attract more service providers to join the platform, because they will have more 3D models to display their products.

Secondly, it can implement the push notification in the future development. Push notifications can greatly enhance the user experience and make the software more practical if they are included in future development. Users can be reminded of some important events, for example receiving a new message or the job status. This can reduce the frequency of users to check for application updates, saving their time and increase the overall satisfaction. Additionally, push notifications could reduce the chance of incorrect or delayed communication between the house owner and service providers.

Next, the recommendation for future development is develop the upload products module in service provider interface. Service providers will be able to manually upload their products and provide essential details like price and description via this module. By enabling service providers to manage their own product lists, this will save time and effort for service provider and the developer. Additionally, it will provide service providers more control over their own products and enable them to edit their listings as necessary. Customers and service providers will eventually enjoy a better experience as a result of this.

Lastly, it is recommended to have the payment function in this application. This would allow users to directly pay for their shopping cart within the app, as well as pay for any invoices provided by the service provider. The application might provide customers a more smooth and convenient experience by including a payment function, removing the need for users to leave the app in order to make payments. It could help service providers get payments more quickly and effectively by automating the payment process for them. Without a payment method, users may need to contact the service provider separately to arrange for payment, which could result in delays and inconvenience for both parties.

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APPENDIX

Figure a: Java file created in Android studio (Total 119 files)
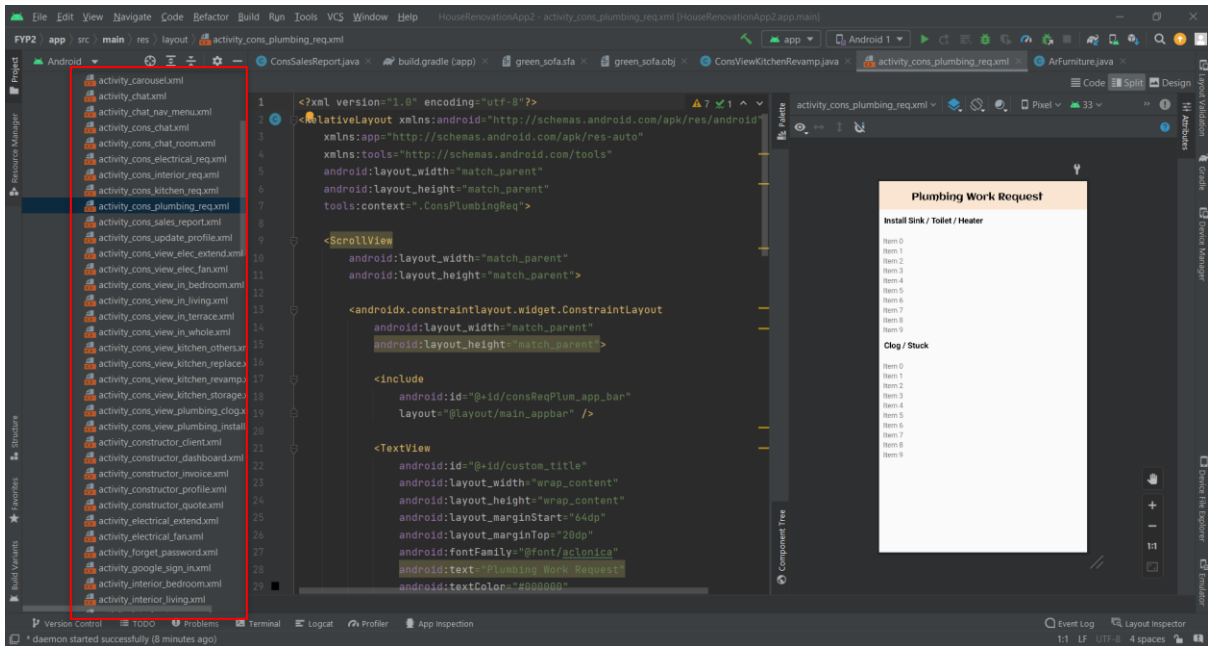
Figure b: xml file created in Android studio (Total 109 files)
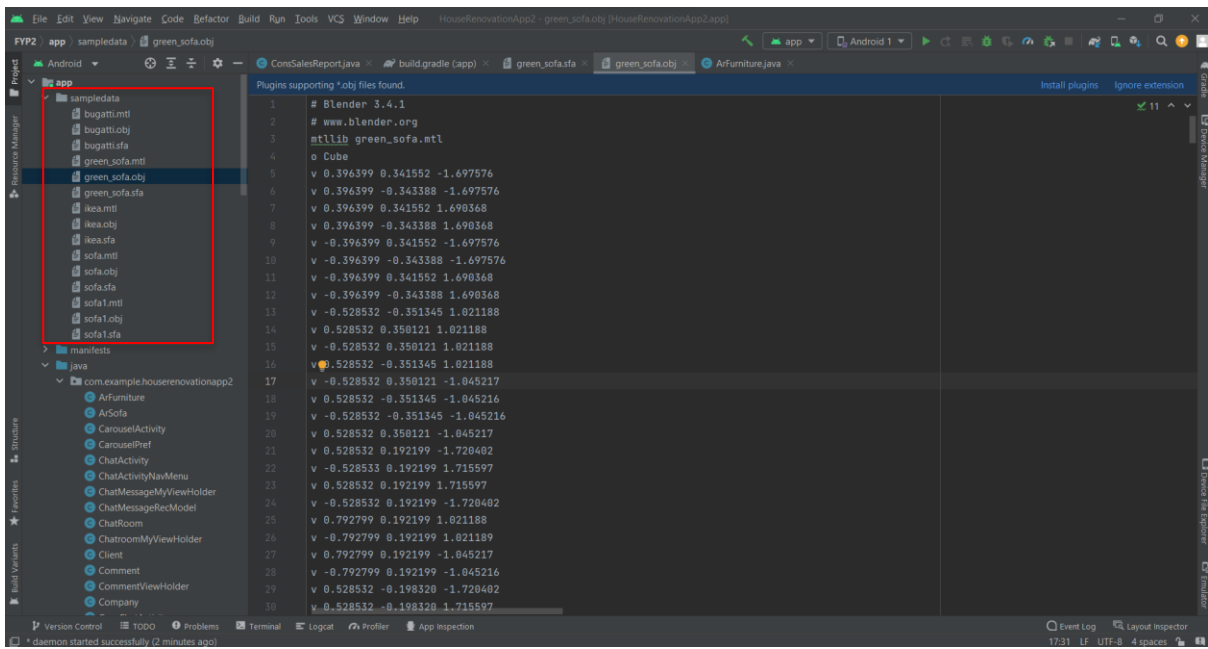
Figure c: The obj file import to Android Studio
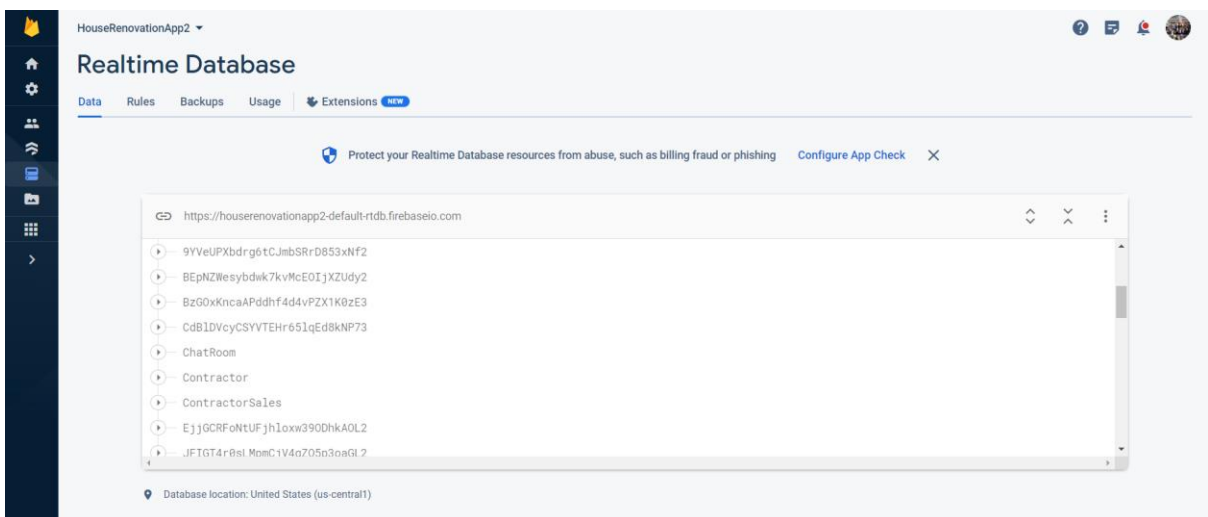
Figure d: Firebase Realtime Database console
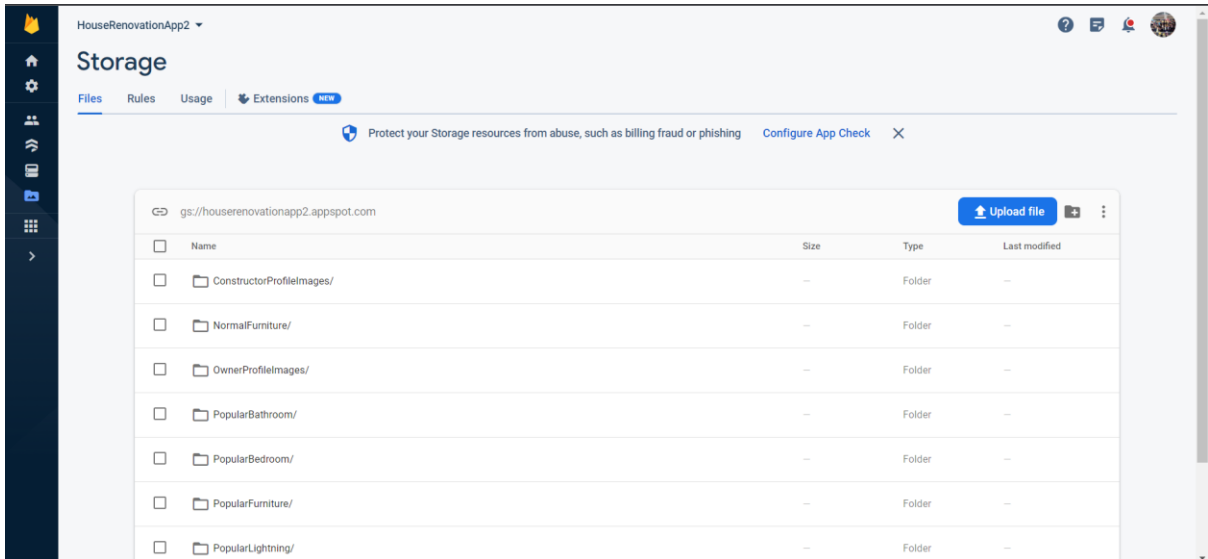
Figure e: Firebase Storage Database console
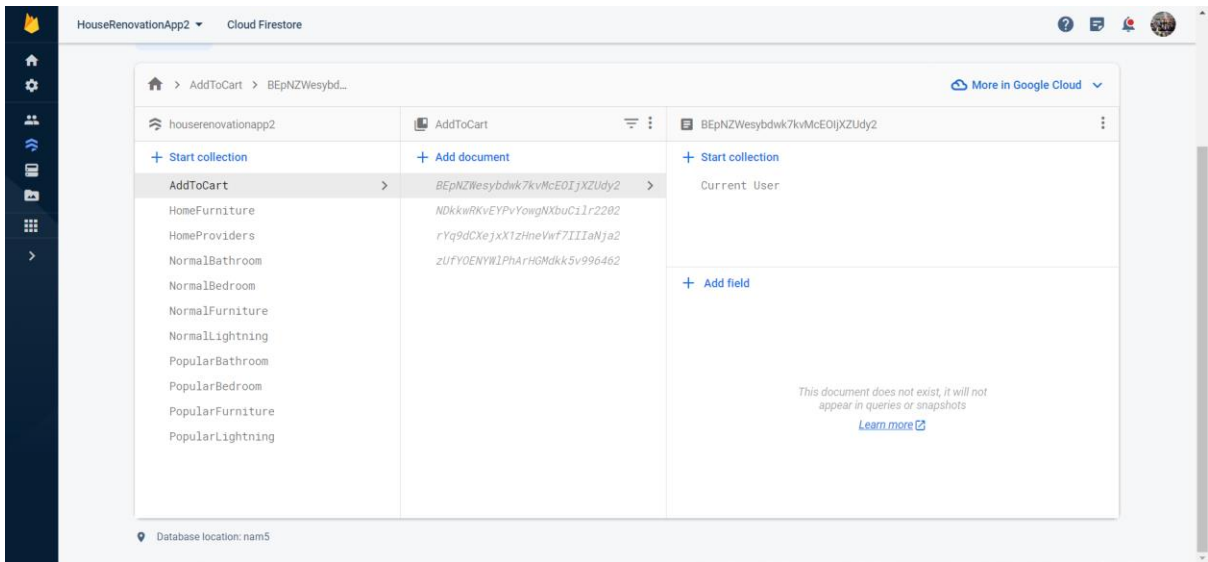
Figure f: Firebase Cloud Firestore Database console

Figure g: Firebase Authentication Database console
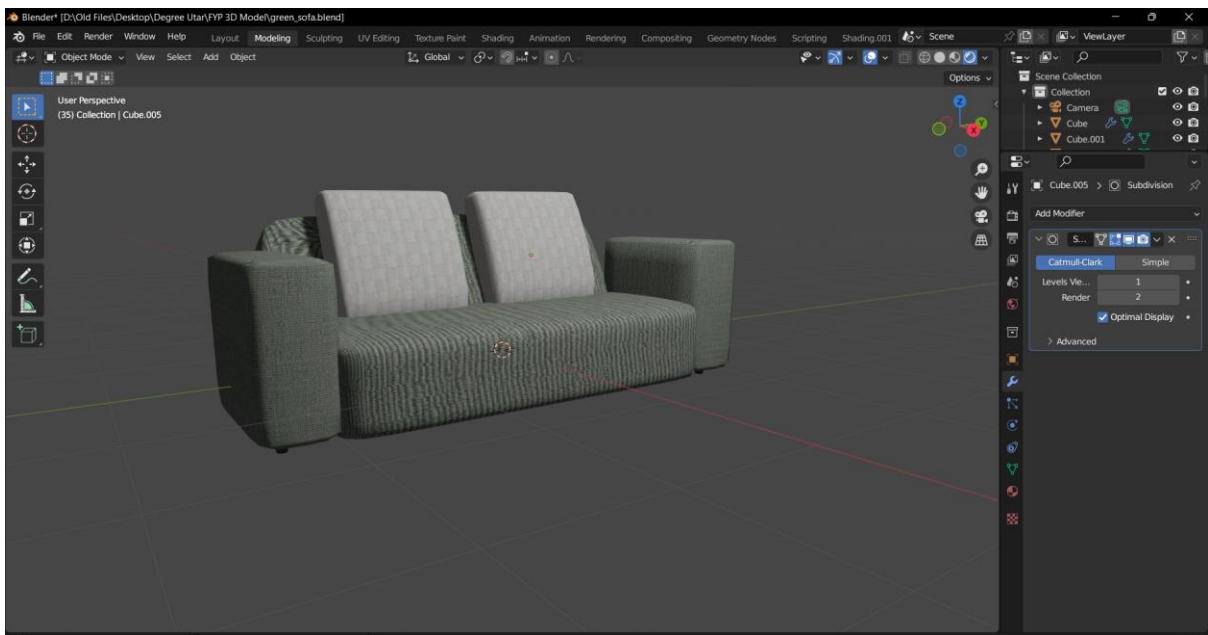
Figure h: Sofa 3D model created in Blender
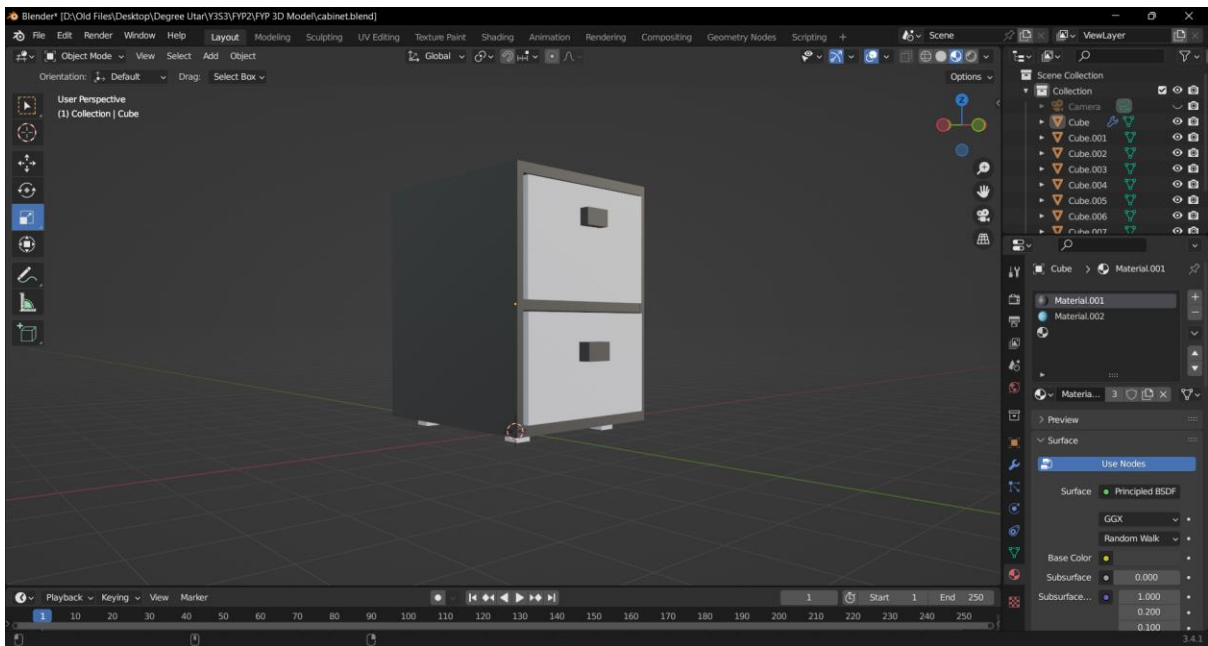
Figure i: Small cabinet 3D model created in Blender

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	Study week no.: W2
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

1. WORK DONE

- Develop the Create Quotation module
  - UI design of this module
  - Firebase set up
  - Auto-fill the based price

2. WORK TO BE DONE
- Complete the Quotation module

3. PROBLEMS ENCOUNTERED
- Hard to develop the auto-filled feature to fill in the client details.

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

_____ _____

Supervisor's signature Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	Study week no.: W3
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

1. WORK DONE

- Complete the Quotation module
  - Auto-fill the client details
  - Create the PDF file function
  - Store in the local storage of the user's device
- Complete the Invoice module

2. WORK TO BE DONE
- Develop the Client module in the service provider interface.

3. PROBLEMS ENCOUNTERED
- No problem encountered

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

_____   _____

Supervisor's signature   Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	**Study week no.: W4**
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

---

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

- Develop the Create Quotation module
  - UI design of this module
  - Firebase set up
  - Auto-fill the based price

2. WORK TO BE DONE

- Complete the Quotation module

3. PROBLEMS ENCOUNTERED

- Hard to develop the auto-filled feature to fill in the client details.

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

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Supervisor's signature

_____
Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	**Study week no.: W5**
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

1. WORK DONE

- Client module
    - UI design of client module
    - Show the client list from the Firebase
- Sales report UI design

2. WORK TO BE DONE
- Continue to develop the client module
    - Filtering feature
    - Data verification
- Continue to develop sales report feature

3. PROBLEMS ENCOUNTERED
- No problem encountered

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	Study week no.: W6
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

1. WORK DONE

- Complete client module with filtering
- Sales report
  - Apply filter function by date

2. WORK TO BE DONE
- Develop the graph of the sales report
- Chat function in both house owner and service provider interface

3. PROBLEMS ENCOUNTERED
- The graph cannot show the desired output, need to try other methods to implement the graph function.

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

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Supervisor's signature

_____
Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	**Study week no.: W7**
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

---

1. WORK DONE

- Complete the graph feature in sales report.
- Store the message send by the user in Firebase based on their user ID.

2. WORK TO BE DONE
- Continue to develop the chat room module.
  - Display the message that send by both house owner and service provider.
  - Enable the send file function

3. PROBLEMS ENCOUNTERED
- The synchronization message is hard to implement

4. SELF EVALUATION OF THE PROGRESS

- A little bit delays due to the problems encountered when develop the chat room function.

_____

Supervisor's signature   Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	**Study week no.: W8**
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

1. WORK DONE

- Complete chat room module and the send file function
- Enable the download function of the PDF file.

2. WORK TO BE DONE

- Modify the UI design of the View Contractor module in house owner interface.
  - Rating and comment function
  - Show the rating and the comment
- AR furniture feature

3. PROBLEMS ENCOUNTERED

- No problem encountered

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

_____   _____

Supervisor's signature   Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	**Study week no.: W9**
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

1. WORK DONE

- Complete the View Contractor module in house owner interface.

2. WORK TO BE DONE

- AR furniture feature
- History module in house owner interface

3. PROBLEMS ENCOUNTERED

- Unable to use the AR Core function in my mobile device, need to lend other device to test the AR furniture.

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

_____ _____

Supervisor's signature   Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	**Study week no.: W10**
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

---

1. WORK DONE

- Client module
  - Show all the reply from the service provider with the quotation price.

2. WORK TO BE DONE
- AR furniture feature
- Complete the client module
  - Filtering by the service provided

3. PROBLEMS ENCOUNTERED
- No encounter any problem

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

_____   _____

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: Y3S3	**Study week no.: W11**
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

1. WORK DONE

- Complete the AR furniture feature
- Complete the client module

2. WORK TO BE DONE

- Test the application
- Write FYP2 report

3. PROBLEMS ENCOUNTERED

- No encounter any problem

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

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Supervisor's signature   Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	**Study week no.: W12**
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

1. WORK DONE

- Test all the module and function in this application

2. WORK TO BE DONE

- Write FYP2 report

3. PROBLEMS ENCOUNTERED

- No encounter any problem

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

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Supervisor's signature   Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S3	**Study week no.: W13**
Student Name & ID: JEE JIA EARN (19ACB01752)	
Supervisor: DR SHADHILA BINTI CHE LAH	
Project Title: HOUSE RENOVATION SERVICE APPLICATION	

---

1. WORK DONE

- Complete FYP2 report and submit it.

2. WORK TO BE DONE

3. PROBLEMS ENCOUNTERED
- No encounter any problem

4. SELF EVALUATION OF THE PROGRESS

- Progressing as planned in the project.

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Supervisor's signature   Student's signature

POSTER

FACULTY OF INFORMATION COMMUNICATION AND TECHNOLOGY

House Renovation Service Application

Project Developer: Jee Jia Earn   Supervisor: Dr Syadhila Binti Che Lah

INTRODUCTION

This house renovation service application is mainly to provide a platform to house owner to find the suitable contractor and desired furniture in a short time.

OBJECTIVE

- To allows real-time interaction between users and service providers.
- To provide user friendly, convenient House Renovation Service Application.

METHODOLOGY

01 Using of firebase which is useful to manage large amount of data and allow the real-time interaction between house owner and service provider.

02 Using AR technology to allow the house owner have a better view on the desired furniture.

RESULTS

House Owner can find the desired service provider in a short time. Besides, house owner is able to interact with the service provider in real-time.

WHY THE PROPOSED APPLICATION IN THIS PROJECT IS BETTER THAN THE EXISTING APPLICATION?

- Faster and easier to use - User friendly and clean UI design.
- Safer database - Only authenticate user can see the specific data store in the firebase.
- Interesting features - Allow users have a AR experience when using this application.

CONCLUSION

This application can allow real-time interaction between house owner and service provide that can save the time of house owner who need to find the service provdier one by one physically or online.

Home

Renovation

PLAGIARISM CHECK RESULT

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_____   _____
  Signature of Supervisor   Signature of Co-Supervisor

 Name: Dr Syadhila Binti Che Lah   Name: _____

 Date: 27.04.2023_____   Date: _____

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UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY
(KAMPAR CAMPUS)
CHECKLIST FOR FYP2 THESIS SUBMISSION

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Student Name	JEE JIA EARN
Supervisor Name	DR SYADHILA BINTI CHE LAH

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