PET ADOPTION AND RE-HOME MOBILE APPLICATION

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UNIVERSITI TUNKU ABDUL RAHMAN

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A project report submitted in partial fulfilment of the requirements for the award of Bachelor of Science Software Engineering with Honours

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Universiti Tunku Abdul Rahman

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DECLARATION

I hereby declare that this project report is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at UTAR or other institutions.

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APPROVAL FOR SUBMISSION

I certify that this project report entitled **"TITLE TO BE THE SAME AS FRONT COVER, CAPITAL LETTER, BOLD"** was prepared by **FONG YIP KEAN** has met the required standard for submission in partial fulfilment of the requirements for the award of Bachelor of Software Engineering with Honours at Universiti Tunku Abdul Rahman.

Approved by,

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Supervisor : Mohammad Babrdel Bonab

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Date : ____________________

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ABSTRACT

The "Pawfect Home" mobile application was developed to address the pressing need for a streamlined platform dedicated to pet adoption and re-homing. This mobile application prioritizes a user-centric design, ensuring a seamless user interface and experience, complemented by reliable functionality. The key features such as the ability to create and manage adoption listings, share awareness of missing pets, and conduct location-based searches for available pets. Additionally, users can view veterinary services nearby and initiate direct communication with pet owners through the application. The location calculation and detection were dependent on the Google Map API implemented. Moreover, email verification and email domain verification were implemented into the mobile application. To further enhance disposable email domain detection, MailChecker.ai API was implemented to prevent registration of disposable email. The project's development was underpinned by the prototype methodology, which allowed for iterative design, feedback incorporation, and continuous refinement of the application's features and functionalities. Testing methodologies, such as unit and integration testing, further validated the application's functionality and user experience. Furthermore, User Acceptance Testing including SUS and UI Usability test was conducted and the system was evaluated by the users and obtained the recommendations and feedbacks verbally or via the feedback form. While the project was envisioned as a non-profit tool, the final product demonstration was restricted to showcasing its functionality without real pet data due to time constraints.

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CHAPTER 1

INTRODUCTION

1.1 General Introduction

Pet adoption is a heartwarming process that connects pets in need of a loving home with potential adopters. However, finding the perfect pet to fit one's lifestyle and needs can often be a daunting task.

To address this issue, a mobile application was designed to simplify the adoption process by connecting pet owners with potential adopters. This report outlines the design, implementation, and evaluation of the Pet Adoption Application. The report details the various issues that were identified during the development process and how they were addressed using different design principles. The report also highlights the application's functionalities, including critical use cases, and the development tools that were used. The report concludes by summarizing the project's success in enhancing the user interface and user experience, as well as outlining areas for future work to further improve the application's functionality and user experience. In this project, the mobile application’s name will be Pawfect Home.

1.2 Problem Statement

A good and well-functioning mobile application for pet adoption can play a role in helping to solve stray animals problem and bring positive impact to the pet adoption related sections in Malaysia. However, the pet adoption mobile applications available on the market (Play Store) are not attractive and useful enough to encourage the users or the pet owners to use the mobile application. After downloading them and use them, it could be due to the several problems listed below.

1. **Poor User Interface and User Experience**
2. **Poor functionality and reliability**
3. **Lack of safe and effective communication channel**

Ignoring these problems will cause stray animals problem become crucial and more animals will be threatened. The stray animals in Malaysia is a problem and has become a challenge for animal shelters as the animal shelters are struggling in providing adequate food and protection for the stray animals. Since the Covid-19 pandemic started, there has been 60% increased in rescue call for stray dogs. Many of the stray dogs are abandoned by their owners (Fazaniza, E. 2021). It's not just about adoption, without properly addressing the Re-Home needs, the pet could be ended up being dumped at the street and become one of the stray animals too. People in the modern society now are spending a significant amount of their time on digital devices, including their smart phone. Hence, Mobile application have become a go-to solution to develop a functional and ease of use pet adoption platform.

Therefore, it is crucial to develop a mobile application that addresses these issues and provides a seamless experience to users.

1.2.1 Poor User Interface and User Experience

UI and UX both aimed to provide a good experience for the user, with distinct differences between them. While UI dealt with the graphical look of the mobile application, UX focused on how all the UI elements worked together to create a seamless user experience (Software Development Academy, 2020). A well-designed UI was crucial for any mobile application, as it played a key role in retaining users.

Regrettably, the user Interface (UI) and user experience (UX) of the pet adoption mobile application were often poorly designed and challenging to navigate. This led to low user engagement and potential frustration. Research indicated that a poorly designed UI could cause 77% of users to stop using an application. Moreover, it could result in decreased revenue, productivity, and increased overall development costs. There were many potential reasons for mobile application failure, and subpar UI/UX design was a significant factor (zahabia,2020).

After comparing and researching similar mobile applications, it was observed that many existing adoption mobile applications had poorly designed user interfaces, making navigation difficult for users. Common issues with the UI/UX for adoption mobile applications available on the market included:

- Too few pets displayed on the screen.
- The interface is messy.
- Random advertising on the interface
- Less responsive UI
- Clunky register form
- Information overload
- Low contrast

1.2.1.1 Proposed approach solution

To develop a mobile application with an effective user interface (UI) and user experience (UX), the project adopted the prototyping approach during the design phase and sought user feedback during the implementation stage.

Prototyping involved creating a visual representation of the mobile application's UI design and refining it. This was done quickly and cost-effectively, allowing for changes and improvements before finalizing the design (UXPin, n.d.). The prototype did not involve coding but focused on the visual aspects.

On the other hand, user feedback was essential for testing the UI and UX. Feedback from users was analysed and incorporated into the project, serving as a key factor in enhancing the UI and UX (Forbes, 2018). The goal was to enhance user satisfaction by improving usability, accessibility, and the overall interaction between the user and the product (Yazid, M. A., & Jantan, A. H. ,2017).

Table 1. 1: Table indicating UI/UX issues

UI/UX issues	**When does the issue occur**	**Why is it important to fix the problem**
Too few pets displayed on the screen.	When user is using the pet browsing page	The users may require more effort to browse through the pet browsing page.
Random advertising on the interface	When user is clicking on different pets, at the middle of two displayed pets.	The users may get frustrated or annoyed due to the random ads.
Less responsive UI	When user is clicking on buttons and clickable section.	The users may not know if they clicked on the button or the application is responsive if the UI doesn't show some response.

Clunky register form	When user is trying to register.	The users may confuse due to the badly designed register form.
Information overload	When user is surfing the pet profile.	The user may confuse due to too much information in a page without proper aligning.
Low contrast	When user is using the mobile application, the theme are low in contrast.	The user may find it hard to read and understand the info or may confuse on how to conduct the operation

1.2.2 Poor functionality and reliability

We cannot make a mobile application that is completely bug-free, but we should strive to make the mobile application consistent and usable. It is crucial to ensure that the mobile application's performance is consistent; otherwise, the mobile application will not retain users and will fail quickly (Kalei, 2021).

Unfortunately, the current performance of the pet adoption mobile application is inconsistent and sometimes becomes unusable. Additionally, some functions are not working well. These problems can lead to user frustration and cause them to abandon the mobile application. After researching the pet adopting mobile application, some of the issues are:

- Not functioning search function
- The application was not functioning.
- Not using location to locate user.

The issues caused frustration and decreased engagement among users. This may result in users being unable to find or list pets effectively, potentially leading to missed adoption opportunities. Fixing the problems will improve user satisfaction and engagement, and ultimately causing the success of the mobile application by facilitating smooth and successful pet adoptions.

1.2.2.1 Proposed approach solution

To address the prevalent issues of poor functionality and reliability, the project incorporated user testing. Alpha testing is the initial round of testing a new product or software solution undergoes. Its primary focus is on identifying any potential issues, bugs, or mistakes before the final product's delivery (airfocus, n.d.). By implementing alpha testing, defects were identified during the development stage. This ensured that the functions worked as intended and that the mobile application was reliable.

Table 1. 2: Functionality/reliability issue

Functionality / Reliability issue	When does the issue occur	Why is it important to fix the problem
Not functioning search and filter function	When user is using the search bar, the result displayed is incorrect. For example: user searched “cat” but the result displayed is dog.	The user may not get the result they want and increased adoption difficulty.
The application was not functioning	When user open the mobile application, the mobile application showed nothing but the error exception.	The user may not be able to use the mobile application to adopt pets.
Not reliable location function	The app does not locate or returning inaccurate location of the user	The user may require more effort to look for suitable pet for adopt because they need to check the location when they are looking for pets.

1.2.3 Lack of safe and effective communication channel

Ideal pet adoption mobile applications should provide a platform for pet owners and potential adopters to communicate effectively and transparently about the adoption and re-Home process. By having a good communication channel would enable pet owners to find suitable adopters who can provide a safe and loving home for their pet, while also allowing adopters to make informed decisions about adopting a pet.

However, the current reality is that many pet adoption mobile applications lack a safe and effective communication system between pet owners and adopters. This can result in frustration for both parties, as they struggle to exchange essential information about the pet. Without a reliable and efficient communication channel, pet owners may miss out on potential adopters who could provide a loving home for their pet, while adopters may end up adopting a pet that is not a good match for their lifestyle and needs.

Furthermore, the current mobile application only provided phone number and email directly to the user who is not verified to contact with the pet owners which will also result privacy problem too. According to Hammouchi (2019), after analysing 9000 data breaches made public since 2005, it led to the loss of 11.5 billion individual records which have a significant financial and technical impact.

Ignoring this problem could lead to missed opportunities, where pets could end up in the pet shelter because the adopter may be frustrated to due to the difficulties to communicate with the pet owners and privacy of pet owners. Therefore, there is a critical need to improve the communication system in pet adoption mobile applications to ensure that pet owners and adopters can communicate seamlessly and efficiently.

1.2.3.1 Proposed approach solution

To address the communication channel's inefficiencies, the project integrated a WhatsApp function. Users could click on the WhatsApp button, and the mobile application redirected them to a WhatsApp conversation with the pet owner. Additionally, both pet owners and users were required to have verified emails. When a user clicked the email button, the application directed them to their email application, with the send email box pre-filled with the pet owner's email address.

1.3 Aim and Objectives

1. To construct a visually appealing and user-friendly interface that will make it easy for users to navigate the application and find the information they need.
2. To implement a fully functionable and reliable pet adoption and re-Home mobile application.
3. To verify that the pet adoption and re-Home application meets all necessary requirements and specifications, including functionality and user friendly.

1.4 Scope and Limitation of the Study

The project aimed to develop a pet adoption mobile application with a focus on a good user interface and experience, reliable functionality, and usability testing.

Firstly, the UI and UX of the mobile application were designed to enable users to navigate and interact with minimal errors. Secondly, the mobile application allowed pet owners to create and manage adoption listings and re-Home listings. Owners of missing pets could upload their pet's photos to raise awareness among other users. Lastly, the application enabled users to search for available pets for adoption. Pets available for adoption were sorted based on the user's location. Users could also search for pets by type and locate nearby vets through the mobile application. They could then contact the pet's owner for adoption directly via the app. The project's scope included:

1. Developing a codeless prototype.

2. Designing and developing the application, which encompassed both front-end and back-end development, as well as database management.
3. Implementing a user testing process to ensure the application's functionality and usability.
4. Delivering a functional pet adoption mobile application.

The study had several limitations: limited resources, ethical considerations, a restricted sample size, and limited data availability.

Firstly, resources for developing the mobile application, such as funding and time, were limited. The project's primary goal was to develop a basic, fully functional, and usable mobile application that met all stated objectives. Advanced features might not have been developed due to time constraints.

Secondly, the sample size was limited, which was a consequence of the project's 6-month duration, with only 3 months allocated for the development stage. The number of participants available to test the mobile application was restricted.

Ethical considerations also posed a limitation. There were concerns about impulse buying of pets and adopting pets with malicious intent. To mitigate this, the mobile application excluded a buying function, focusing only on adoption and re-homing. However, there was always a risk that individuals might adopt pets for the wrong reasons. While the application aimed to connect pets with caring homes, it was difficult to ensure the intentions of every adopter. Some barriers were implemented to prevent impulsive adoptions and those with ill intentions.

Additionally, the project did not account for business constraints and operated under the assumption of being a non-profit pet adoption mobile application.

Lastly, data availability was limited. The final product demonstration did not include any real pet data, as the project's scope was to develop a functional and user-friendly mobile application within the given time frame.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Pet ownership is becoming more popular, with millions of homes throughout the world keeping at least one pet. However, numerous pets wind up in shelters and require adoption. To solve this issue, mobile applications that assist the adoption process have been created. These apps seek to match pet owners wishing to re-home their pets with potential adopters looking for a new pet.

While there are several pet adoption mobile applications available, their usefulness, user experience, and reliability vary tremendously. Some applications are difficult to use, while others lack a safe communication system between pet owners and adopters. Furthermore, there are ethical problems surrounding pet adoption, such as impulse buying and adopting with unethical intentions.

This literature review aims to explore the current state of pet adoption mobile applications, their strengths and weaknesses, and the potential for improvement. The review will examine existing research on pet adoption mobile applications, including their features, usability, and impact on pet adoption rates. Furthermore, the review will explore the limitations and ethical considerations associated with these applications and potential solutions to address these issues.

Overall, this literature review aims to provide insights into the current state of pet adoption mobile applications and identify opportunities for improvement to facilitate the pet adoption process and increase the likelihood of successful pet adoption.

2.2 Background

The pet adoption industry is a multi-billion-dollar industry that continues to grow rapidly. According to Bernama (2020), pets adopted by human since they were born often lack of survival skills and will be challenging for them to survive without human taking care of them. Hence, pet adopter should be considered carefully whether they are ready to take care their pets until the last second of its life because dumping pets on the streets is irresponsible. The abandoned pets may starve, become ill, or being killed by the predators of accidents.

According to Bernama (2020), the dumping of pets has tripled around Kuala Lumpur after the Movement Control Order (MCO), and the animal shelters will be unable handle and take care all pets if there are more people started to dump their pets there. Furthermore, another problem arises and needed for the attention of the society is the anime abuse cases have increased by 30%.

With the rise of pet ownership, there has been an increase in the number of pets that need to be adopted or re-homed. This led to the need of a platform that allow pet adoption and re-home process to be easy to practice. Hence, the development of a quality mobile applications that can connect pet owners with potential adopters is needed.

With the advancement of the smartphone technology, mobile application has been developed to simplify the whole adoption and re-Home process by allowing the pet owners to create and manage the pet listing on adoption and re-home to expose their pets to the potential adopters.

2.3 User Interface (UI) and User Experience (UX) discussion

According to Galitz, W. O. (2007), The visual and interactive aspects of an application with which users interact are referred to as User Interface (UI), whereas the total experience that users receive when using an application is referred to as User Experience (UX). The importance of UI and UX in deciding the success or failure of software programmes cannot be overstated. A well-designed UI and UX may make an application easy to use, easy to understand, and is enjoyable to use for users, good UI and UX will be resulting in greater user satisfaction and engagement. In the other hand, a badly designed UI and UX, can cause user frustration, confusion, and dissatisfaction, which is causing low adoption rates and the application may being rated negatively.

Furthermore, trust can be a major factor of the success of a mobile application. In the context of e-commerce systems, the user's trust is largely influenced by the design of the UI and UX. According to Helander et al. (2001), a well-designed UI and UX can increase the user's confidence in an e-commerce system. This can be achieved by following design principles such as providing clear and concise information about the product or service being offered and using consistent design patterns that are easily recognisable to the user. By implementing such design principles, users are more likely to trust the system and therefore engage with it more positively.

According to Galitz, W. O. (2007), the paper discussed the widely adopted design principles by outlining the most cited design principle. The adoption rate was measured in centrality degree which ranged from 0 to 1 in the paper. The result shown in the Table 2. 1. Please note that the table only included the top ten design principle in terms of popularity was used from the paper.

Table 2. 1: Top 10 design principles

No.	Design Principle	Centrality degree
1	Offer information feedback	0.81
2	Strive for consistency	0.56
3	Simple and natural dialog	0.5
4	Know the user	0.5
5	Minimize the user’s memory load	0.5
6	Actions should be reversible	0.5
7	Prevent errors	0.5
8	Give user control	0.44
9	Make things visible	0.44
10	Structure the User’s Interface	0.38

Mobile application will be used as the context to interpret and explain Table 2.1. As mentioned in the table, offer information feedback refers to providing information to user to let them know about the outcome of their action or the current state of the system. The design principle can help user to understand what is happening to the mobile application to let them make decision. The feedback can be visual cues, sounds, or text messages. Allowing the user feels that they are controlling the application is crucial.

Strive for consistency means the design of the mobile application should be consistent where the design elements should be similar for the whole mobile application to allow the user to understand the mobile application easily. Consistency will help the user learn to use the mobile application in a short time and reduce the error the user may make.

Furthermore, simple, and natural dialog refers to the interaction between the user and the mobile application should be as simple as possible. The simple refers to languages used in the application. The texts and terms used in the application should avoid using technical terms and emphasize plain and simple languages to allow the user to understand the instructions and feedback clearly to minimize the error.

The next design principle is knowing the user. The design principle simply refers to understand your target audience’s preferences and needs. By understanding the user, designer can create the UI and UX that are tailored with the preferences and needs of the target audience which will leads to higher satisfaction and better performance.

Moreover, minimize the user's memory load is one of the crucial design principles that promotes reducing the amount of information that are needed to remember by the user. The main objective of this design principle is to avoid letting user depending on their short-term memory too much to perform tasks on the mobile application.

In addition, actions should be reversible means the action done by the user should always be able to revert. For example, if user clicked on the report the adoption listing, there must be a back button to allow user to undo the action as the users could clicked on the button accidentally or the users might just want to test the function out.

Prevent errors is another crucial factor for any mobile application development. The error done by the users when doing certain action should be minimized by keeping the UI easy to use. If the user is keep making mistakes, it may lead to frustration and even safety hazard in some cases. In the mobile application scope, validation of the input field should be put into the consideration too.

Additionally, give users control is mentioned in the table 2.1. The design principle indicates that the mobile application should give as much control as possible to the user. For example, customize the settings, choose between different options, and perform actions in the way the users want.

Another crucial design principle is making things visible. The design principle simply refers to always make the relevant information visible to the users. It means always make the interface easy to navigate with all the relevant information readily available to navigate by the users.

Finally, structure the user's Interface refers to the design of the mobile application should be always organized in a logical way. The goal of the design principle is to ensure the users can find what they want easily without having to guess by making the UI easy to understand and use.

The design principles studied can address the UI and UX issues identified in the previous chapter which are too few pets displayed on the screen, random advertising on the interface, less responsive UI, Clunky register form, Information overload, and Low contrast. The table 2.2 shows how each of the UI and UX problem related with the design principles.

Table 2. 2: UI/UX issue and how to address them

UI/UX Issue	**Design Principle**
Too few pets displayed on the screen	Make things visible
Random advertising on the interface	*Not applicable(Ads will be removed)*
Less responsive UI	Offer information feedback
Clunky register form	Simple and natural dialog
Information overload	Structure the user's interface
Low contrast	Structure the user's interface

Overall, the UI and UX design is crucial for any software development process. A badly designed UI and UX will highly affect the user’s satisfaction and the success rate of their actions. Hence, the UI and UX will highly be considered in this project.

2.4 Reasons of buying and selling pets are discouraged.

2.4.1 Commercial breeding

The pet industry has seen a surge in demand for specific pet types and the demand had led to a rise of commercial breeding, and many of them are unlicensed and unethical. A newspaper article “Unlicensed breeders hide operations” written by MUTHIAH (2023), highlighted the grim reality of the breeding practices and the importance of adopting pets instead of buying them. One of the reasons is the terrible environment conditions in which the animals are being kept. In the newspaper article, the dogs rescued were found with matted hair and serve skin issues. It also mentioned that the animals are often kept in small spaces, with very limited or no medical care, and are subjected to continuous breeding cycles without paying attention for their well-being.

2.4.2 Overpopulation of stray animals

The exact count of stray dogs and cats in Malaysia remains uncertain, but estimates suggest there are around 6 million stray dogs and 5 million stray cats. These figures are notably high when compared to the number of pet dogs and cats owned in the nation (Munir et al., 2023). The overpopulation of stray animals will cause them being put to sleep when there is complain received by the local councils and it is not going to solve the problem in long term (Fazaniza, 2021). In addition, the nine local councils in the state will need to spend a total of RM 10.3 million a year to manage pounds, pay the dog catchers and put the stray animals to sleep.

2.4.3 Animal shelters.

As mentioned in the newspaper article (Fazaniza, 2021), there are a lot of peoples leaving their pet at the doorsteps of the animal shelters since the pandemic begun. The pet shelters are struggling to feed to animals due to the growing number of strays. In Selangor, three animal shelters are struggling to meet their monthly expenses for the operational costs of RM 12,000 to RM 16,000.

2.4.4 Act for animal welfare

The well-being of animals and their protection from abuse and neglect are referred to as animal welfare. The Animal Welfare Act is a piece of legislation that tries to protect animals in Malaysia from abuse of any kind. The pet breeders often touch the edge or stepped directly on the law, like mentioned at section 2.4.1.

2.4.4.1 Animals Act of 1953

According to Alvin W.L. (2013), the Animals Act of 1953 protects the animals from mistreatment in Malaysia. The law prohibits animal cruelty and prohibits the animal abusers to hurt, scare, or neglecting the animals. The defined animal cruelty in the Act includes not providing enough food and water for the animals, killing, and hurting them. Overall, this act is important to ensure the animals are treated well and no animals were mistreated.

However, the law was criticized for being weak and not offering enough of enforcement to protect the animals. Hence, the law was updated in 2015 and came out with the Animal Welfare Act 2015.

2.4.4.2 Animal Welfare Act 2015

According to SAFM (n.d.), The Animal Welfare Act 2015 Malaysia was gazetted in December 2015. The Act establishes the Animal Welfare Board and guarantees that animal welfare is protected while encouraging responsible pet ownership. The Act is a comprehensive law that establishes the norm for excellent animal care across Malaysia.

The Animal Welfare Act of 2015 forbids cruel acts against animals such as beating, torturing, ignoring, inflicting undue pain or suffering, cruelly confining animals, mutilating animals without veterinarian certification, and engaging in animal cruelty activities. Those who commit such crimes face fines ranging from RM 20,000 to RM 100,000, imprisonment for up to three years, or both. Certain acts, however, are not deemed offences under this act, such as established veterinarian management practises, baiting nuisance animals for public health, disease control, and population control, and feeding animals as food for other animals based on their natural eating patterns.

2.5 Existing animal adoption mobile applications

The demand of pet adoption is increasing due to the number of dumping pets had increased after the Movement Control Order (MCO) (Bernama, 2020). Hence, there are several mobile applications was developed to response to the demand. I had researched a few pets adoption mobile application available on the Google Play Store and analysed their functions, advantages, disadvantages, and what my personal experience as a user is. The pet adoption mobile applications are:

1. PetFinder
2. Adopt Me
3. Pet Adoption

The mobile applications mentioned share some general functions. The general functions include:

1. Register account
2. Login account
3. Adoption pet listing
4. Viewing pet profile

The pet adoption mobile applications have changed the pet adoption process by allowing the users to search and obtain the information of animals that need to be adopted easily and pet owner that wants to surrender their pet put their pet on adoption listing through their mobile devices. With these applications, the potential adopters can easily search for pets based on their preferences, location, and they contact owners directly to inquire about adoption if they wish to adopt the pet. The convenience provided by these applications has made the pet adoption process more accessible, encouraging the pet owner to surrender their pet to new home instead of dumping them on the street and making the pets to find their forever home easier.

2.5.1 PetFinder

Figure 2. 1: PetFinder Logo

PetFinder stands as Malaysia's premier pet adoption mobile application. Upon downloading and exploring its features, I discerned that PetFinder boasts a comprehensive range of functionalities, encompassing pet adoption listings, detailed pet profiles, and direct communication with pet owners. It's accessible across iOS, Android, and web platforms.

The app's adoption listing feature enables users to discover pets in their vicinity. If a particular pet piques their interest, they can delve deeper into the pet's profile, which provides extensive details such as age, gender, breed, health status, characteristics, adoption fee, location, a media gallery, and the date of listing. If users are inclined to adopt after perusing these details, they can effortlessly reach out to the pet owner via the contact feature.

Moreover, PetFinder extends a unique feature for pet owners to report and search for their missing pets, even allowing them to offer rewards. This section mirrors the adoption listing but is tailored for lost pets. The app also conveniently pinpoints nearby veterinary clinics based on the user's location and houses a dedicated section for blog posts centered on pet adoption and general pet knowledge.

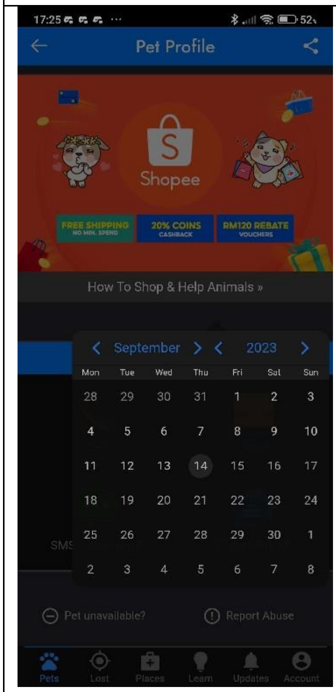
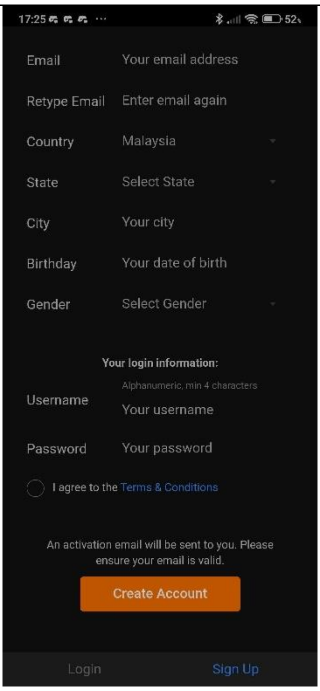
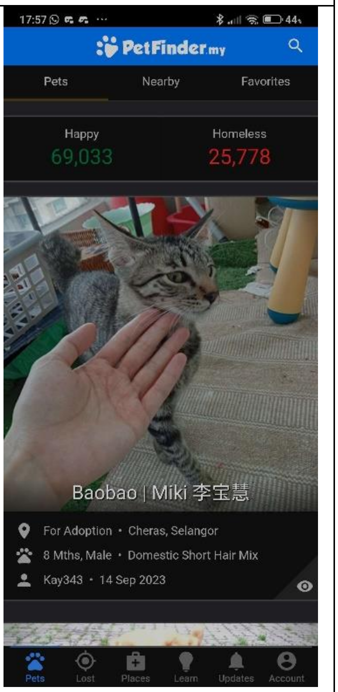
PetFinder's strengths lie in its robust functionality, seamless user experience, precise location tracking, and comprehensive information. Throughout my usage, the app proved reliable without any crashes or error prompts. Its location-based results were consistently accurate.

However, it's not without its flaws. The app is marred by sporadic ads and a somewhat cumbersome user interface, both of which can detract from the overall user experience. The ads, especially, were intrusive when browsing pet listings. The interface, while functional, lacks intuitive feedback and suffers from low contrast, making information retrieval more taxing. The pet listing view is particularly challenging to navigate as the dominant pet photos obscure much of the page, making it cumbersome to browse through available pets. The color scheme, predominantly black, grey, and blue, demands more cognitive effort from users.

A glaring security concern is the lack of email verification, posing potential risks to pets, prospective adopters, and pet owners alike. During the registration process, users can input any invalid or disposable email, and upon account creation, they can instantly access pet owners' phone numbers without any email verification.

To address these shortcomings in our upcoming pet adoption application, our project scope encompasses meticulous UI and UX design, minimizing obtrusive ads, enhancing color contrast for easier readability, and instituting a rigorous email verification system. Our primary objective is to offer a user-centric design that simplifies pet listing navigation and enhances the overall user experience.

Table 2. 3: PetFinder Screenshots

PetFinder screenshots		
 Figure 2. 2: Registration calendar bug	 Figure 2. 3: Alignment problems	 Figure 2. 4: Limited pet displayed at once

Mon	Tue	Wed	Thu	Fri	Sat	Sun
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	1
2	3	4	5	6	7	8

Email	Your email address
Retype Email	Enter email again
Country	Malaysia
State	Select State
City	Your city
Birthday	Your date of birth
Gender	Select Gender

Your login information:

Username	Alphanumeric, min 4 characters Your username
Password	Your password

○ I agree to the Terms & Conditions

An activation email will be sent to you. Please ensure your email is valid.

2.5.2 Pets Adoption

Figure 2. 5: Pet Adoption Logo

The Pet Adoption mobile application, accessible via the Google Play Store. It offers a streamlined method for users to explore potential pets for adoption. The app's design is user-friendly, making it easier for individuals to view available pets, complete with essential details like name, gender, description, and location. This user-centric design has made the initial stages of pet adoption simpler and more approachable.

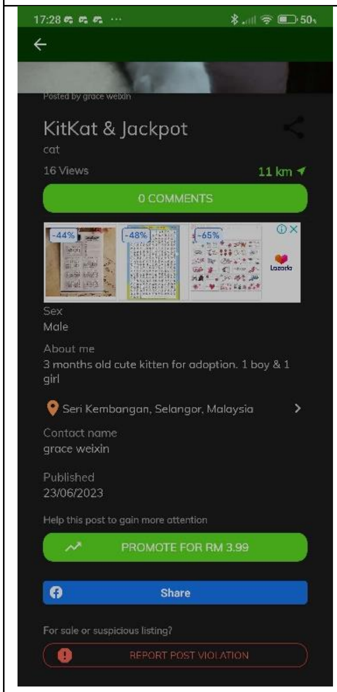
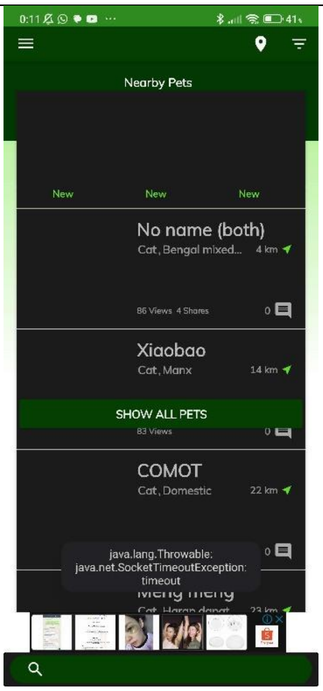
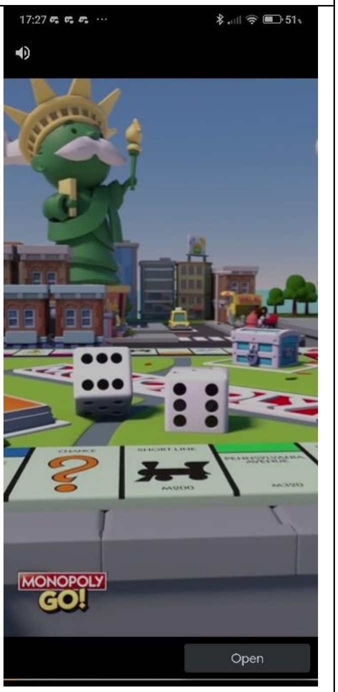
While the application boasts a user-friendly interface, it is not without its flaws. A significant issue is the intrusive advertisements that often hinder the user experience. These ads can be distracting, detracting from the app's primary purpose. Additionally, the app struggles with accurate location detection, sometimes misrepresenting the user's actual location. This flaw can lead to potential mismatches between pets and adopters based on geographical accessibility. Another limitation is the lack of distance restrictions, which can show users pets located outside their preferred adoption radius. The app's search and filter functions also leave much to be desired, making it difficult for users to refine their searches based on specific pet characteristics. Furthermore, pet descriptions within the app can be vague, requiring users to invest more effort to understand the pets they're considering. A significant concern is the app's lack of a user verification process, potentially compromising the privacy and safety of both pet adopters and owners.

To address these issues, Pawfect Home aims to provide an enhanced pet adoption experience. One of its primary goals is to remove disruptive ads, ensuring users have a smooth and focused adoption journey. Pawfect Home will emphasize consistent and reliable functionality, reducing the likelihood of errors or glitches. The app's UI and UX design will be a top priority, ensuring an intuitive and enjoyable user experience.

Security is paramount. "Pawfect Home" plans to introduce a comprehensive email verification process to enhance user safety. This process will validate email addresses, consider domain names, and use verification codes, ensuring the protection of personal information for all parties involved in the adoption process.

Lastly, "Pawfect Home" will cater exclusively to Malaysia, recognizing that pet adoption is primarily a local endeavor. By concentrating on a specific region, the app aims to offer more precise and localized pet adoption choices, ensuring users find pets within their immediate area.

Table 2. 4: Pet Adoption Screenshots

Pet Adoption screenshots		
 17:28 Posted by grace weixin KitKat & Jackpot cat 16 Views 11 km 0 COMMENTS -44% -48% -65% Lazada Sex Male About me 3 months old cute kitten for adoption. 1 boy & 1 girl Seri Kembangan, Selangor, Malaysia Contact name grace weixin Published 23/06/2023 Help this post to gain more attention PROMOTE FOR RM 3.99 Share For sale or suspicious listing? REPORT POST VIOLATION	 0:11 Nearby Pets New New New No name (both) Cat, Bengal mixed... 4 km 86 Views 4 Shares 0 Xiaobao Cat, Manx 14 km SHOW ALL PETS 83 Views 0 COMOT Cat, Domestic 22 km 0 java.lang.Throwable: java.net.SocketTimeoutException: timeout Meng meng Cat, Harga dapat 23 km	
Figure 2. 6: Spacing and alignment problems	Figure 2. 7: App error	Figure 2. 8: Intrusive ads

2.5.3 Adopt Me

Figure 2. 9: Adopt Me Logo

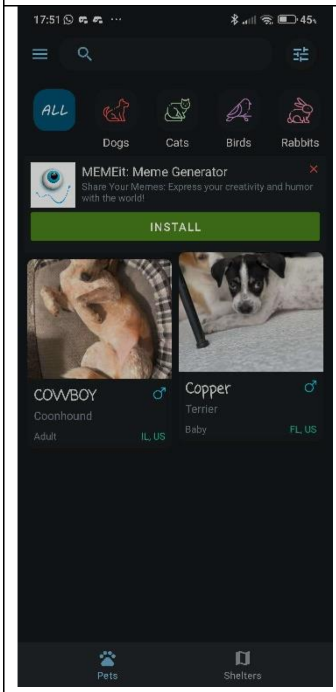
Adopt Me is a popular mobile application that focuses on pet adoption options in Canada and the United States. The app is available for Android devices and offers several functions that help users find their ideal pet. One of the key advantages of Adopt Me is its accurate categorization of pets, making it easier for users to search for specific breeds, ages, sizes, and colors. The search function is also detailed and easy to understand, with an intuitive filter that helps users narrow down their search results.

Users can view pet details, including breed, age, size, color, personality, and location, which are all clearly displayed on the app. The app also provides the date the listing was published and the pet's adoption status. The UI is well-designed and easy to use, with a clean layout that makes navigating the app a breeze. Additionally, the app includes well-designed display ads that are not intrusive or annoying.

However, one major disadvantage of Adopt Me is that it is only available for shelter adoption, limiting the pet adoption options available to users. The app also offers less functionality compared to other pet adoption apps, and users may encounter random pop-up ads.

To overcome these disadvantages, our app can offer more functionality, like PetFinder, and be open for everyone with account verification. We can also eliminate pop-up ads and provide a user-friendly interface for a better user experience. The app can provide various pet adoption options, including those from shelters, rescue organizations, and private individual.

Table 2. 5: Adopt me Screenshots

<table>
<tr><th colspan="3">Adopt me screenshots</th></tr>
<tr><td>

Share Your Memes: Express your creativity and humor with the world!

Figure 2. 10: Good interface design</td><td></td><td></td></tr>
</table>

2.6 Methodology discussed

According to (Pedamkar, n.d.), SDLC Methodologies are a standard procedure or method used by the software industry to develop an application using the software development life cycle (SDLC) process. These methodologies often contain phases which include planning, analysis, design, development, testing, implementation, and maintenance the software project. The software development methodologies improve the deliverable's quality in the software development process. There are different approaches available, and we select an appropriate methodology to implement into the project. Overall, the software methodology that contains instructions for creating an application as a component of software engineering that is used to create a software application. The methodologies we will discussing are waterfall mode, agile framework, and spiral mode.

2.6.1 Waterfall Model

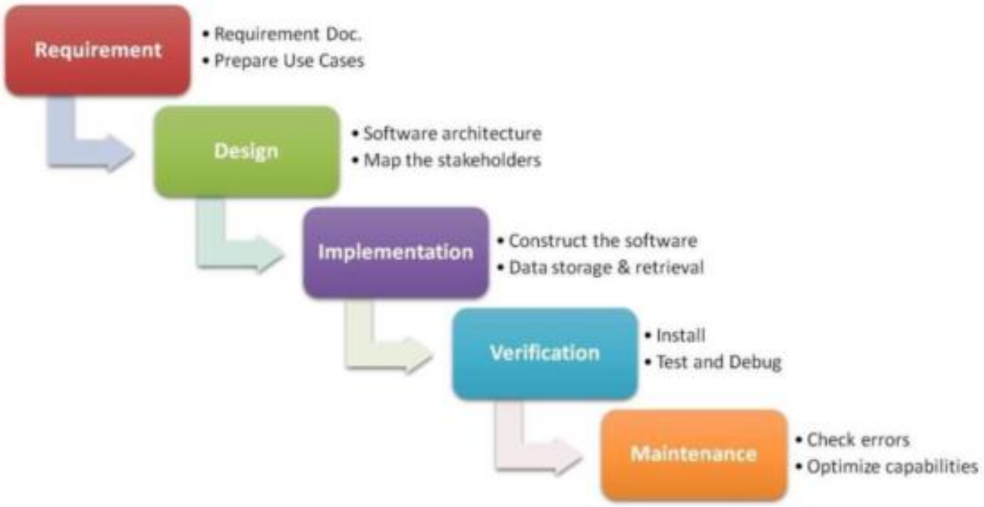


Figure 2. 11: Waterfall Model (UKEssays, 2018)

According to Shresth (2021), the waterfall model is a software development life cycle (SDLC) methodology used in the development of software projects. It is a systematic and extensively used software development approach that splits software development operations into predefined phases. The main idea behind this approach is that each step should be processed one by one in a predefined order. Overall, the waterfall model is a simple and straightforward technique.

2.6.1.1 Phases of the Waterfall Model

According to Powell-Morse (2016), the implementation of the waterfall model is straightforward in development projects due to its logical progression nature of the phases in the model itself. The basic concept behind this model is that all the stages should process one by one in a pre-defined sequence. However, it would be best if you kept in mind that the next phase should not begin before completing the previous one, and there should be no overlapping of the phases. That’s why this SDLC waterfall approach is also known as a linear-sequential life cycle model (Shresth, 2021). However, the main concept of each phase in the waterfall model is still retained despite the differences and the phases are as follows:

Requirement:

The initial stage where the software development project's requirements are defined and analysed to determine if they're appropriate. The identified requirements are documented in an Software Requirement Specification (SRS) document, serving as a basis for the entire development process.

Design:

The finalized SRS document is used to determine the technical requirements needed for software implementation, including software architecture designs, database schema designs, and programming languages/frameworks to be used. The outcome is a design specification.

Implementation:

Developers transform the requirements in the SRS document and design specification into actual source code.

Verification:

After coding, systematic testing takes place to ensure the software is free of bugs and meets the original requirements specified in the SRS document. The coding phase iterates until all bugs are fixed.

Maintenance:

After deployment, the software is maintained by the development team to fix errors, optimize or improve the software.

2.6.1.2 Advantages of the Waterfall Model

There are some signification advantages according to Powell-Morse (2016). The waterfall model allows the new developers who joined the project team adapt into the project quickly as the waterfall model allow then the understand the project efficiently in a time manner. This is because the waterfall model emphasize documentation in every stages.

Furthermore, the model is easy to implement and understand because of the linear progression nature of the stages in the waterfall model, each phase is straightforward and highly organised, with a set of clearly defined milestones essential to accomplish before advancing to the next phase.

In addition, the outcome of the project are clear and specific because all project requirements are identified and analysed at all phases. This approach ensures that client’s requirements are always satisfied and minimizes the risk of defect during the development cycles.

2.6.1.3 Disadvantages of the Waterfall Model

The waterfall model has some significant disadvantages that can cause problems in the software development life cycle. The first disadvantage is the model lacks adaptability and may require significant leaps backward to the previous stage or step if a fundamental flaw is discovered late in the cycle which will heavily impact the project’s schedule and budget.

Additionally, the model does not integrate mid-process user or client feedback and requires costly and time-consuming revisions. Testing is also delayed until later in the process, which may lead to late discovery of bugs or design issues and encourages poor coding practices.

2.6.2 Prototype Model

According to Sabale, R.G. and Dani, A.R. (2012), the Prototyping model is a software development model in which a prototype is developed, tested, and changed until it is acceptable. The model also builds the component parts for the final system or programme. The model is an iterative approach and trial-and-error process used by both the developer and the customer.

2.6.2.1 Phases of the Prototype Model

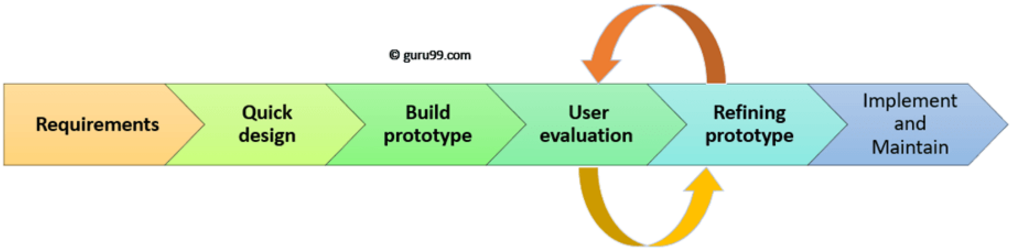


Figure 2. 12: Prototype Model (Matthew,2023)

Requirement Gathering:

The development team will engage with the customer at this stage to identify their needs and what they want the product to achieve. The development team will utilise meetings, interviews, and other types of communication to gather information and ensure that they have a comprehensive understanding of what the client wants.

Design:

Once the requirements have been gathered, the development team will create a quick design of the software. This design is not the final product, but rather a preliminary design that shows the client how the software will be developed.

Prototype:

Following the completion of the design, the development team will produce a software prototype. This prototype is a reduced version of the programme that enables the customer to observe how the criteria are being met. The prototype does not feature all of the final product's functionality, but rather gives a visual representation of the programme.

Customer Evaluation:

During this step, the customer will review the prototype. This assessment is required to evaluate the software's strengths and shortcomings as well as to determine whether any requirements were not effectively implemented. The comments from the customer will be used to develop the prototype in the following step.

Refined Prototype:

The development team will enhance the prototype depending on the client's comments throughout this phase. The original design will be utilised to make modifications, and the new design will be used to construct the prototype's next generation.

Final Product:

The actual development of the programme will commence after the customer is pleased with the final prototype. Based on the prototype, the development team will produce the final version of the programme. Before distributing the product to the customer, extensive testing will be performed to guarantee that all capabilities operate properly.

2.6.2.2 Advantages of the Prototype Model

The engagement of stakeholders or clients is critical in the system development process. They are crucial in assessing each prototype iteration and offering helpful comments. This partnership encourages significant engagement between developers and stakeholders, resulting in improved communication and stakeholder satisfaction. Furthermore, because created prototypes serve as an early visualisation of the system, problems may be detected early. This aids in the identification of any missing criteria and considerably decreases development risk.

2.6.2.3 Disadvantages of the Prototype Model

Prototyping is a popular software development strategy that entails creating iterative prototypes to get user input and modify the software design. Despite its advantages, this method has several drawbacks. One of the key disadvantages is that prototyping takes time since iterations must be built until stakeholders are pleased with the final version. Furthermore, the expense of prototype creation might be wasted because each prototype is abandoned after each iteration. The quality of development solutions may be jeopardised due to the necessity for developers to quickly produce the prototype. Finally, because client requirements are regularly adjusted or revised during the iterative process, a lack of precise or adequate project documentation is a worry.

2.6.3 Spiral model

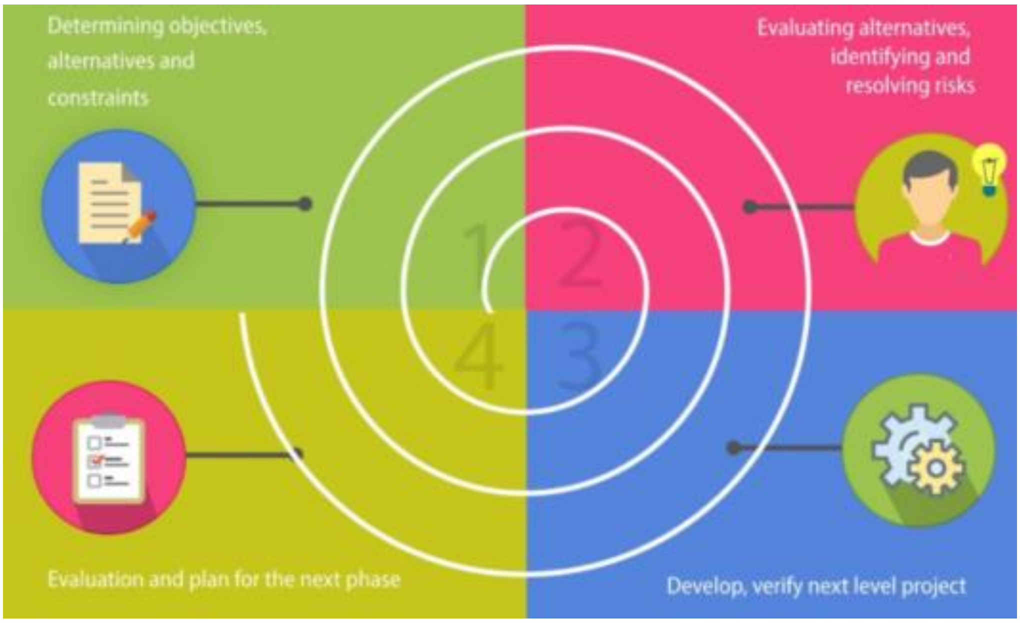

Determining objectives, alternatives and constraints
Evaluating alternatives, identifying and resolving risks
1
2
4
3
Evaluation and plan for the next phase
Develop, verify next level project

Figure 2. 13: Spiral Model (Techuz, 2018)

According to Alshamrani and Bahattab (2015), the spiral model is a way of making software that combines different ways of working. The spiral model helps to reduce the risk of error during the development phases by breaking the work into smaller parts so it is easier for checking. In a result, the problem is easier to identify. The main idea of spiral model is the development team starts with a simple plan and adds to the project over time. In addition, the new parts of the plan are being tested at each of the stages and the problem are immediately fixed once they are found, each of the new parts is known as a prototype. This method allows the team to learn from their mistakes and make changes as the project development process go.

2.6.3.1 Phases of Spiral Model

Planning Phase

This phase entails understanding the system requirements through ongoing contact between customers and system analysts. The major purpose of this phase is to establish the project's goals and objectives, the scope of the project, the limitations, and the stakeholders' requirements. After gathering the requirements, they are examined and a strategy for the following step is developed.

Risk Analysis Phase:

In this phase, the risks and the alternative solutions are identified. The development team will be conducting the risk assessments to identify and develops strategies to mitigate the risks. A prototype is produced at the end of this phase to evaluate the feasibility of the project.

Development Phase:

In this phase, the actual software is developed along with the testing. The requirements gathered in the planning phase will be implemented in this phase. The software is built in a series of iterations with each iteration will be adding more functionality.

Evaluation Phase:

This phase allows the customer to evaluate the output of the project before the project continues to the next spiral or next round. The project is evaluated based on the objectives set in the planning phase. If the project meets the objectives, it can proceed to the next spiral else it may require changes in the planning or risk analysis phase before proceeding.

2.6.3.2 Advantages of the Spiral Model

The spiral model has several advantages. The first advantage is that the spiral model involves extensive risk analysis. The extensive risk analysis significantly helps in identifying the potential issues early in the development process. In a result, the risks during the development stages are reduced sharply as the project progresses through each iteration or "spiral."

Furthermore, another benefit of the spiral model is that the development process requires the involvement of stakeholders. In each spiral, prototypes are provided which allows the stakeholders to verify the outcome and provide feedbacks for it.

Additionally, stakeholders are involved in the evaluation phase to assess the prototype before moving on to the next iteration. The spiral model is recommended for projects with constantly changing requirements since new functionalities can be added in the next iteration.

2.6.3.3 Disadvantages of the Spiral Model

However just like the other model, the spiral model also has some disadvantages. The spiral model can be costly to use, which caused the small-scale projects cannot adopt the model.

Additionally, the success of the project is heavily dependent on the quality of the risk assessment performed in the risk analysis phase. Lastly, it can be difficult to estimate the time required to complete the project as there is no set number of iterations or "spirals."

2.7 Comparison of the similar pet adoption mobile application

Note: Table 2.6 is based on personal experience

Table 2. 6: Comparison between PetFinder, Pet Adoption, Adopt me, and Pawfect Home

	PetFinder	Pets Adoption	Adopt me	Pawfect Home
Consistency of application	Yes. The mobile application works without any error message.	No. The mobile application will pop out exception message randomly.	Yes. The mobile application works without any error message.	Yes. The mobile application shall work without any error message.
Readable UI	Yes. The UI is decent and can be improved.	No. The UI is messy, barely readable, and requires effort to use	Yes. The UI is very good and can be used easily.	Yes. The UI shall be able to be used easily.
Good looking and user-friendly UI	No. The UI can be improved.	No. The UI must be improved.	Yes. The UI is good. It’s user friendly and easy to learn.	Yes. The UI shall be user friendly and easy to learn.
Satisfied UX	No, Random ads popped out	No, Random ads popped out	Overall experience is great.	Yes. The overall UX shall be satisfied by user
Overall complexity of the	High. The mobile application consists of	Low. The mobile application	Low. The mobile application	High. The mobile application consists of

mobile application	many functions.	consists little function.	consists little function.	many functions.
Functions provided (Scaled from 1 to 10)	8. The mobile application is rich in function	2. The mobile application is barely usable, and the function is less.	3. The mobile application is usable and good. However, the function is less.	7. The mobile application is rich in function

Table 2. 7: Comparison between PetFinder, Pet Adoption, Adopt me, and Pawfect Home (non bias)

	PetFinder	Pets Adoption	Adopt me	Pawfect Home
Accurate filtering function	Yes. The result of filtering is accurate.	No. The filtering function is not working at all.	Yes. The result of filtering is accurate.	Yes. The application shall provide accurate filtering result
Accurate Searching function	Yes. The result of searching is accurate.	No. The result of searching function is inaccurate.	Yes. The result of searching function is incredible. The use can search for animal breed.	Yes. The application shall provide accurate searching result
Location detection function	Yes. Location detection	Yes. Location detection function is	No. The application doesn’t	Yes. The application shall locate

	function is included.	included but not usable.	provide any location detection.	the user accurately
Communication channel between pet owner and adopter provided in the platform	Email. SMS, WhatsApp, phone call	Phone call, SMS	Location of the shelter	Email. SMS, WhatsApp, phone call
Random Ads	Yes	Yes	Yes	No. The application shall not include ads.

2.8 Definition of adoption and re-home in this project

2.8.1 Adoption

In the context of this project, "adoption" refers to the act of taking in and providing a permanent home for a stray animal, an animal from an animal shelter, or a newborn animal. Essentially, it involves giving a loving and permanent home to an animal that doesn't currently have one.

2.8.2 Re-home

On the other hand, "re-home" refers specifically to the situation where an owner decides to surrender their pet to a new home. This could be due to a variety of reasons, such as the owner being unable to care for the pet, moving to a location where pets are not allowed, or experiencing a change in life circumstances that makes it difficult to continue caring for the animal. In this case, the pet is not a stray or from an animal shelter, but rather is being re-homed from a previous home to a new one.

2.9 The importance of email verification

In the digital ages, data plays an important role fir the various businesses, from decision-making to shaping user experiences. According to Thompson (2023), The accuracy and legitimacy of the email addresses is one of the crucial factors of vulnerability of the data security ecosystem. An invalid email can not only compromise data integrity but expose the businesses' data security for risks, including data breaches, phishing onslaughts, and potential reputational damage (Email Hippo).

Thompson (2023) highlighted several key factors regarding the importance of email validation. Firstly, email validation plays a crucial role in protecting against potential vulnerabilities. By confirming the authenticity of a user's email addresses in datasets, it helps reduce data entry mistakes, ensuring data remains genuine. Additionally, it decreases the risk of data breaches, thereby protecting sensitive information. Beyond that, it's instrumental in detecting and preventing phishing attacks, which are becoming increasingly common in our digital world. Lastly, it aids in building a trustworthy data environment, which is essential for businesses in their decision-making processes.

Then, he also highlighted that invalid or inaccurate emails bring potential risk. Firstly, invalid email can result in data breaches, allowing unauthorized individuals access to confidential data. Furthermore, they can become the gateways for deceptive attacks such as phishing attack, targeting unsuspecting users. Additionally, the presence of such emails can damage an organization's reputation, undermining the trust and confidence gained by the clients and users. Lastly, the invalid email can lead to the wastage of resources, as businesses might make decisions based on flawed data or they need extra effort to filter out those invalid emails.

To Pursue of a Clean Database, email validation plays an important role in achieving this. Email verification prevents invalid entries of email, making certain that every data point is usable. Additionally, it verifies the existence of email addresses which making sure that the email is legitimate, guaranteeing that communications are directed to their intended recipients.

Protecting user data is one of the important criteria of this project. However, the data breaches are becoming alarmingly frequent in the digital era, email validation emerges as a guardian. It safeguards users' sensitive information by identifying and eliminating invalid or potentially harmful email addresses. As a result, only verified and legitimate email addresses can use the mobile application to contact the pet owners and reduce the risk of unauthorized entities gaining access to the sensitive information in the mobile application such as contact number.

In a nutshell, as the digital realm becomes increasingly data-centric, the importance of email validation in ensuring data security and integrity cannot be overstated. It stands as a critical tool in the arsenal of businesses and data providers, ensuring that they can operate in a secure and trustworthy environment. However, disposable email still exists to act as a temporary email so that the users are able to register without their personal email and it leads to another problem.

2.10 Impact of disposable email

The discussion of disposable email will be referring to the paper “Characterizing pixel tracking through the lens of disposable email services” written by Hu, Peng, and Wang (2019).

In this paper, Hu, Peng, and Wang (2019) conducted the study over three months, by monitoring more than 56,000 disposable email addresses under popular usernames. Their dataset comprised 2,332,544 incoming email messages from 210,373 online services and organizations.

First, let’s define what is disposable email. Disposable email is the temporary email addresses that offered to the users allowing them to register for online accounts without revealing or using their actual personal email addresses. These disposable email address services are designed to provide users with a short-term email address that automatically disposes of received emails after a certain period. Unlike traditional email services, disposable email services often maintain a public inbox, meaning any user can access any disposable email address at any given time and many of them are free to use.

Disposable will have a significant impact for security. The paper reveals several security implications associated with the use of disposable email services. The first security risk is account hijacking. Accounts registered with the disposable email addresses can be easily hijacked, it can lead to potential data leaks and financial losses for users. In addition, the hijacked account can be used to spam the other users on the platform.

Furthermore, most disposable email services maintain public inboxes, which means that any user can access any disposable email address at any time. It brought significant security risk as sensitive information, authentication codes, password resets, and other confidential data can be accessed by unintended parties.

Additionally, the study found that there's often a delay in disposing of incoming emails despite the service provide claims that the expiration time is short. The study found that some services retain emails for up to 30 days.

But why people use disposable email? The primary motivation behind using disposable email services, as highlighted in the paper, is the desire for privacy and the need to protect one's primary email address from spam, phishing attacks, and potential data breaches. By using disposable email addresses, users can register for online services without linking their activities with their own personal email to hide real identities. In addition, disposable email can avoid attracting spam emails to their personal email address. Users can protect themselves from potential attacks and redirecting such threats to their disposable email addresses.

For the security purpose, disposable email address was restricted and prevented from registering an account to protect the users from spam and security risk. For example, since pet adopters need to contact the pet owner for adoption, the pet owner’s contact number will be exposed. Hence, the barrier of email verification is a must to prevent spammers.

2.11 Development tool available

2.11.1 React native

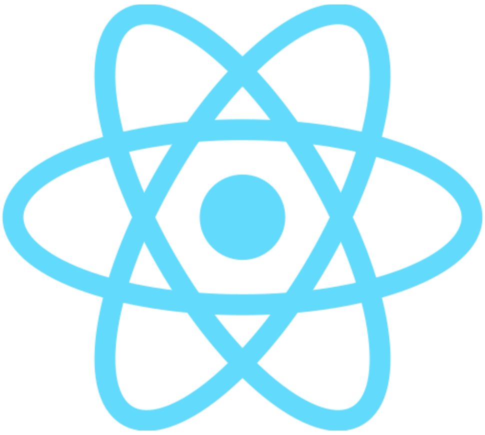


Figure 2. 14: React Native Logo (Rechienb, 2022)

According to Budziński, M. (2022), React Native is a popular JavaScript-based mobile app framework that allows the developer to build mobile application for various platform with the same code base.

React Native is an open-source mobile application framework created by Facebook that allows developers to build cross-platform (iOS and Android for mobile application) mobile applications easily and efficiently using the React JavaScript library. React Native is one of the leading mobile application development tools due to its convenience. React Native has gained popularity among developers due to its flexibility, performance, and ease of use. One of the major advantages of React Native is it allows the developers write the code once and deploy it to the multiple platforms, such as iOS, Android, and web, saving a lot of time and resources.

Furthermore, React Native saves a lot of time by offering hot reloading where the developers are allowed to view the output of the changes real time after they save the codes. Moreover, React Native provides many ready-made components to ease up the development process.

However, React Natives does come with the drawbacks of requires more expertise to ensure high performance, Steep learning curve, and long feature release time.

2.11.2 Flutter

Figure 2. 15: Flutter Logo

According to Perfecto (2021), Flutter is an open-source UI software development kit (SDK) for mobile application development created by Google. Similarly, Flutter allows mobile application developer to develop their cross-platform mobile application for iOS and Android using a single codebase. Unlike React Native, Flutter uses Dart, a modern, object-oriented programming language, to create apps are able to run on multiple platforms.

There are several advantages of Flutter. One of the advantages of using Flutter is that it provides hot reload feature that allows the developers instantly view the output of changes they make to the application code on the emulator or their own physical device. Hence, time and cost are saved with the quick reload function.

Furthermore, Flutter also provides a lot of customizable components that allows the developers do not need to code from scratch and make it easy to create good looking and responsive User Interface (UI). In addition, the widgets provided are customizable to match the expectation of the clients and developers.

However, there are also some disadvantages of using Flutter. Flutter is released since 2017 and it is a relatively new framework Since it is a relatively new framework, the popularity is still low so there may be some limitations in terms of community support and resources available compared to React Native.

CHAPTER 3

METHODOLOGY AND WORK PLAN

3.1 Introduction

Methodology and work plan are important components of any research project. The methodology outlines the approach that will be used to achieve the project objectives, while the work plan details the steps that will be taken to complete the project within the given timeline. The methodology and work plan ensure that the research project is conducted in a systematic and organized manner, which helps to ensure the reliability and validity of the results. The Resourced allocated is mentioned in table 3. 1.

Table 3. 1: Resources Allocation

Resources	Allocation
Personnel	The author himself gathered requirements, analyzed them, designed the mobile application, and developed it on his own. Suitable testers were involved in the testing phase to identify any potential defects in the mobile application.
Time	The entire project lasted for six months. The first three months were dedicated to the project preparatory stage, followed by three months for the development stage. During the development stage, the requirements identified in the preparatory stage were developed.
Costs	The project did not incur any monetary costs. All software used for the project was either open-source or freeware. Additionally, all required hardware was already available, eliminating the need for additional purchases.
Materials	The project utilized various software development tools, including IDEs like Visual Studio Code and an Android emulator. The software development framework chosen was React Native, and the database engine used was Firebase. API tools such as Flask, REST, Google Map API, and MailCheck.ai API were employed. For hardware, I used my laptop, monitors, and smartphone for testing purposes.

3.2 Collecting requirements

This section delved into the design considerations for the pet adoption mobile application. Adopting the perspective of an end user, it aimed to discern the essential requirements and functionalities that would enhance the user experience. The mobile applications considered for requirements collection included PetFinder, Pet Adoption, and Adopt Me.

The general functionalities observed are account registration and login, pet listing views, detailed pet descriptions, search and filter capabilities, and a reporting function for listings. Additionally, PetFinder offers unique features such as informative articles, displaying nearby veterinary clinics, and a page specifically built for posting missing pets.

Upon thorough exploration, several common challenges or disadvantages were identified across the three applications. Intrusive advertisements heavily disrupted the user experience. Certain elements of the UI and UX design required refinement. There were also concerns regarding insecure communication channels; due to the absence of account verification, users could access the pet owner’s phone number and email directly without an account or without a verified account. Specifically, the "Pet Adoption" application exhibited non-functional features, further diminishing its usability.

To address these identified limitations, it was decided that users must have a verified account to use the mobile application. This would maximize secure communication between users and pet owners without exposing the pet owner’s contact details to anyone with the mobile application. A built-in chat function was recommended for implementation to ensure complete safety. Verification mechanisms, including email verification, phone number verification, and email domain verification, were deemed essential to ensure the authenticity of users and pet listers. A refined UI and UX design, prioritizing user-friendliness and visual appeal, was also emphasized. Furthermore, the elimination of random and intrusive advertisements was seen as a significant enhancement to the user experience. Ensuring that all functionalities, especially the search and filter features, operated seamlessly and accurately was also deemed crucial.

After careful considerations, the general requirements for the new pet adoption mobile application, aimed at improving the currently available mobile applications, were identified as:

1. Phone number verification
2. Email verification
3. View pet listing with less effort.
4. Accurate searching and filtering function
5. Location service for more relevant pets displayed.
6. Built-in chat feature for safe communication channels
7. Verification of phone number and email before the adoption process is completed.
8. Visual appealing and user-friendly UI.
9. Eliminate intrusive advertisements.

However, there are always a gap between ideal and reality. The requirements listed can fix most of the problem of the existing pet adoption mobile application, if without any resource's consideration. The requirements will be analysed in the next section whether they are realistic with the resources available.

3.3 Analysis of the requirements

In this section, we analyse each of the requirements identified in the "Identify Requirements" section to determine their feasibility given the limited resources available for this project. The constraints for this project include limited personnel, a three-month development timeframe, a zero budget, and only the materials readily available.

Firstly, let's discuss phone number verification. In today's digital age, many major online service providers use SMS verification codes as either a primary or supplementary method for user identity verification. This is because phone numbers are often tied to a user's identity (Zhao, S., 2019). However, upon closer examination, this requirement appears unfeasible given our resource constraints. Specifically, the cost of implementing an SMS API surpasses our project's financial capacity. As illustrated by the pricing details from bulk SMS Malaysia (Appendix A), a mere 1000 messages cost over RM100.

Nevertheless, an alternative method for user verification is through email. This approach is feasible because a Personal Computer (PC) can function as a server to send verification emails. Moreover, email domain verification can utilize free API services, making this requirement implementable within our project.

Viewing a pet is similar to browsing a shopping item list. The primary distinction is that pets are up for adoption, not sale. Therefore, an intuitive user interface that minimizes reading effort while maximizing information conveyance is essential. Given our time constraints, the requirement to view pet listings efficiently is realistic and will be addressed within the UI and UX design, as discussed in Chapter 2.3.

The inclusion of a location service to display relevant pet listings is feasible when considering our time and budget constraints. This feature can leverage the free Google Maps API to obtain accurate user location data and match it with the pets' location data. Consequently, users will see nearby pets available for adoption, enhancing the app's relevance and convenience.

However, the built-in chat feature for secure communication is unrealistic due to time constraints. Creating such a feature is time-intensive. After consulting with the project supervisor, we decided against including this chat function.

The requirement to verify phone numbers and emails before finalizing the adoption process was also deemed unrealistic. Implementing this would necessitate an event scheduler, which our limited timeframe doesn't accommodate. Without an event scheduler, this feature becomes impractical. Hence, it won't be incorporated into the project.

The stipulation for an ad-free experience is easily achievable since our project doesn't have a commercial focus. Given that our primary concern is pet adoption, omitting ads aligns with our objectives.

In conclusion, most requirements identified for this project are realistic and achievable within our constraints. The project will prioritize general requirements like registration and login. Subsequently, emphasis will be placed on feasible requirements, such as a user-friendly UI, precise search and filter functions, and location-based pet listings. Moreover, the application will remain ad-free, reflecting our non-commercial approach.

3.4 Methodology used

3.4.1 Prototype Model

The development project selected the prototype model as its methodology. This model includes several steps such as gathering requirements, designing, iterating through constructing a prototype, evaluating it with customers, refining the prototype, and ultimately implementing the final product.

3.4.1.1 First Iteration:

In the first iteration, the focus was on designing the front end of the pet adoption mobile application. This iteration involved creating a user-friendly interface to enhance the user experience. The user interface included all the pages. During the first iteration, the team created low-fidelity designs for the application. The design was crafted carefully to ensure it met the project's requirements. Once the design was completed, it was presented to the tester for feedback and approval.

Prototype Design:

In this stage, the design of all user interfaces was created based on the requirements gathered from the previous stage. The design and prototype were crafted in Figma.

Prototype Development:

After the design was finalized, the project moved on to coding the front-end using React Native. This included creating all the user interfaces, implementing basic functionality such as interaction between pages, and integrating design components.

Prototype Testing:

In this stage, the developed prototype was tested by the tester to evaluate the user experience and identify potential issues with the design or functionality. Feedback was collected for the refinement stage.

Prototype Refinement:

Based on the feedback collected, improvements were made to address any identified issues. This might have included changes to the user interface, functionality enhancements, or the addition of new features.

3.4.1.2 Second Iteration:

In the second iteration, the project focused on implementing the actual functionality of the pet adoption mobile application. This iteration involved creating the back-end system and integrating the previously developed front-end to ensure the mobile application operated as intended. The database, APIs, and other logic were coded to integrate with the front end during this phase.

Prototype Design:

In this stage, the design of all application functions and logic was brainstormed based on the requirements from the previous stage.

Prototype Development:

With the updated design in place, the project continued to build the application. The emphasis during this stage was on backend functionality, such as data storage, user authentication, and communication between the front-end and back-end.

Prototype Testing:

Depending on the feedback gathered during the testing stage, iterations might have been repeated, starting with the prototype refinement stage, to further enhance the application.

Repeat:

Depending on the feedback gathered during the testing stage, iteration may need happen again, starting with the prototype refinement stage to further improve the application.

3.5 Prototype Tool

3.5.1 Figma

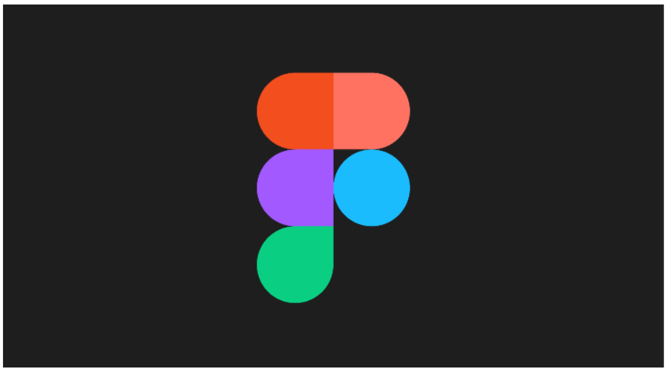


Figure 3. 1: Figma Logo (Machiel, 2022)

In this project, Figma is selected as user interface prototype design tool. According to Maiorca (2023), Figma is a web-based application for graphics editing, user interface design, and prototyping. Figma allows the users to work on different devices because the content is saved on the cloud. Furthermore, Figma can be used for various digital design purposes, such as wireframing websites and designing mobile app interfaces and build an interactive prototype.

Figma offers extensive library of design elements to create a good-looking UI and it is easy to learn because most of the operations are just drag and drop. Hence, Figma is a good choice to create and design the user interface of the project.

Moreover, Figma may be utilised to construct an app design system. A design system is a collection of reusable design components, standards, and assets that assure the app's consistency. The design components such as header and footer can be determined once and keep being reused. Furthermore, Figma also enables the user to develop interactive prototypes of their concepts. This feature enables the user tests on the design, detect usability concerns, and adjust before going on to development.

In conclusion, Figma is a powerful design tool suitable for creating user interfaces, developing interactive prototypes, and establishing a design system for the project. Given its capabilities, Figma was aptly chosen as the prototype design tool for this project.

3.6 Development tools used

3.6.1 GitHub

Figure 3. 2: GitHub Logo (GitHub, 2022)

According to GitHub (n.d.), GitHub is a platform that allows the developers and their teams to work together for the same project by sharing the codes their codes via the repositories.

GitHub is a collaborative platform that is most popular in using for version control for any kind of software development projects. One of the key features of GitHub is it allows multiple users to work on the same project simultaneously. Furthermore, GitHub offers a variety of features, including issue tracking, code review, and documentation. The features that GitHub is offering making it the most popular tool for the software development projects.

GitHub uses Git, a distributed version control system that monitors file changes and allows users to seamlessly integrate their modifications made to the software development project with the other collaborators. Moreover, community-driven environment allow the GitHub users contribute to public repositories and engage with developers from all around the world.

For this project, GitHub was chosen primarily for its version control and online code storage capabilities. The version control feature facilitates tracking of the project's versions, allowing for reversion to previous code states if errors arise. Once code is pushed to a repository, it's stored on GitHub, ensuring its accessibility from any device, and serving as a backup for project files.

3.6.2 React Native

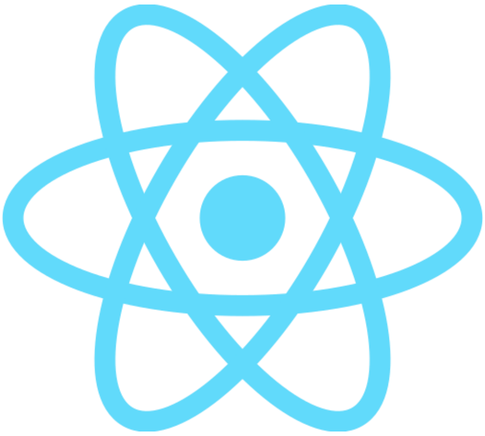


Figure 3. 3: React Native Logo (Rachienb, 2022)

React Native was discussed as a development tool in the Literature review section 2.9 where it is explaining and identifying the available development tools. After careful consideration, React Native will be adopted as the mobile application development tools for the project.

The major drawbacks mentioned in Literature review are steep learning curve and long release time. However, React Native was included in the university's syllabus as a compulsory subject. Hence, with the subject knowledges I obtained from the subject, steep learning curve is no longer a drawback for me. Moreover, the readily available components and the current version of React Native is enough to develop the mobile application for the project.

Flutter was compared with React Native in the Literature review. One of the disadvantages of Flutter was it is still relatively new as it was released on 2017. Hence, Flutter is less popular, and its community is smaller compared to React Native.

Overall, both development frameworks are excellent to adopt and use but React Native will be more suitable to adopt in this project.

3.6.3 Android Studio Emulator

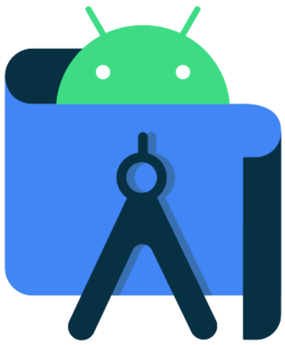


Figure 3. 4: Android Studio Emulator logo (Scott Swarthout, 2020)

The Android Studio Emulator is an emulator that emulates an Android device on a computer and enables developers to test and run Android applications on their computers, just as they would on a real Android device. It is included in Android Studio, which is the primary integrated development environment (IDE) for building Android apps.

In this project, the Android Studio Emulator was used in conjunction with React Native. React Native offers a hot reloading function that allows changes made to the code to be directly output to the Android Studio Emulator. Therefore, the Android Studio Emulator was used to view changes in real-time after the developer makes changes.

Using the Android Studio Emulator helped to streamline the development and testing process, as it allows developers to easily address any error codes that may be displayed on the emulator and work on them immediately. This efficient approach did save time and effort in the development cycle, allowed the developers to focus on creating high-quality applications.

3.6.4 MySQL

Figure 3. 5: MySQL Logo

MySQL is a very popular open-source relational database management system (RDBMS) that manages, organises, and manipulates the data using Structured Query Language (SQL). Moreover, MySQL is well-known for its dependability, stability, and performance, and is popular and frequently used. Furthermore, MySQL organises data using tables, and associations between tables may be made using keys. It also supports transactions, which allow numerous inquiries to be combined into a single unit of work.

The main reasons MySQL was adopted for this project are it is popular, and the issue can be easily identified with the sources available, low learning curve due it was adopted in all the previous project the author was involved.

3.6.5 Visual Studio Code

Figure 3. 6: Visual Studio Code Logo

Visual Studio Code (VS Code) is a free compiler that allows developer to use it for writing code, it is developed by Microsoft. VS Code provides a lightweight and customizable environment for coding, debugging, and building applications. VS Code will be selected as the IDE of this project is because it has a variety of features, including syntax highlighting, code completion, code refactoring, debugging, and Git integration.

One of the key advantages of VS Code is its wide range of extensions that allow the developers to add additional functionality to VS Code, such as adding the GitHub integration, which is one of the development tools adopted in this project.

In addition, VS code supports a variety of programming languages, which is convenient to code in JavaScript, TypeScript, and Python. This makes it a good choice for this project because this project works with variety of programming languages. Overall, VS Code is the choice for this project due to its user-friendly interface, customizable features, various of programming languages supported, and vast extension provided.

3.7 API tools

3.7.1 Flask

Figure 3. 7: Flask Logo (Fdhahn, 2012)

According to Deery (2023), Flask is a lightweight and flexible web framework, ideal for crafting robust APIs. Flask is chosen to be used to use in this project due to several reason, the first reason is its simplicity and flexibility. Flask offers a clean and easy-to-understand syntax, so that the project can be developed fluently with the minimum learning curve of Flask resulting in improved efficiency for the overall development process. In addition, this simplicity of Flask doesn't come at the expense of its flexibility.

Furthermore, Flask's setup is easy and only requires minimum effort. What it means is Flask can be swiftly integrate it into the Pawfect Home and start building the required API endpoints. Given that the project relies heavily on CRUD (Create, Read, Update, Delete) operations, Flask's quick setup is a significant advantage.

Additionally, Flask is compatible with various database. For instance, MySQL is chosen as the database of the project and integrating Flask with SQLAlchemy facilitates a smooth connection to MySQL. This integration ensures data are efficiently stored and retrieved when needed.

Moreover, given that the project will need to handle sensitive data, such as user password, security is important. Flask provides a robust security mechanism, ensuring that data remains protected from potential threats. From data validation to session management, Flask offers a suite of tools to bolster the security of the mobile application.

3.7.2 REST API

REST (Representational State Transfer) API is a set of conventions and architectural principles used for designing networked applications. One characteristic of the REST API is its statelessness. All the information requested from a client to a server have to be fulfilled for let REST for REST to understand and process the request. The server should not retain any session-specific data about the client between requests.

Furthermore, REST APIs operate on a client-server model. The client handles the user interface and user experience, while the server processes requests, manages data, and executes core application logic.

Moreover, REST is resource-based. In REST, the concept of a "resource" is fundamental. A resource is an object or representation with associated data. Each resource can be identified by a specific URI (Uniform Resource Identifier).

Additionally, RESTful APIs use standard HTTP methods to perform CRUD (Create, Read, Update, Delete) operations. The methods GET, POST, PUT, and DELETE are utilized. GET retrieves data from the server, such as fetching pet details. POST sends data to the server, like adding a new pet listing to the database. PUT updates records in the database, for instance, changing a username. DELETE removes records from the database, like deleting an account.

In this project, the REST API worked closely with Flask. The REST API was used on the client side to call APIs defined in Flask. Flask then performed operations specifically defined for the called API.

3.7.3 Google Map API

Figure 3. 8: Google Maps Platform Logo

The Google Maps API is a set of APIs provided by Google that allows developers to integrate Google Maps functionality directly into their own applications. Developers can implement the Google Maps in various platform including mobile application which allow the mobile application retrieve map data, or even create custom layer and visuals on top of the standard version of map.

One of the core functionalities was used in this project was the Geocoding and Reverse Geocoding. Geocoding is the process of converting human readable addresses into geographic coordinates (longitude and latitude) which allows the developers to place markers on a map. For example, when user search KLCC in the mobile application, the request will be sent with Google Map API and receive response with KLCC’s longitude and latitude with a red marker pointed on the map. Reverse geocoding, like Geocoding but in a different direction, is the process of converting longitude and latitude into a human-readable address.

Furthermore, Place Autocomplete is another core function was implemented in this project. Place Autocomplete allows the user to search directly with the address or place name. With proper settings and restriction, it is possible to make the result more relevant and limited to Malaysia only. For example, when user input UTAR into the input field, the API will respond with nearest UTAR (Kampar or Sungai Long) and only UTAR in Malaysia.

Moreover, the mobile application’s location service is heavily dependent on Google Maps API to enhance the user experience. User could view the most relevant result if they granted their location permission, Google Maps API will retrieve the user’s location information and respond with user’s location details. For example, if user granted location permission, the pet listing will be able to sort by distance in ascending order.

3.7.4 MailCheck.ai API

Figure 3. 9: MailCheck.ai Logo

MailCheck.ai is an email domain verifier, meticulously crafted to pinpoint disposable emails with a high degree of accuracy. In the digital realm, the use of temporary or disposable emails can pose significant security risks and potentially degrade the overall user experience. The potential impact caused by disposable emails have been comprehensively detailed in the Literature Review.

To fortify the system against these challenges, the project chose to integrate the MailCheck.ai API. There are two main reasons to integrate it: detecting disposable emails and subsequently preventing users from registering with them.

The decision to implement MailCheck.ai was not only its accuracy and performance but also ease of use and implementation, resulting in lower learning curve. Furthermore, its cost-effective model, particularly the free plan, offers substantial value. While the free tier is capped at 120 requests, this allocation is not a lot, but it is enough for the current state of project and for demonstration ensuring the project can showcase its capabilities without incurring additional costs.

However, mailcheck.ai will be the second layer of email domain checker, the first layer does not involve any API to reduce API usage. The details will be discussed in other section.

3.8 Project Plan

3.8.1 Work Breakdown Structure

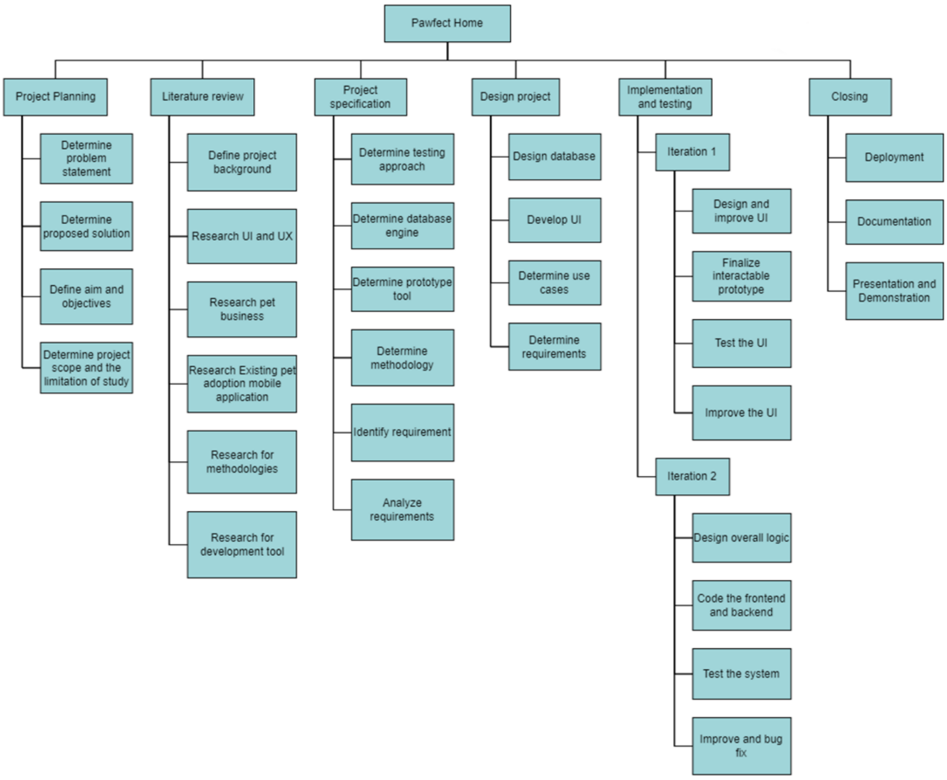
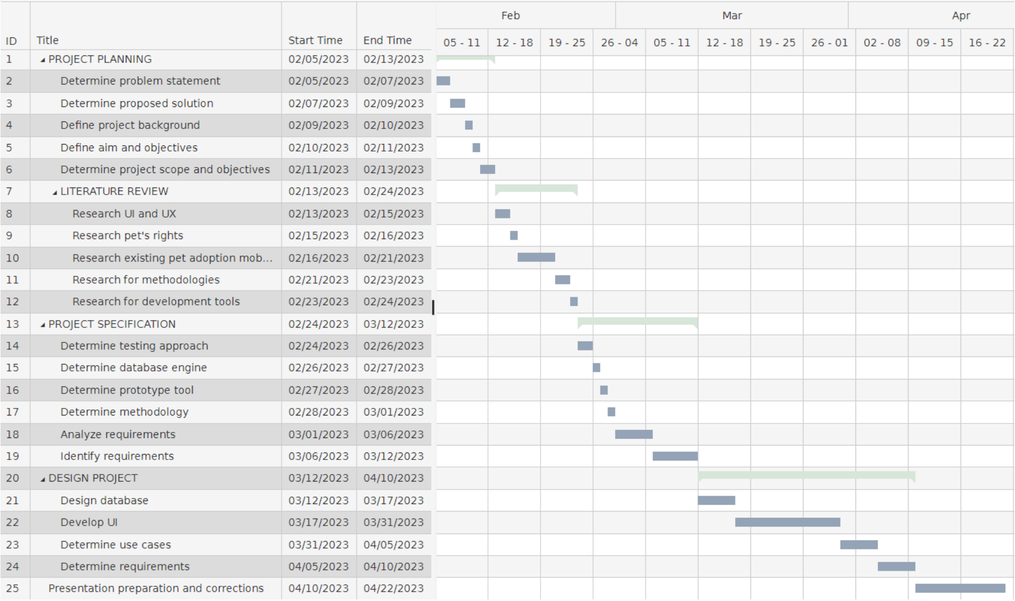

Pawfect Home
Project Planning
Determine problem statement
Determine proposed solution
Define aim and objectives
Determine project scope and the limitation of study
Literature review
Define project background
Research UI and UX
Research pet business
Research Existing pet adoption mobile application
Research for methodologies
Research for development tool
Project specification
Determine testing approach
Determine database engine
Determine prototype tool
Determine methodology
Identify requirement
Analyze requirements
Design project
Design database
Develop UI
Determine use cases
Determine requirements
Implementation and testing
Iteration 1
Design and improve UI
Finalize interactable prototype
Test the UI
Improve the UI
Iteration 2
Design overall logic
Code the frontend and backend
Test the system
Improve and bug fix
Closing
Deployment
Documentation
Presentation and Demonstration

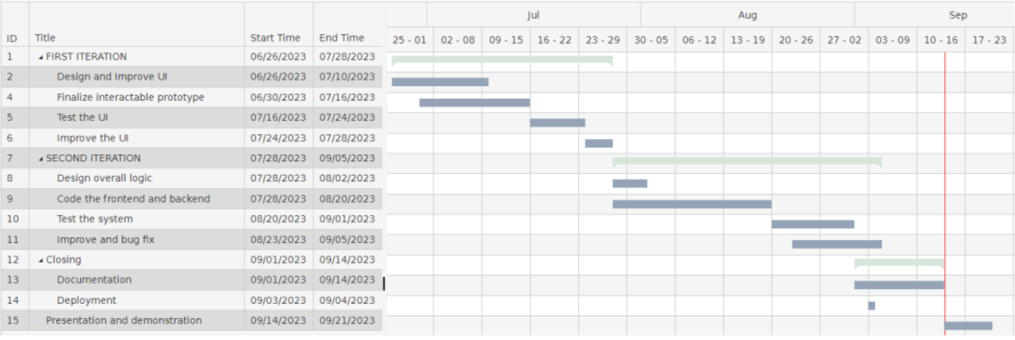
Figure 3. 10: Work Breakdown Structure

3.8.2 Gantt Chart



ID	Title	Start Time	End Time
1	◢ PROJECT PLANNING	02/05/2023	02/13/2023
2	Determine problem statement	02/05/2023	02/07/2023
3	Determine proposed solution	02/07/2023	02/09/2023
4	Define project background	02/09/2023	02/10/2023
5	Define aim and objectives	02/10/2023	02/11/2023
6	Determine project scope and objectives	02/11/2023	02/13/2023
7	◢ LITERATURE REVIEW	02/13/2023	02/24/2023
8	Research UI and UX	02/13/2023	02/15/2023
9	Research pet's rights	02/15/2023	02/16/2023
10	Research existing pet adoption mob...	02/16/2023	02/21/2023
11	Research for methodologies	02/21/2023	02/23/2023
12	Research for development tools	02/23/2023	02/24/2023
13	◢ PROJECT SPECIFICATION	02/24/2023	03/12/2023
14	Determine testing approach	02/24/2023	02/26/2023
15	Determine database engine	02/26/2023	02/27/2023
16	Determine prototype tool	02/27/2023	02/28/2023
17	Determine methodology	02/28/2023	03/01/2023
18	Analyze requirements	03/01/2023	03/06/2023
19	Identify requirements	03/06/2023	03/12/2023
20	◢ DESIGN PROJECT	03/12/2023	04/10/2023
21	Design database	03/12/2023	03/17/2023
22	Develop UI	03/17/2023	03/31/2023
23	Determine use cases	03/31/2023	04/05/2023
24	Determine requirements	04/05/2023	04/10/2023
25	Presentation preparation and corrections	04/10/2023	04/22/2023

Figure 3. 11: Gantt Chart (Project 1)



ID	Title	Start Time	End Time
1	◢ FIRST ITERATION	06/26/2023	07/28/2023
2	Design and Improve UI	06/26/2023	07/10/2023
4	Finalize interactable prototype	06/30/2023	07/16/2023
5	Test the UI	07/16/2023	07/24/2023
6	Improve the UI	07/24/2023	07/28/2023
7	◢ SECOND ITERATION	07/28/2023	09/05/2023
8	Design overall logic	07/28/2023	08/02/2023
9	Code the frontend and backend	07/28/2023	08/20/2023
10	Test the system	08/20/2023	09/01/2023
11	Improve and bug fix	08/23/2023	09/05/2023
12	◢ Closing	09/01/2023	09/14/2023
13	Documentation	09/01/2023	09/14/2023
14	Deployment	09/03/2023	09/04/2023
15	Presentation and demonstration	09/14/2023	09/21/2023

Figure 3. 12: Gantt Chart (Project 2)

CHAPTER 4

PROJECT SPECIFICATION

4.1 Introduction

This chapter outlines the foundational blueprint of the project, drawing upon previous work and research. It served as the primary reference during the implementation stage, ensuring that the project's development aligned with its predefined specifications and objectives.

4.2 System architecture design

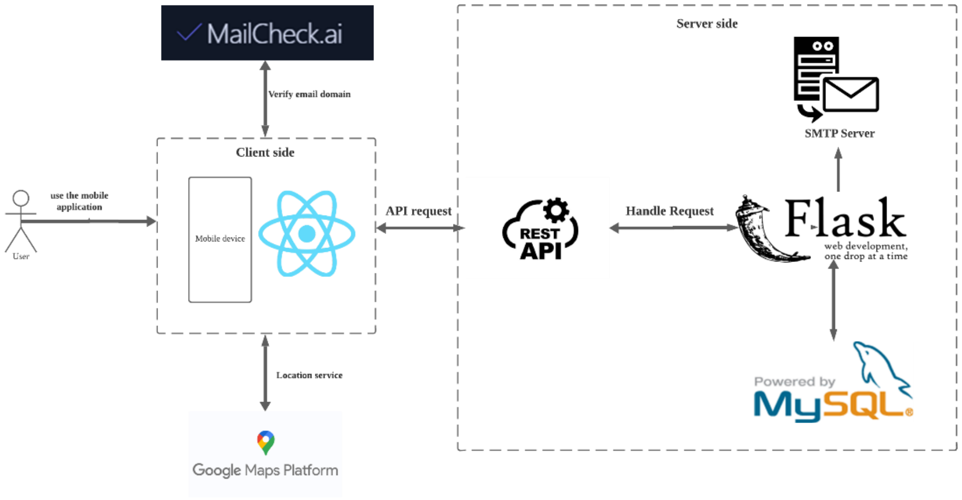


Figure 4. 1: System architecture design

Referring to the Figure, the system architecture is designed to provide a seamless experience for users while ensuring data accuracy and security. React Native is the core of the system architecture as the mobile development framework, to build mobile application using JavaScript.

First, users interact with the mobile application developed in React Native framework. This framework ensures the functionalities developed within the framework are accessible to all users with a consistent user experience regardless of their device type. Although React Native framework is designed for cross-platform, in this project we will only be focusing on Android platform.

When user is registering and account, MailCheck,ai API could be called to verify the email address's domain name to prevent registration of disposable email. If condition met, React Native will send a request to this API to verify the email domain. The API will respond the verification result back to the React Native.

Location service is one of the core features in this project, so Google Map API is integrated. For features that require location data, such as finding nearby pet listings or vet clinics, the application utilizes the Google Map API. This API provides accurate location services, allowing the application to offer location-based functionalities efficiently.

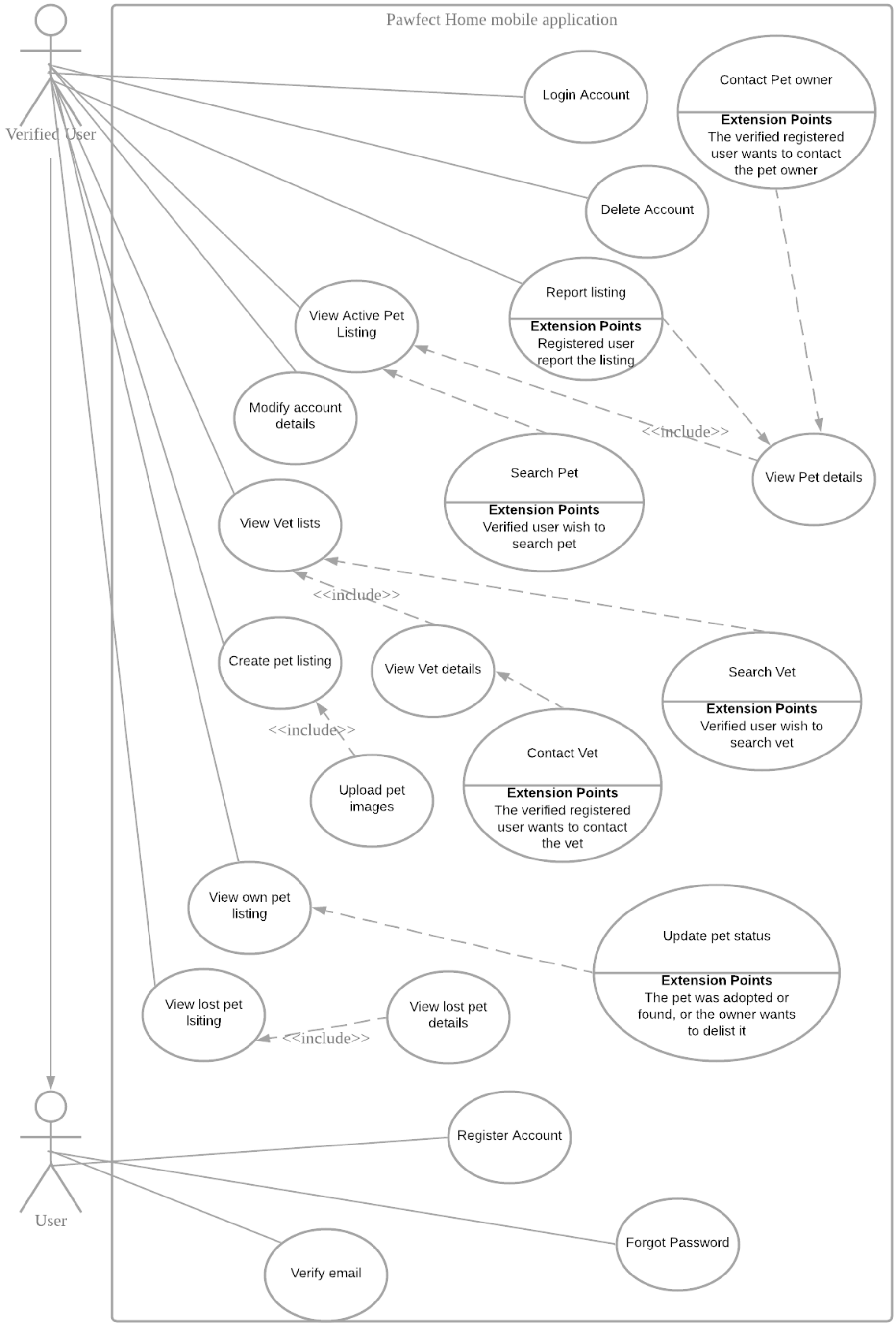
To communicate with database, React Native will use RESTful API requests. RESTful API is playing a role of middleman that ensures that data is transmitted between the frontend and backend in a structured and consistent manner, facilitating smooth data flow and processing.

Upon receiving a request made by the React Native application, the REST API direct the request to Flask. Then, Flask will handle the business logic, processes the request, and prepares the appropriate response.

After that, Flask interacts with the database which in this project is MySQL to store, retrieve, or modify data based on the request it receives to complete the CRUD operations. This interaction ensures that all data involved are securely stored and can be accessed when needed.

Lastly, for functionalities that require sending out email from the server, such as account verification and password resets, Flask uses the Simple Mail Transfer Protocol (SMTP). SMTP ensures that emails are delivered reliably to the intended recipients with easy setup

4.3 Use case diagram



Assumption:
1) Modify account details includes change password and change username
2) Verified user need to update their own pet listing after their pet was adopted
3) The user must be verified via email before they can use the mobile application
4) The verified user may create adoption, lost, or re-Home listing

Figure 4. 2: Use case diagram

4.4 Use case description

Table 4. 1: Register account use case description

Use Case Name: Register account	ID**: 1**	Importance Level**:** **High**
Primary Actor: User		
Stakeholders and Interests: User: wants to register an account to use the mobile application.		
Brief Description: This use case describes the process user wants to create a new account to access the pet adoption platform.		
Trigger: The user clicks on the register button on the initial page.		
Normal Flow of Events: 1. The user navigates to the SignUp screen. 2. The user enters their desired username, email, password, and contact number. 3. The system validates the provided details, including checking for valid email format, password criteria, and unique email and contact number. 4. Upon successful validation, the system sends a verification code to the user's email. 5. The user receives the verification code in their email and enters it into the EmailVerification screen. 6. The system verifies the code. 7. Upon successful verification, the user is navigated to the EmailVerification2 screen, indicating a successful registration. 8. The user is prompted to proceed to the Login screen.		

Sub-flows: S1. The user wants to re-enter the verification code: a) The user requests a new verification code. b) The system sends a new code to the user's email. c) The user enters the new code into the application.
Alternate/Exceptional Flows: A1. The entered email is in an invalid format email: a) The system displays an error message to the user to enter a valid email. A2. The entered email is in a disposable email: a) The system displays an error message to the user to enter a disposable email. A3. The entered password does not meet the criteria: a) The system displays an error message detailing the password requirements. A4. The entered email already exists in the system: a) The system displays an error message indicating that the email is already registered. A5. The entered contact number already exists in the system: a) The system displays an error message indicating that the contact number is already registered. A6. The user enters an incorrect verification code: a) The system displays an error message. A7. The user enters an expired verification code: a) The system allow user to request a new verification code. A8. The user attempts to navigate away or press the back button during the email verification process: a) The system prompts the user for confirmation. b) If confirmed, the verification record is deleted, and the user is navigated to the initial page. A9. There's an error or exception while processing the registration or verification:

a) The system displays an appropriate error message and may prompt the user to retry or contact support.

Table 4. 2: Login use case description

Use Case Name: Login	ID**: 2**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified User: wants to login their account to use the mobile application.		
Brief Description: This use case describes the process verified user wants to login their account to access the mobile application.		
Trigger: The user clicks on the login button on the initial page or Sign up page.		
Normal Flow of Events: 1. The user navigates to the Login screen. 2. The user enters their email and password. 3. The system validates the provided credentials against the stored user data. 4. Upon successful validation, user logged in and directed to Home Page.		
Sub-flows:		

Alternate/Exceptional Flows:

A1. If the user's status is 'unverified', the system sends a verification email and navigates the user to the EmailVerification screen.

A2. If the user's status is 'banned', the system displays a modal message indicating the user is banned and prompts them to contact customer service.

A3. The entered email or password is incorrect:

   a. The system displays a modal message indicating an incorrect email or password.

A4. The user's account status is unexpected (neither 'active', 'banned', nor 'unverified'):

   a. The system displays a modal message indicating an unexpected user status and prompts the user to contact support.

A5. The user attempts to navigate away or press the back button during the login process:

   a. The system exits the application.

A6. There's an error or exception while processing the login:

   a. The system displays a modal message indicating the error or reason for the failed login attempt.

Table 4. 3: Forgot password use case description

Use Case Name: Forgot Password	ID**: 3**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: forgot their password.		
Brief Description: This use case describes the process verified user forgot their password and wish to reset.		
Trigger: The user clicks on the forgot password button at the login page.		
Normal Flow of Events: 1. The user is presented with the ForgotPassword screen where they are prompted to enter their email address. 2. The user enters their email address and clicks the "Submit" button. 3. The system validates the email address format. 4. If the email address exists in the system, a verification code is sent to the user's email. 5. The user is then directed to the ForgotPassword2 screen where they are prompted to enter the verification code received in their email. 6. The user enters the verification code and clicks the "Submit" button. 7. The system verifies the entered code. 8. If the code is correct, the user is directed to the ResetPassword screen. 9. The user enters a new password and confirm password. 10. The system validates the new password’s format. 11. If the new password meets the criteria and matches the confirmed password, the password is reset. 12. The user is then directed to the PasswordChanged screen, confirming the successful password reset.		

13. The user clicks "Proceed to Login" and is directed back to the Login page.
Sub-flows: S1. At any point, if the user wishes to go back, they can click the back button or the "X" icon, which will navigate them back to the Login page.
Alternate/Exceptional Flows: A1. If the email address entered in the ForgotPassword screen does not exist in the system, the user is still directed to the ForgotPassword2 screen, but no verification code is sent. A2. If the verification code entered in the ForgotPassword2 screen is incorrect or has expired, the user is presented with an error message. They have the option to request a new code. A3. If the new password entered in the ResetPassword screen does not meet the criteria, the user is presented with an error message. A4. If the new password entered in the ResetPassword screen does not match the confirmed password, the user is presented with an error message.

Table 4. 4: Create pet listing use case description

Use Case Name: Create Pet Listing	ID**: 4**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: wish to create a pet listing		
Brief Description: This use case describes the process a user goes through to create a new pet listing		
Trigger: The verified user clicks on create pet listing button.		
Normal Flow of Events: 1. User fills in the pet details including animal type, breed, pet name, adoption fee, listing type, pet gender, and description. 2. User selects a date for the pet's birth or arrival. 3. User proceeds to the next step to set the pet's location. 4. The app request location permissions. If granted, the app fetches the current location of the user. 5. User can manually search for a location using the Google Places Autocomplete. 6. User can view the selected location on a map and adjust it by tapping on a new location. 7. User can choose to upload images from the gallery or capture new ones using the camera. 8. The app allows the user to upload up to 5 images. 9. User can view the uploaded images in a horizontal list and has the option to remove any image. 10. User submits the listing. 11. The app uploads the images to the server and associates them with the pet listing.		

12. The app sends the pet details, location details, and listing details to the server.
13. Upon successful submission, the user is navigated to a confirmation screen.
14. User acknowledges the confirmation and is redirected to the Account Setting screen.

Sub-flows:

S1. Using the Back Button

  a. At any point during the listing creation, the user can press the back button to return to the previous screen.

  b. If user presses back button at the confirmation screen, they will be navigated to home screen.

S2. Removing an Uploaded Photo

  a. After uploading photos, the user can view them in a horizontal list.

  b. For each photo, there's a delete icon.

  c. Upon pressing the delete icon, the respective photo is removed from the list.

Alternate/Exceptional Flows:

A1. If the user denies location permissions, they are informed and can manually set the location.

A2. If the user tries to upload more than 5 images, they are alerted about the limit.

A3. If there's an error during the image upload or listing creation, the user is informed about the issue.

Table 4. 5: View active pet listing use case description

Use Case Name: View Active Pet Listing	ID**: 5**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: wish the view active pet listing, possibly to check if their own lost pet is listed.		
Brief Description: This use case describes the process a user goes through to browse and view pets on the home screen.		
Trigger: The user accesses the home screen of the application.		
Normal Flow of Events: 1. The user is asked to allow location permission. 2. The user is presented with the Home Screen which displays a list of pets arranged by distance (ascending). 3. The user can select from various pet categories (e.g., Cat, Dog, Bird, Hamster) to filter the displayed pets. 4. The user can scroll through the list of pets, each displaying an image, name, breed, age, and location. 5. The user can click on a pet to view its detailed information. 6. As the user scrolls to the bottom, more pets are loaded (pagination) if available.		
Sub-flows:		
Alternate/Exceptional Flows: A4.If the pet data is still loading, the user sees a loading indicator.		

A5. If there's an error while fetching the pet data, the user is informed about the error (though this specific flow is not explicitly shown in the provided code). A6. If the user denies location permission, a modal pops up informing them about the importance of location access.

Table 4. 6: View active pet listing pet details use case description

Use Case Name: View Active Pet Listing Pet Details	ID**: 6**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: Interested in the pet listing and wish to learn more details		
Brief Description: This use case describes the process a verified user goes through to view detailed information about a pet on the home screen.		
Trigger: The user selects a pet from a list or search results to view its details.		
Normal Flow of Events: 1. The user is presented with the PetDetails screen which displays detailed information about the selected pet. 2. The user can swipe through multiple images of the pet. 3. The user views the pet's name, type, breed, age, location, and the owner's name. 4. The user can read description of the pet. 5. The user is informed about the date when the listing was created. 6. The user can view the adoption fee for the pet. 7. The user can contact the pet owner by clicking on the a. Email icon which opens the default email app with the pet owner’s email address pre-filled		

  b. Phone icon which opens the default caller app with the pet owner’s contact number pre-filled
  c. WhatsApp icon which opens the WhatsApp with the pet owner’s contact number
  d. SMS icon which opens the default SMS app with the pet owner’s contact number pre-filled

8. If the user finds any issues with the listing, they can click on the "Report Listing" button to report it.

Sub-flows:

S1. The user can click the back button to navigate back to the previous screen or list of pets.

S2. When the description is lengthy:

  a. The system initially shows a shortened version of the description.
  b. The user can toggle between the shortened and full versions by clicking "Show More" or "Show Less".

S3. If the user clicks on an image of the pet, it enlarges for a better view.

Alternate/Exceptional Flows:

A1. If the pet details are still loading, the user sees a loading indicator.

A2. If there's an error while fetching the pet details, the user is informed about the error.

A3. If the user decides to report the listing, a modal pops up where they can select a reason for the report and provide a description. After submitting the report, they receive a confirmation message.

A4. If there's an error while submitting the report, the user is informed about the error.

Table 4. 7: Search active pet listing use case description

Use Case Name: Search Active Pet Listing	ID**: 7**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: Wish to search the pet listing		
Brief Description: This use case describes the process a verified user goes through to search for specific pets using filters in the search modal.		
Trigger: The user or pet owner clicks on the "Search" button on the home screen.		
Normal Flow of Events: 1. The user clicks on the "Search" button, which opens the search modal. 2. Within the modal, the user is presented with various dropdowns to filter their search: 3. Pet Type: The user can select a specific type of pet (e.g., Cat, Dog, Bird, Hamster, Reptile, Furry). 4. Status: The user can select the status of the pet (e.g., Re-Home, Adopt). 5. Age: The user can select an age range for the pet (e.g., Less than 1 year, 1-3 years old, 4-6 years old, 7-10 years old, at least 10 years old). 6. Location: The user can select a specific location or state (All Malaysia States). 7. The user can click on the "Clear Filters" button to reset all the selected filters. 8. Once the user has selected their desired filters, they click on the "Search" button.		

9. The search modal closes, returning the user to the home screen with the updated pet listings.
Sub-flows:
Alternate/Exceptional Flows: A1. The user can swipe down on the modal or click outside the modal area to close it without applying any filters. A2. If the user does not select any filters and clicks "Search", the list will display results based on the default or previously applied filters.

Table 4. 8: Report listing use case description

Use Case Name: Report Listing	ID**: 8**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: Wish to report the pet listing		
Brief Description: This use case describes the process a verified user goes through to report a specific pet listing using the report modal.		
Trigger: The user clicks on the "Report" button associated with a specific pet listing.		
Normal Flow of Events: 1. The user clicks on the "Report" button, which opens the report modal. 2. Within the modal, the user is presented with two fields: a. Report Reason: A dropdown where the user can select a specific reason for reporting the listing (e.g., Spam, Suspicious, Scam, Fake account, Illegal listing, Other reasons). b. Description: A text input field where the user can provide a detailed description or explanation for the report. 3. The user can click on the "Clear All" button to reset both fields. 4. Once the user has selected a report reason and provided a description, they click on the "Submit" button. 5. The system checks if both fields are filled: a. If both fields are filled, the report is submitted, and the modal closes. b. If any field is empty, the user is alerted to fill in both fields before submitting.		

Sub-flows:
Alternate/Exceptional Flows: A1. The user can swipe down on the modal or click outside the modal area to close it without submitting a report. A2. If the user attempts to submit without filling in both fields, an alert is displayed prompting them to complete both fields.

Table 4. 9: View vet listing use case description

Use Case Name: View Vet Listing	ID**: 9**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: View the vet listings		
Brief Description: This use case describes the process a verified user goes through view the vet listing.		
Trigger: The verified user navigates to the vet screen.		
Normal Flow of Events: 1. The system fetches the user's current location. 2. The system fetches and displays a list of vet clinics based on the user's location. 3. The user can view details of each vet clinic, including the name, operating hours, and address. 4. The user can click on a specific vet clinic to view more details about it.		
Sub-flows:		
Alternate/Exceptional Flows: A1. If the system cannot fetch the user's location, it will display vet clinics without location-based filtering.		

Table 4. 10: Search vet listing use case description

Use Case Name: Search Vet Listing	ID**: 10**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: Wish to search the vets.		
Brief Description: This use case describes the process a verified user goes through to search for specific vet clinics using filters.		
Trigger: The verified user clicks on the "Search" button on the VetScreen.		
Normal Flow of Events: 5. The search modal opens, allowing the user to apply filters. 6. The user selects a specific state from the dropdown list. (All Malaysia's State included) 7. The user clicks on the "Search" button. 8. The system fetches and displays vet clinics based on the selected state. 9. The user can view the filtered list of vet clinics.		
Sub-flows:		
Alternate/Exceptional Flows: A2. If the user does not select any state in the search modal and submits, the system will display the original list of vet clinics based on the user's location.		

A3. If the user decides not to search after opening the search modal, they can close the modal without applying any filters. A4. If the user wishes to clear the selected filters, they can click on the "Clear Filters" button.

Table 4. 11: View vet listing details use case description

Use Case Name: View Vet Listing Details	ID**: 11**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: Wish to view the vet details.		
Brief Description: This use case describes the process a user goes through to view the specific vet clinics details.		
Trigger: The verified user clicks on the interested vet displayed on the VetScreen.		
Normal Flow of Events: 1. The system fetches detailed information about the selected vet clinic 2. The system displays the name, operating hours, and address of the vet clinic. 3. The user can click on the "Search on Google" link to search for the vet clinic on Google. 4. The system displays a map showing the location of the vet clinic. The user can click on the map to open the location in Google Maps. 5. The user can contact the vet clinic by clicking on the email or phone icons.		

Sub-flows: S1. User clicks on "Search on Google". a. System opens the default browser and searches for the vet clinic on Google. S2. User clicks on the displayed map. a. System opens the location in Google Maps, showing the exact location of the vet clinic. S3. The user can contact the vet clinic by clicking on the email or phone icons. a. Clicking the email icon opens the default email app with the vet clinic's email address pre-filled b. Clicking the phone icon opens the default caller app with the vet clinic's contact number pre-filled
Alternate/Exceptional Flows: A1. If the system encounters an error while fetching the vet details, it displays a loading screen with a message indicating that the data is being fetched.

Table 4. 12: View lost pet use case description

Use Case Name: View Lost Pet	ID**: 12**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: Wants to view lost pets, possibly to help find them or to check if their own lost pet is listed.		
Brief Description: This use case describes the process a verified user goes through to view the lost pet list.		
Trigger: The verified user clicks on the lost pet tab and navigate to it.		

Normal Flow of Events:

1. The user navigate to the "Lost Pet Screen".
2. The system fetches the user's current location (if permission is granted).
3. The system displays a list of lost pets, prioritizing those near the user's location (if available).
4. The user can scroll through the list to view more pets.
5. If the user reaches the end of the list, the system fetches and displays more lost pets (pagination).
6. The user can select a pet to view more details about it.

Sub-flows:

S1. If the user's location is not available:

   a. The system fetches and displays lost pets without prioritizing by location.

S2. When the user selects a pet:

   a. The system navigates to the "MissingPetDetails" screen.

   b. The system displays detailed information about the selected pet.

Alternate/Exceptional Flows:

A1.If there's an error in fetching the user's location:

   a. The system continues to display the lost pets without prioritizing by location but prioritizing creation date

A2.If there are no more pets to display:

   a. The system does not fetch more pets.

Table 4. 13: View lost pet details use case description

Use Case Name: View Lost Pet Details	ID**: 13**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: Wants to view detailed information about a specific lost pet, possibly to help find them or to check if it's their own lost pet.		
Brief Description: This use case describes the process a user goes through to view specific lost pet details clinics using.		
Trigger: The verified user clicks on the any of the lost pet at the Lost Pet Screen.		
Normal Flow of Events: 1. The user select lost pet displayed at lost pet screen. 2. The system fetches and displays detailed information about the selected pet, including photos, name, breed, age, location, and owner's name. 3. The user can view a brief or full description of the pet's missing details. 4. The user can view the date the listing was created and the reward fee. 5. The user can use the contact button to contact the pet owner.		
Sub-flows: S1. When the description is lengthy: a. The system initially shows a shortened version of the description. b. The user can toggle between the shortened and full versions by clicking "Show More" or "Show Less". S2. The user can contact the pet owner by clicking on the a. Email icon which opens the default email app with the pet owner’s email address pre-filled.		

b. Phone icon which opens the default caller app with the pet owner’s contact number pre-filled. c. WhatsApp icon which opens the WhatsApp with the pet owner’s contact number. d. SMS icon which opens the default SMS app with the pet owner’s contact number pre-filled.
Alternate/Exceptional Flows: A1. If there's an error in fetching the pet's details: a. The system displays an error message to the user. A2. If there's an error in initiating the contact method a. The system displays an error message to the user.

Table 4. 14: Edit Profile use case description

Use Case Name: Edit Profile	ID**: 14**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: Wants to update their username.		
Brief Description: This use case describes the process a verified user goes through to change their account username.		
Trigger: The verified user clicks on the profile button.		
Normal Flow of Events: 1. The user accesses the "Edit Profile" screen from Account Setting Screen. 2. The system fetches and displays the current user details, including username, email, and contact number. 3. The user can edit their username. 4. The user submits the updated username.		

5. The system validates the input (e.g., checks if the username is not empty).
6. The system updates the username in the database.
7. The user receives a confirmation that their username has been updated successfully.
8. The user is redirected to the "Account Setting" screen.

Sub-flows:

S1. The user click on the back button

a. Direct user to Account Setting page

Alternate/Exceptional Flows:

A1. If the username input is empty or invalid:

a. The system displays an error message to the user.

A2. If there's an error in updating the user details:

a. The system displays an error message to the user.

Table 4. 15: Change password use case description

Use Case Name: Change Password	ID**: 15**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: Wants to update their password.		
Brief Description: This use case describes the process a verified user changing their password.		
Trigger: The user clicks on the change password button.		
Normal Flow of Events: 1. User sees the current password field		

2. User enters a new password in the "New Password" field.
3. System validates the password based on criteria (at least 8 characters, contains 1 number, 1 special character, and 1 capital letter). If the password doesn't meet the criteria, a warning message is displayed.
4. User enters the password again in the "Confirm Password" field.
5. System checks if the confirmed password matches the new password. If not, a warning message is displayed.
6. User clicks the "Reset Password" button.
7. System sends a request to the server to update the password.
8. If the password update is successful, the system navigates the user to the "Password Changed" screen.
9. If there's an error, the system displays an error message.
10. User can click the back button (X) to navigate back to the previous screen.
11. Password Changed Screen (PasswordChanged)
12. User sees a success message indicating that the password has been changed successfully.
13. User is prompted to log in with the new password.
14. User clicks the "Proceed to Login" button.
15. System navigates the user to the "Login" screen.
16. If the user presses the back button, the system navigates them to the "Login" screen.

Sub-flows:

S2. The user click on the back button

   a. Direct user to Account Setting page

Alternate/Exceptional Flows:

A3.If the username input is empty or invalid:

   a. The system displays an error message to the user.

A4.If there's an error in updating the user details:

   a. The system displays an error message to the user.

Table 4. 16: View user pet listing use case description

<table>
<tr><td><b>Use Case Name:</b> View User Pet Listing</td><td>ID<b>: 16</b></td><td>Importance Level<b>:</b> High</td></tr>
<tr><td colspan="3"><b>Primary Actor:</b> Verified user</td></tr>
<tr><td colspan="3"><b>Stakeholders and Interests:</b>
Verified user: wants to view their created listing.</td></tr>
<tr><td colspan="3"><b>Brief Description:</b>
This use case describes user to view their own created pet listings.</td></tr>
<tr><td colspan="3"><b>Trigger:</b> The user clicks on the My Pet Listing button.</td></tr>
<tr><td colspan="3"><b>Normal Flow of Events:</b>
1. User navigates to the "PetListingActiveScreen".
2. System fetches the active pet listings associated with the user's ID.
3. System displays the active pet listings with images, pet names, breeds, and ages.</td></tr>
<tr><td colspan="3"><b>Sub-flows:</b>
S1. User can select a specific pet listing.
a. System navigates the user to the pet listing details screen.
S2. User can selects the floating “+” button.
a. System navigates the user to the "CreateListing" screen where they can add a new pet listing.
S3. The user click on the back button
a. Direct user to Account Setting page</td></tr>
<tr><td colspan="3">Alternate/Exceptional Flows:
A1.If the user has no active pet listings:
a. System displays an empty state
b. User can still use the floating action button to add a new listing.
A2.If there's an issue fetching the active listings from the server:1.</td></tr>
</table>

a. System displays an error message.

Table 4. 17: View user pet listing details use case description

Use Case Name: View User Pet Listing Details	ID**: 17**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: wants to view their created listing.		
Brief Description: This use case describes verified user to view their own created pet listings.		
Trigger: The user clicks on any of the pet listing displayed at the user pet listing screen.		
Normal Flow of Events: 1. The system fetches the detailed information of the selected pet listing from the server. 2. The system displays the pet's photos, name, type, breed, age, location, and description. 3. The user can view the full description by selecting "Show More" if the description is truncated. 4. The user has the option to update the listing status by selecting either "Found", "Adopted", or "Delist".		
Sub-flows: S4. Using cancel button in confirmation modal a. The user can confirm or cancel the status update from the modal. S5. The user click on the back button a. Direct user to Pet Listing Active page S6. Using show more feature a. The full description will be shown		
Alternate/Exceptional Flows: A1.If the system fails to fetch the pet listing details:		

a. The system displays an error message to the user.

Table 4. 18: Update pet listing status

Use Case Name: Update Pet Listing Status	ID**: 18**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: wants to update their created listing.		
Brief Description: This use case describes how a verified user to update the status of a pet listing, either marking it as "Found", "Adopted", or "Delisted".		
Trigger: The verified user clicks on the any of the button in User Pet Listing Detail.		
Normal Flow of Events: 1. The user views the details of a pet listing. 2. The user decides to update the status of the listing. 3. The user selects the desired status ("Found", "Adopted", or "Delisted"). 4. A confirmation modal appears, asking the user to confirm their choice. 5. The user confirms the status update. 6. The system sends a request to the server to update the listing status. 7. The server processes the request and updates the listing status. 8. The system provides feedback to the user, indicating the successful update of the listing status. 9. The user is redirected to the Pet Listing History Screen.		

Sub-flows:
Alternate/Exceptional Flows: A1. If the server fails to update the listing status: a. The system provides an error message to the user. b. The user is given the option to retry or cancel the update. A2. If the user decides not to update the status after the confirmation modal: a. The user selects the "Back" option in the modal. b. The modal closes, and the user remains on the pet listing details page.

Table 4. 19: View user pet listing history use case description

Use Case Name: View User Pet Listing History	ID**: 19**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: wants to view their created listing history.		
Brief Description: This use case describes how a verified user to view their own inactive created pet listing		
Trigger: The user clicks on the History tab.		
Normal Flow of Events: 1. The user accesses the "PetListingHistoryScreen". 2. The system fetches the historical pet listings of the user from the server.		

3. The system displays a list of pet listings, showing each pet's photo, name, type, breed, age, and listing status (e.g., "missing", "adopted", "delisted"). 4. The user can select a specific pet listing to view its detailed information.
Sub-flows: S1. Using the back button a. The user will be navigated to Account Setting screen.
Alternate/Exceptional Flows: A1.If the system fails to fetch the pet listing history: a. The system displays an error message to the user.

Table 4. 20: View user pet listing history details use case description

Use Case Name: View User Pet Listing History details	ID**: 20**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: wants to view their created listing history details.		
Brief Description: This use case describes how a verified user to view their own inactive created pet listing details		
Trigger: The user selects any of the inactive pet listing in Pet Listing History screen.		
Normal Flow of Events: 1. The user selects a specific pet listing from the Pet Listing History screen.		

2. The system fetches detailed information of the selected pet listing from the server.
3. The system displays the pet's photos.
4. The system displays the pet's name, type, breed, age, and location.
5. The system displays the pet's description. If the description is lengthy, it shows a truncated version with an option to "Show More" or "Show Less".
6. The system displays the date when the pet was listed and its current status ("missing", "adopted", "delisted").
7. The user can navigate back to the PetListingHistoryScreen by pressing the back button.

Sub-flows:

S2. When the description is lengthy:

- a. The system initially shows a shortened version of the description.
- b. The user can toggle between the shortened and full versions by clicking "Show More" or "Show Less".

Alternate/Exceptional Flows:

A2. If the system fails to fetch the pet listing details:

- a. The system displays an error message to the user.
- b. The user is given the option to navigate back.

A3. If the pet listing does not have image loaded:

- a. The images are not displayed.
- b. The rest of the details are shown as usual.

Table 4. 21: Delete account use case description

Use Case Name: Delete Account	ID**: 21**	Importance Level**:** High
Primary Actor: User, Pet Owner		
Stakeholders and Interests: Verified user: wants to delete their account.		
Brief Description: This use case describes how a verified user can delete account.		
Trigger: The user clicks on the delete account button.		
Normal Flow of Events: 1. User is presented with a warning about the deletion of their account. 2. User has two options: a. "NO, Go Back": This option allows the user to cancel the deletion process and navigate back to the previous screen. b. "YES, Continue": This option takes the user to the next step of the account deletion process. 3. User is presented with a more detailed warning about the consequences of deleting their account. 4. User has two options: a. "NO, Cancel and Back": This option allows the user to cancel the deletion process and navigate back to the account settings. b. "Understood, Continue": The system attempts to delete the user's account from the database. 5. If successful, the user's token is removed from the local storage, effectively logging them out. 6. The user is then navigated to the final confirmation screen. 7. User is presented with a farewell message.		

Sub-flows: S1. Using the Back Button a. At First Delete Account screen, the system navigates the user back to the Account Setting screen without any changes. b. At First Delete Account 2 screen, the system navigates the user back to the Account Setting screen without any changes. S2. Using the Close Button a. At First Delete Account 3 screen, the system navigates the user back to the Initial page.
Alternate/Exceptional Flows: A1. If there's an error during the deletion process in the DeleteAccount2 screen, the user is presented with an error message, and the process is halted.

Table 4. 22: Logout use case description

Use Case Name: Logout	ID**: 22**	Importance Level**:** High
Primary Actor: Verified user		
Stakeholders and Interests: Verified user: wants to delete their account.		
Brief Description: This use case describes how a verified user can delete account.		
Trigger: The user clicks on the delete account button.		
Normal Flow of Events: 1. User selects the "Log Out" option. 2. A modal appears, asking for confirmation if the user is sure they want to log out. 3. Log Out Confirmation Modal, User is presented with two options:		

a. "No": This option allows the user to cancel the log out process and remain on the Account Setting screen. b. "Yes, Logout": Upon selecting this option: 4. The system logs the user out. 5. The user is then navigated to the starting page of the application.
Sub-flows: S1. Cancel Log Out: a. User presses the "No" option in the Log Out Confirmation Modal. b. The modal disappears, and the user remains on the Account Setting screen.
Alternate/Exceptional Flows:

4.5 Requirements

4.5.1 Requirement collection

Requirements are the core to build mobile applications, it acts as the guidance for the developers to develop software that meets the expectations of the customers. The requirements collection method was mentioned in Chapter 3.2 and Chapter 3.3. This chapter is mainly to identify and simplify the result gathered from Chapter 3.3 and document it.

4.5.2 Functional requirements

Table 4. 23: User registration and authentication Functional Requirements

User Registration and Authentication	
FR ID	**FR Description**
FR1.1	The system shall allow new users to register by providing their username, email, password, and contact number.
FR1.2	The system shall verify the password format to follow the format of at least 8 characters, contain 1 number, 1 special character, and 1 capital letter.
FR1.3	The system shall check if the phone number is already registered by another user.
FR1.4	The system shall validate the email's domain and format before accepting the registration.
FR1.5	The system shall send a verification email with a code to the user's email address upon successful registration.
FR1.6	The system shall verify the code entered by the user during email verification.
FR1.7	The system shall allow users to request another verification email after 5 minutes if not received.
FR1.8	The system shall authenticate users using their registered credentials.
FR1.9	The system shall provide a "Forgot Password" feature, using email verification before allowing users to reset their password.

FR1.10	The system shall allow user to use the mobile application directly without needing to log in again until user logout or uninstall the mobile application.

Table 4. 24: Pet listing creation and management Functional Requirements

Pet Listing Creation and Management	
FR ID	**FR Description**
FR2.1	The system shall allow users to create a pet listing by entering pet details, including type, breed, name, gender, adoption/reward fee, and born date.
FR2.2	The system shall allow users to input their pet's location information or select directly on a map.
FR2.3	The system shall allow users to upload a minimum of 1 and up to 5 images for each pet listing and provide an option to remove uploaded images before submission.
FR2.4	The system shall allow users to modify their pet listings' status.

Table 4. 25: Pet listing viewing Functional Requirements

Pet Listing Viewing	
FR ID	**FR Description**
FR3.1	The system shall display available pet listings with details such as image, name, breed, age, and location, sorted by the user's location.
FR3.2	The system shall allow users to filter and search pet listings based on criteria like pet type, listing status, age, and location.
FR3.3	The system shall allow users to view all images of a pet, enlarge them, and display indicators for available images.
FR3.4	The system shall allow users to contact pet owners through various platforms like email, WhatsApp, phone call, and SMS.
FR3.5	The system shall allow users to report a pet listing by selecting a report reason and providing a description.

Table 4. 26: Vet listing viewing Functional Requirements

Vet Listings Viewing	
FR ID	**FR Description**
FR4.1	The system shall display vet clinics based on the user's location, showing details like name, operating hours, and address.
FR4.2	The system shall provide clickable maps for vet clinic locations and options to contact them or search for them online.
FR4.3	The system shall allow users to search for vet clinics based on state and clear search filters with a single button.

Table 4. 27: Lost pet details Functional Requirements

Lost Pet Details	
FR ID	**FR Description**
FR5.1	The system shall allow users to view lost pet details, sorted by the user's location, with the same design and functionality as pet listing details, excluding the report listing feature.

Table 4. 28: Account management Functional Requirements

Account management	
FR ID	**FR Description**
FR6.1	The system shall allow users to view and edit their username.
FR6.2	The system shall allow users to change their password after verifying their current password.
FR6.3	The system shall provide an option for users to delete their account, displaying a warning message before deletion and removing all user data upon confirmation.

Table 4. 29: Logout Functional Requirements

Logout	
FR ID	**FR Description**
FR7.1	The system shall allow users to log out, clearing their session, removing the user's authentication token from local storage, and navigating the user to the starting page of the application.

Table 4. 30: Error handling Functional Requirements

Error Handling	
FR ID	**FR Description**
FR8.1	The system shall display appropriate error messages for invalid inputs or actions.
FR8.2	The system shall guide users on how to rectify errors when they occur.

4.5.3 Non-Functional Requirements (NFR):

Table 4. 31: Usability Non-Functional Requirements

Usability	
NFR ID	**NFR Description**
NFR1.1	The system shall provide a user-friendly interface with clear navigation options.
NFR1.2	The system shall provide clear error messages to guide users in case of mistakes or system errors.
NFR1.3	The system shall not include any ads.

Table 4. 32: Performance Non-Functional Requirements

Performance	
NFR ID	**NFR Description**
NFR2.1	The system shall respond to user inputs within 2 seconds.
NFR2.2	Image uploads for pet listings shall not exceed 10 seconds per image.

Table 4. 33: Security Non-Functional Requirements

Security	
NFR ID	**NFR Description**
NFR3.1	User passwords shall be hashed before being stored in the database.
NFR3.2	The system shall securely remove the user's authentication token from local storage during the log-out process.

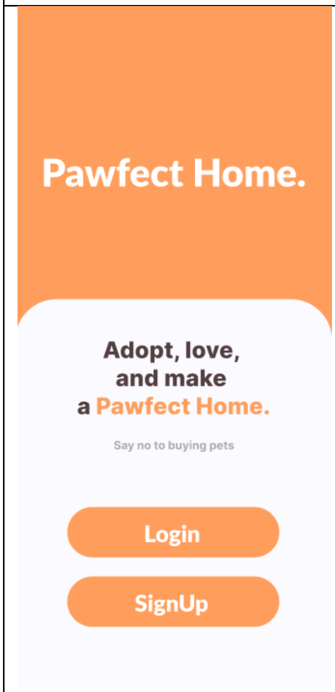
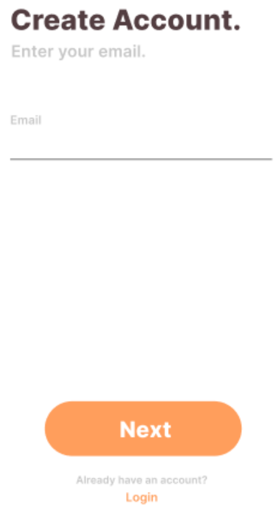
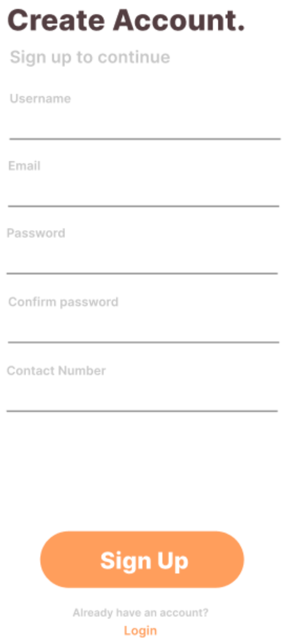
Table 4. 34: Interoperability Non-Functional Requirements

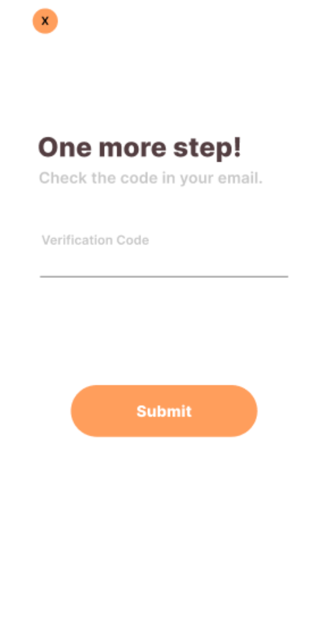
Interoperability	
NFR ID	**NFR Description**
NFR5.1	The system shall be responsive and compatible with any Android device.

4.6 Prototype interface

The following table and figures are demonstrating the prototype UI of the mobile application which will be using for UI testing later. The table gives a general idea of what the actual mobile application would look like.

Table 4. 35: Prototype screenshots

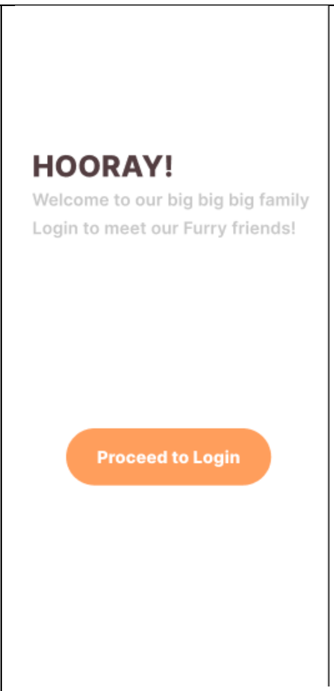
Protype Screenshots		
 Pawfect Home. Adopt, love, and make a Pawfect Home. Say no to buying pets Login SignUp Figure 4. 3: Initial Page	 Create Account. Enter your email. Email Next Already have an account? Login Figure 4. 4: Create account	 Create Account. Sign up to continue Username Email Password Confirm password Contact Number Sign Up Already have an account? Login Figure 4. 5: Create account 2



One more step!

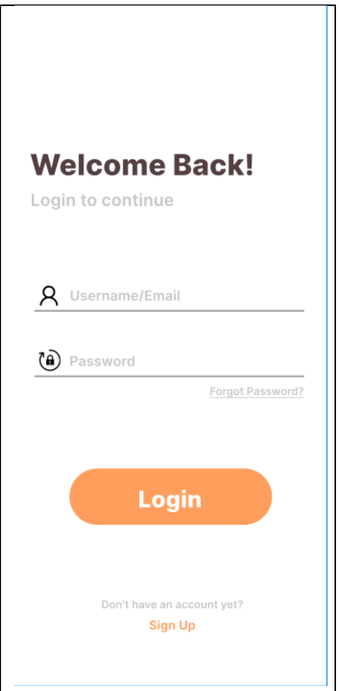
Check the code in your email.

Figure 4. 6: Email verification


HOORAY!

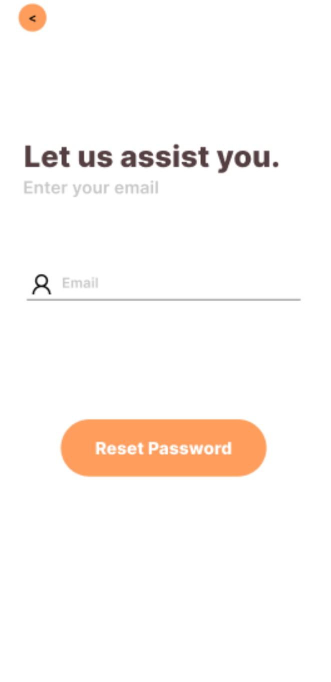
Welcome to our big big big family Login to meet our Furry friends!

Figure 4. 7: Success page


Welcome Back!

Login to continue

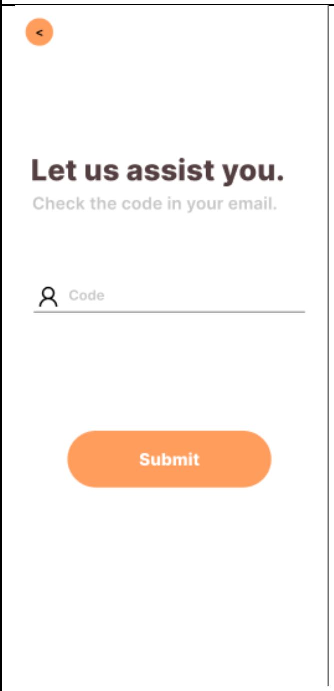
Figure 4. 8: Login page



Let us assist you.

Enter your email

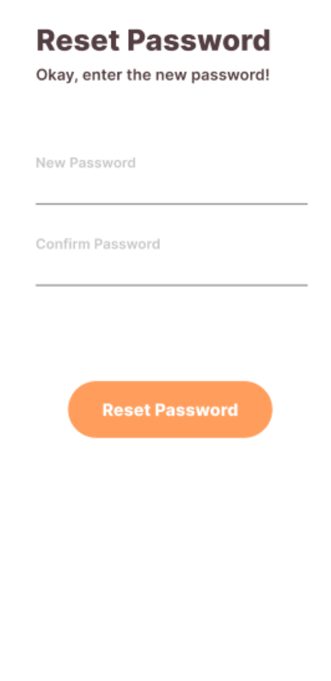
Figure 4. 9: Forgot password



Let us assist you.

Check the code in your email.

Figure 4. 10: Forgot password 2


Reset Password

Okay, enter the new password!

Figure 4. 11: Reset password

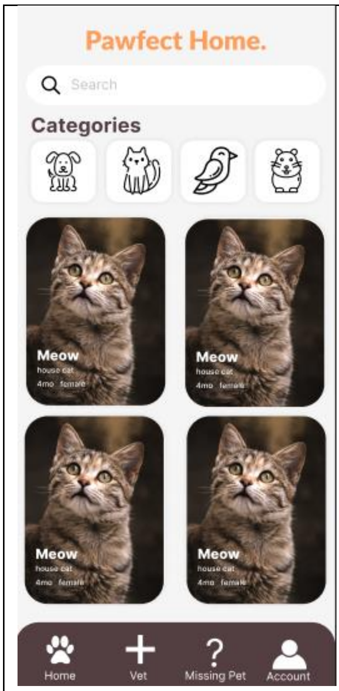
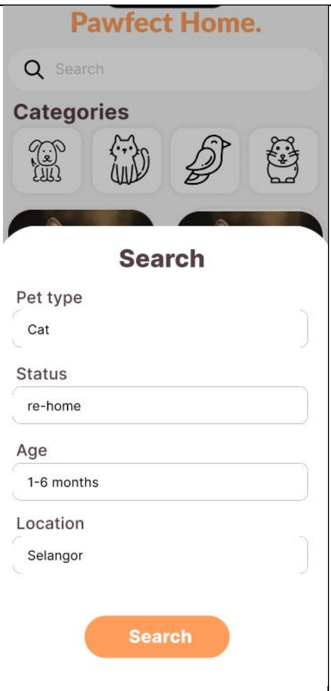


Figure 4. 12: Home screen



Search

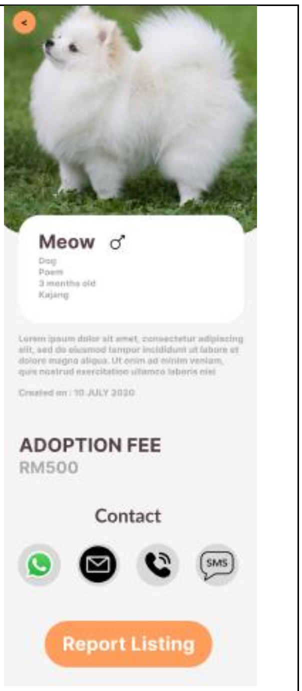
Pet type: Cat

Status: re-home

Age: 1-6 months

Location: Selangor

Figure 4. 13: Search


Meow ♂

Dog
Poem
3 months old
Kajang

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi

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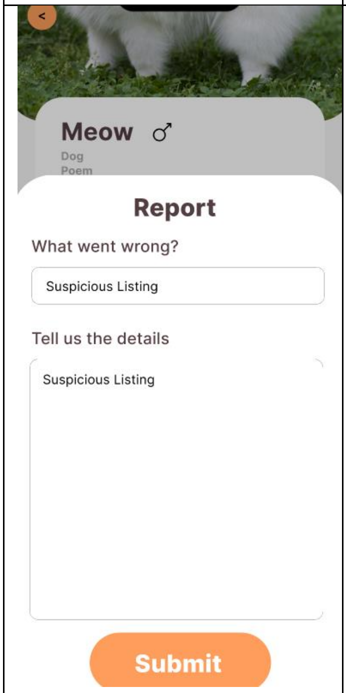
ADOPTION FEE
RM500

Figure 4. 14: Pet details

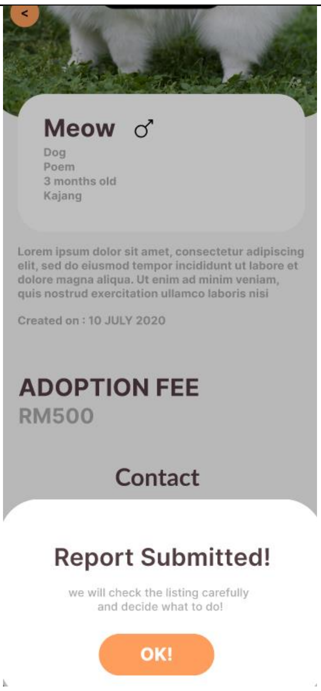


Report

What went wrong?: Suspicious Listing

Tell us the details: Suspicious Listing

Figure 4. 15: Report listing


Meow ♂

Dog
Poem
3 months old
Kajang

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi

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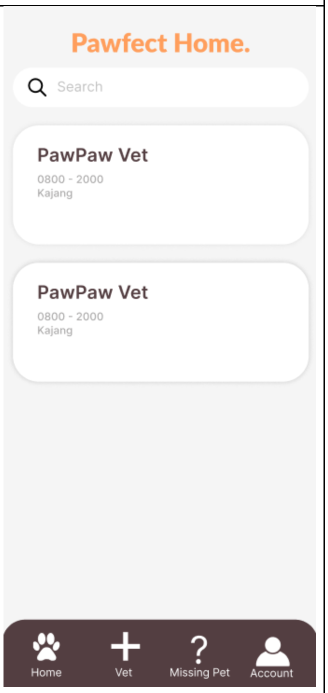
Contact

Report Submitted!

we will check the listing carefully and decide what to do!

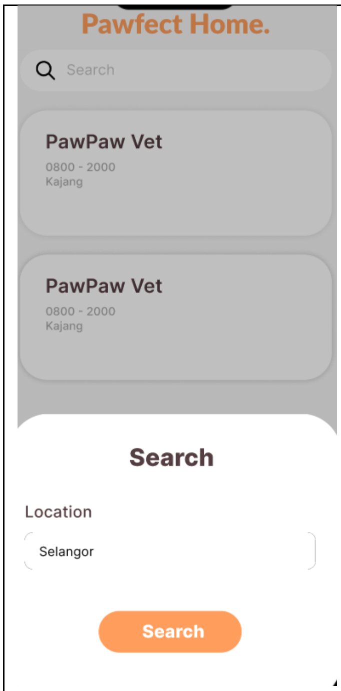
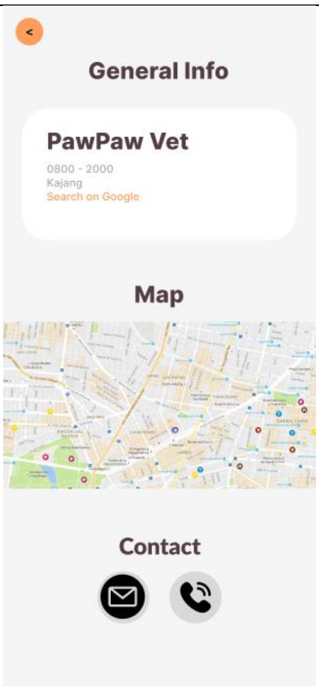
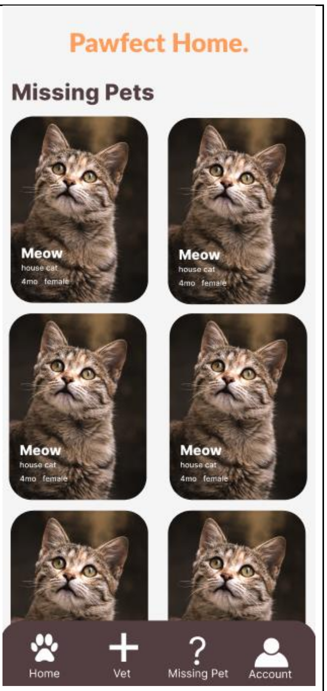
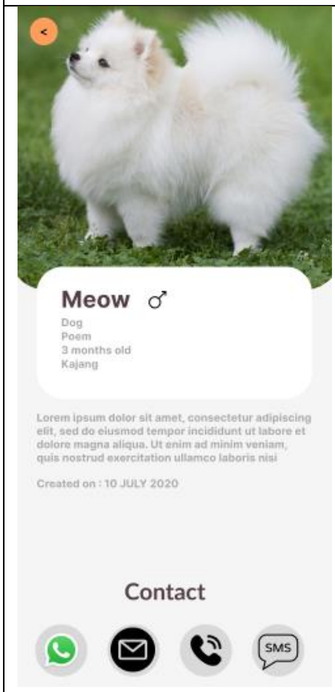
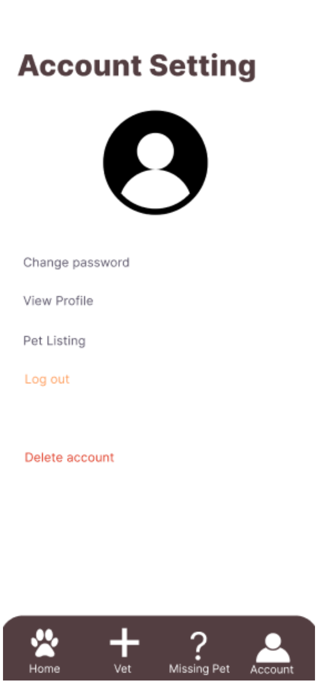
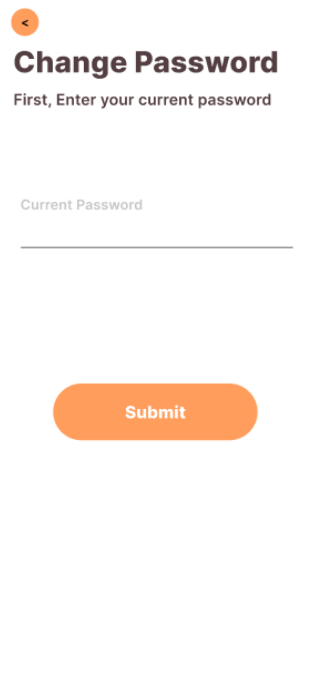
Figure 4. 16: Report submitted

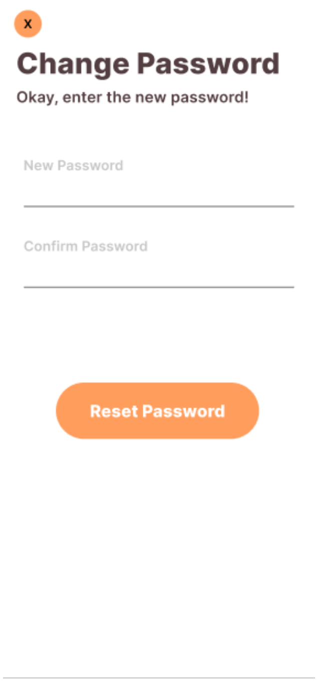


PawPaw Vet
0800 - 2000
Kajang

PawPaw Vet
0800 - 2000
Kajang

Figure 4. 17: Vet

 Pawfect Home. Search PawPaw Vet 0800 - 2000 Kajang PawPaw Vet 0800 - 2000 Kajang Search Location Selangor Search Figure 4. 18: Search vet	 General Info PawPaw Vet 0800 - 2000 Kajang Search on Google Map Contact Figure 4. 19: Vet details	 Pawfect Home. Missing Pets Meow house cat 4mo female Meow house cat 4mo female Meow house cat 4mo female Meow house cat 4mo female Home Vet Missing Pet Account Figure 4. 20: Lost Pet
 Meow ♂ Dog Poem 3 months old Kajang Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi Created on : 10 JULY 2020 Contact SMS Figure 4. 21: Lost pet details	 Account Setting Change password View Profile Pet Listing Log out Delete account Home Vet Missing Pet Account Figure 4. 22: Account setting	 Change Password First, Enter your current password Current Password Submit Figure 4. 23: Change Password



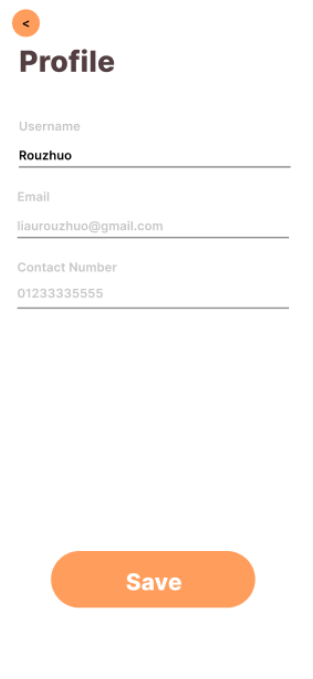
Change Password

Okay, enter the new password!

New Password

Confirm Password

Figure 4. 24: Change Password 2



Profile

Username: Rouzhuo

Email: liaurouzhuo@gmail.com

Contact Number: 01233335555

Figure 4. 25: Profile

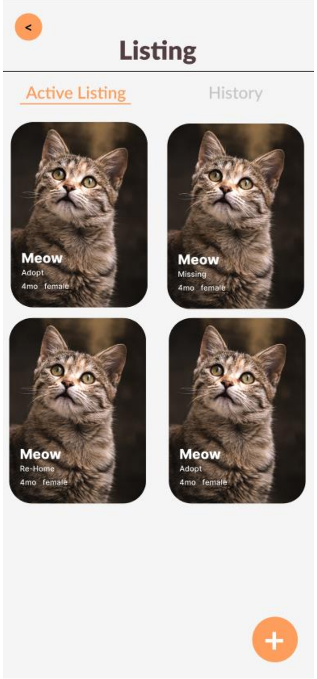


Figure 4. 26: User created listing

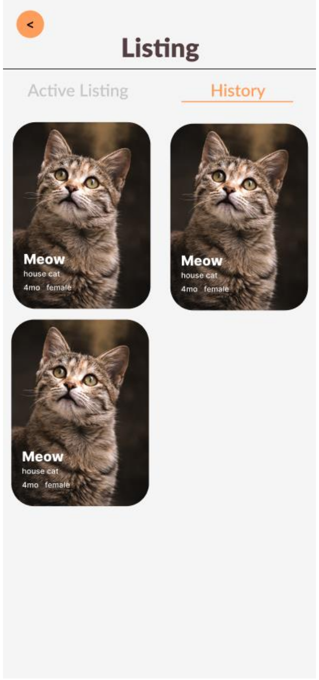
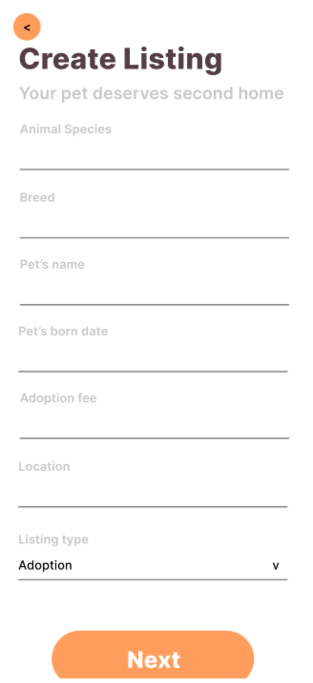


Figure 4. 27: User created listing history



Create Listing

Your pet deserves second home

Animal Species

Breed

Pet's name

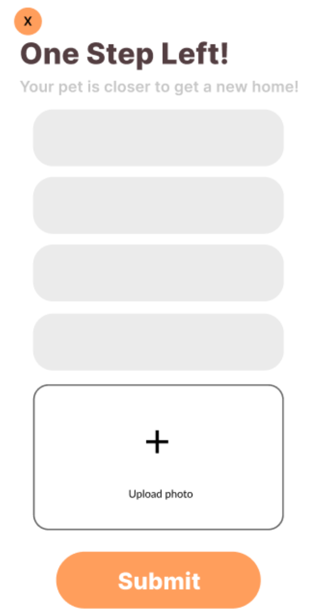
Pet's born date

Adoption fee

Location

Listing type: Adoption

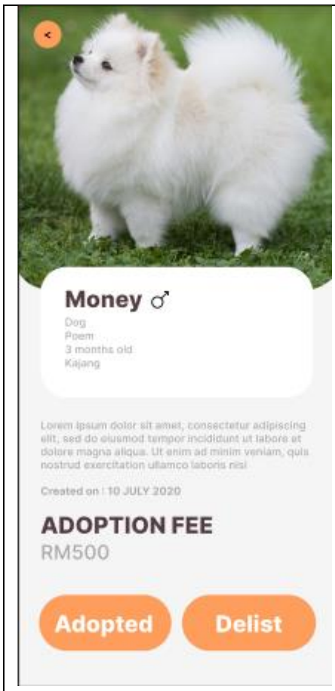
Figure 4. 28: Create listing



One Step Left!

Your pet is closer to get a new home!

Figure 4. 29: Create listing image uploading



Money ♂

Dog
Poem
3 months old
Kajang

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi

Created on : 10 JULY 2020

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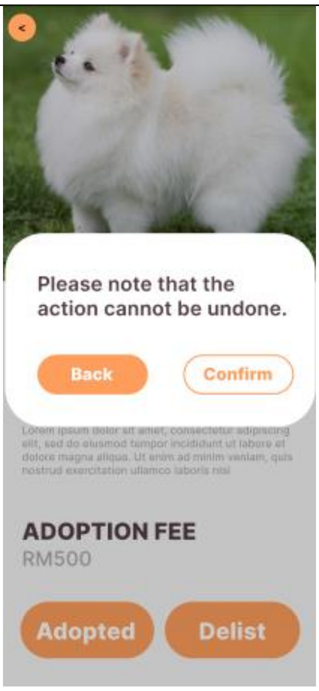
RM500

Figure 4. 30: User created listing details

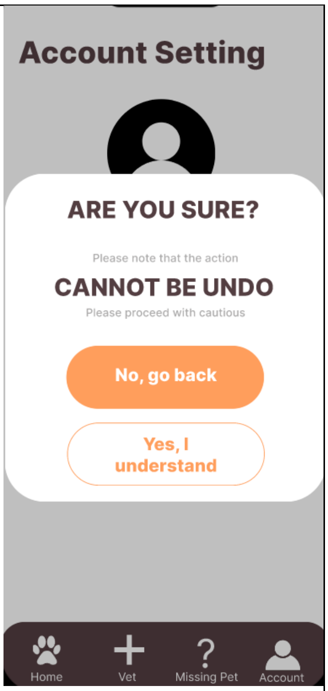


Please note that the action cannot be undone.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi

ADOPTION FEE
RM500

Figure 4. 31: Confirmation action

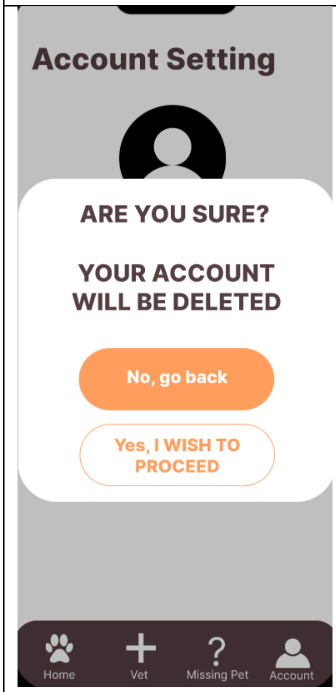


Account Setting

ARE YOU SURE?

Please note that the action
CANNOT BE UNDO
Please proceed with cautious

Figure 4. 32: Delete account

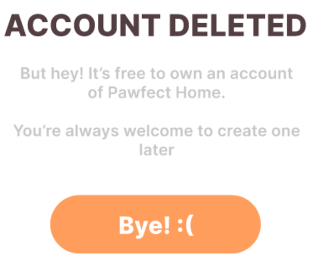


Account Setting

ARE YOU SURE?

YOUR ACCOUNT WILL BE DELETED

Figure 4. 33: Delete account 2



ACCOUNT DELETED

But hey! It's free to own an account of Pawfect Home.

You're always welcome to create one later

Figure 4. 34: Delete account 3

CHAPTER 5

PROJECT DESIGN

5.1 Introduction

The design phase of any project is crucial, the design phase build the foundation upon which the entire system is built. In this chapter, the design elements of the project will be explained in detail with diagrams, providing a comprehensive overview of the various components that collectively shape the system's architecture and user experience. The chapter begin with the Database Entity Relationship Diagram (ERD), the structural relationships and the table structure within the database, ensuring data integrity and efficiency. The Use Case Diagram and the use case descriptions offer insights into the system's functional requirements, detailing the interactions between the users and the system. Then, the Requirements section includes both functional and non-functional requirements that provided a clear idea about the system to make the development easier. Lastly, the Prototype Design provides a tangible representation of the system's user interface. In short, these components not only define the system's blueprint and the general idea of the mobile application but also ensure that the final product aligns seamlessly with user requirements and project objectives.

5.2 Database Design

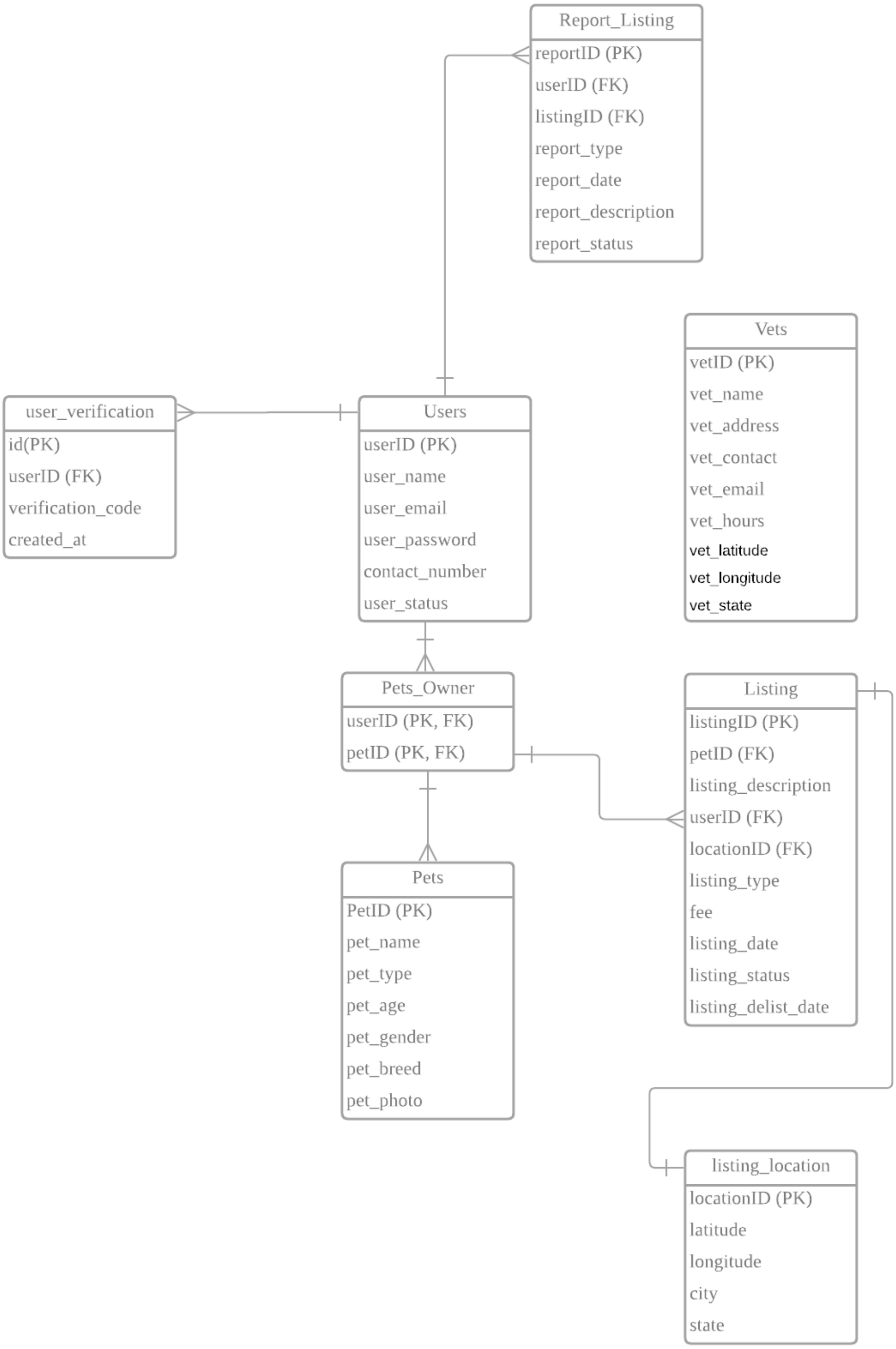


Figure 5. 1: ERD Diagram

Table 5. 1: Users database table

Field	**Type**	**Description**
userID	Int (PK)	This is the primary key of the Users table; It will have an auto increment feature to automatically generate a unique value to every record that entered to the database
user_name	String	This field will be storing user's name
user_email	String	This field will be storing user's email
user_password	String	This field will be storing user's password
contact_number	String	This field will be storing user's contact number
user_status	String	This field will be storing user's status

Table 5. 2: Pets database table

Field	**Type**	**Description**
PetID	Int(PK)	This is the primary key of the Pet table; It will have an auto increment feature to automatically generate a unique value to every record that entered to the database
pet_name	String	This field will be storing pet’s name
pet_type	String	This field will be storing pet’s type
pet_age	Int	This field will be storing pet’s age
pet_gender	String	This field will be storing pet’s gender
pet_breed	String	This field will be storing pet’s breed
pet_photo	String	This field will be storing pet’s photo’s name

Table 5. 3: pet_owners database table

Field	**Type**	**Description**
PetID	Int (PK) (FK)	This is the primary key and foreign key of the Pet Owners table; It will have an auto increment feature to automatically generate a unique value to every record that entered to the database
UserID	Int(PK) (FK)	This is the primary key and foreign key of the Pet Owners table; It will have an auto increment feature to automatically generate a unique value to every record that entered to the database

Table 5. 4: listing database table

Field	**Type**	**Description**
listingID	Int(PK)	This is the primary key of the Listing table; It will have an auto increment feature to automatically generate a unique value to every record that entered to the database
petID	Int (FK)	This is a foreign key linked from Pet Owners table
listing_description	String	This field will be storing listing's description
UserID	Int	This is a foreign key linked from Pet Owners table
locationID	Int(FK)	This field will be storing the location's id from listing_location table
listing_type	String	This field will be storing either rehome, missing or adoption of the pets
fee	String	This field will be storing reward fee / adoption fee of the pet listing
listing_date	DATE	This field will be storing date of creation of the pet listing
listing_status	String	This field will be storing listing status

listing_delist_date	DATE	This field will be storing date of delist of the pet listing

Table 5. 5: Report listing database table

Field	**Type**	**Description**
reportID	Int(PK)	This is the primary key of the report_listing table; It will have an auto increment feature to automatically generate a unique value to every record that entered to the database
userID	Int (FK)	This is a foreign key linked from User table
listingID	Int(FK)	This is a foreign key which will be taken out the listingID based on the userID
Report_type	String	This field will be storing the type of report made
Report_date	DATE	This field will be storing the date of the report
Report_description	String	This field will be storing the description of the report
Report_status	String	This field will be storing the status of the report

Table 5. 6: user_verification database table

Field	**Type**	**Description**

id	Int (PK)	This is the primary key of the user verification table; It will have an auto increment feature to automatically generate a unique value to every record that entered to the database
userID	Int (FK)	This field will be storing user ID
verification_code	String	This field will be storing verification code
created_at	DATE	This field will be storing date of record created

Table 5. 7: Vets database table

Field	**Type**	**Description**
vetID	Int (PK)	This is the primary key of the Vet table; It will have an auto increment feature to automatically generate a unique value to every record that entered to the database
vet_name	String	This field will be storing vet's name
vet_address	String	This field will be storing vet's address
vet_contact	String	This field will be storing vet's contact number
vet_email	String	This field will be storing vet's email

vet hours	String	This field will be storing vet’s operating hours
vet_latitude	String	This field will be storing vet’s latitude
vet_longitude	String	This field will be stroing vet’s longitude
vet_state	String	This field will be strong vet’s state

Table 5. 8: Listing_location database table

Field	Type	Description
locationID	Int (PK)	This is the primary key of the listing location table; It will have an auto increment feature to automatically generate a unique value to every record that entered to the database
city	String	This field will be storing city
state	String	This field will be storing state
latitude	String	This field will be stroing vet's latitude
longitude	String	This field will be stroing vet's longitude

5.3 Data Flow Diagram

A Data Flow Diagram (DFD) is a graphical representation used to visualize the flow of data within a system, showing how input data is transformed into output data through processes and data stores. It provides a clear picture of the system's components, the flow of information, and the interactions among different components.

In this chapter, the DFD is used to demonstrate the flows of the four main processes: Manage Account, Process Pet Listing, Pet Listing Creation, and Process Vet Listing. There are three levels of DFD: the Context Diagram, which illustrates the flows for the whole system; Level 0, which illustrates the flows for different processes; and Level 1, which illustrates the flows individually for all four processes. Assumptions have been included in the DFDs for better understanding and improve readability.

5.3.1 Data Flow Diagram Context Diagram

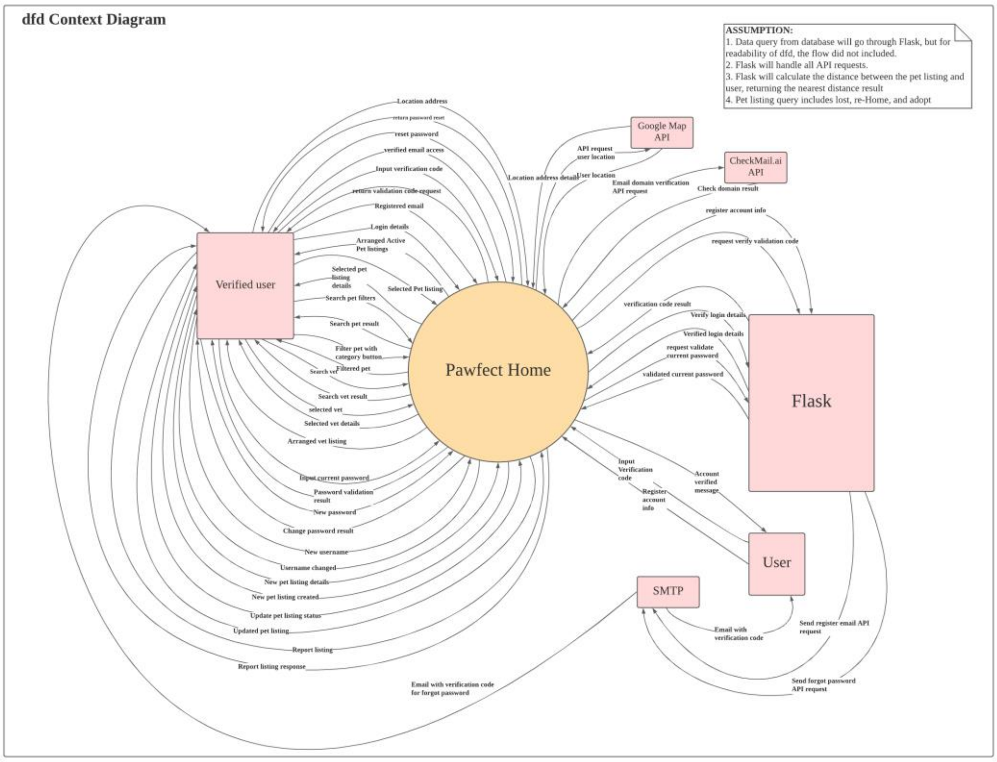
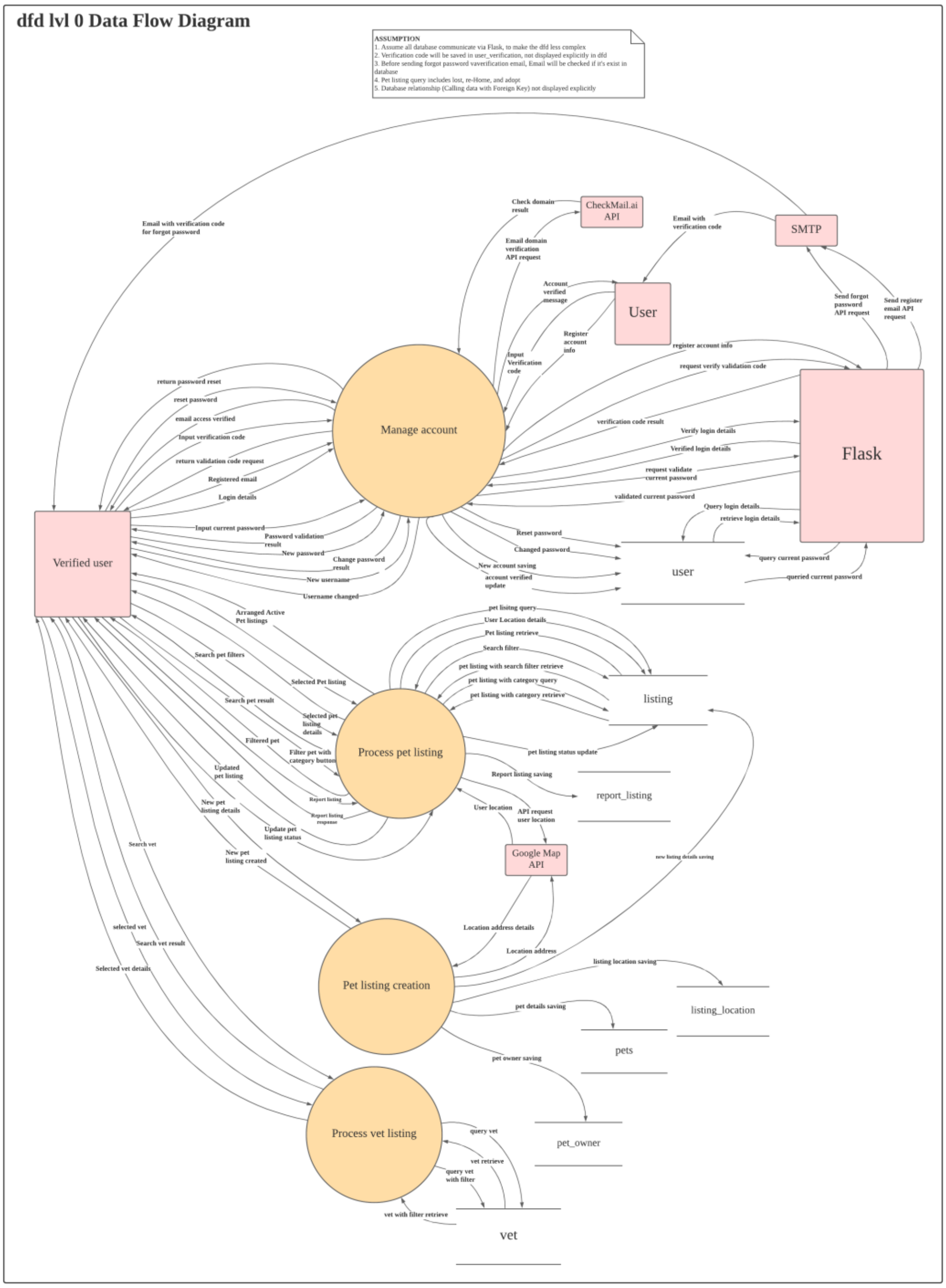


Figure 5. 2: DFD Context Diagram

5.3.2 Data Flow Diagram Level 0

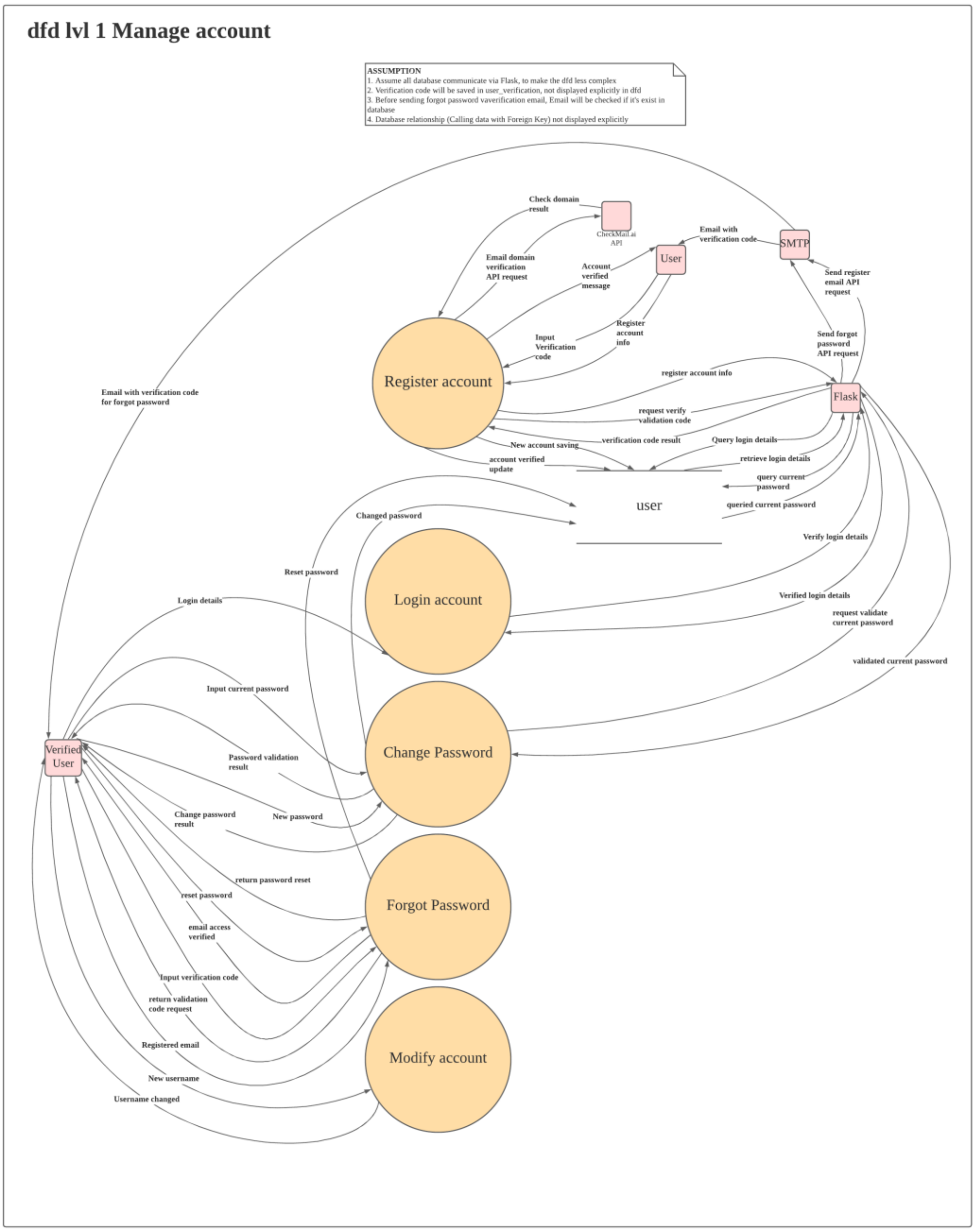


dfd lvl 0 Data Flow Diagram

ASSUMPTION
1. Assume all database communicate via Flask, to make the dfd less complex
2. Verification code will be saved in user_verification, not displayed explicitly in dfd
3. Before sending forgot password vaverification email, Email will be checked if it's exist in database
4. Pet listing query includes lost, re-Home, and adopt
5. Database relationship (Calling data with Foreign Key) not displayed explicitly

Figure 5. 3: DFD level 0

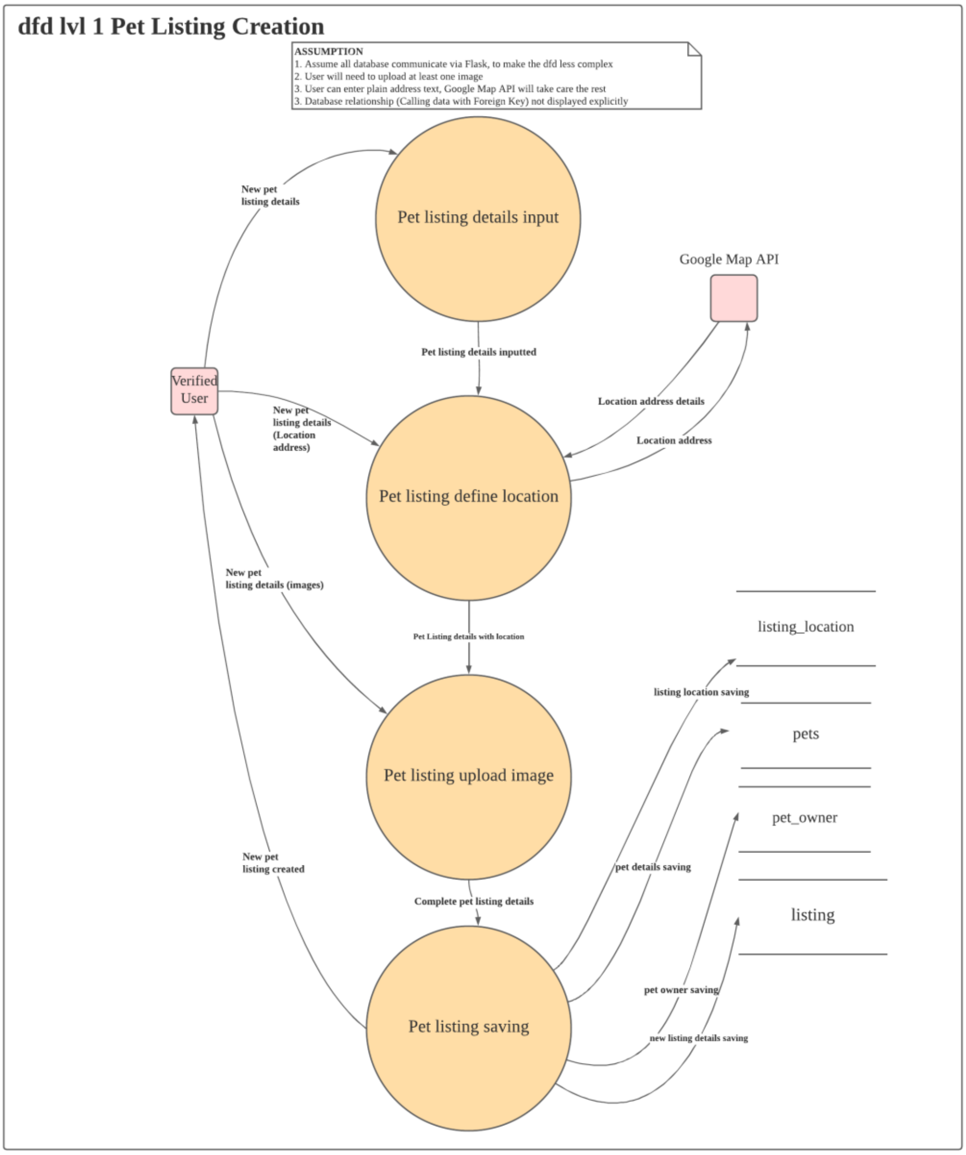
5.3.3 Data Flow Diagram level 1 Manage Account



ASSUMPTION
1. Assume all database communicate via Flask, to make the dfd less complex
2. Verification code will be saved in user_verification, not displayed explicitly in dfd
3. Before sending forgot password vaverification email, Email will be checked if it's exist in database
4. Database relationship (Calling data with Foreign Key) not displayed explicitly

Figure 5. 4: DFD level 1 manage account

5.3.4 Data Flow Diagram level 1 Pet Listing Creation

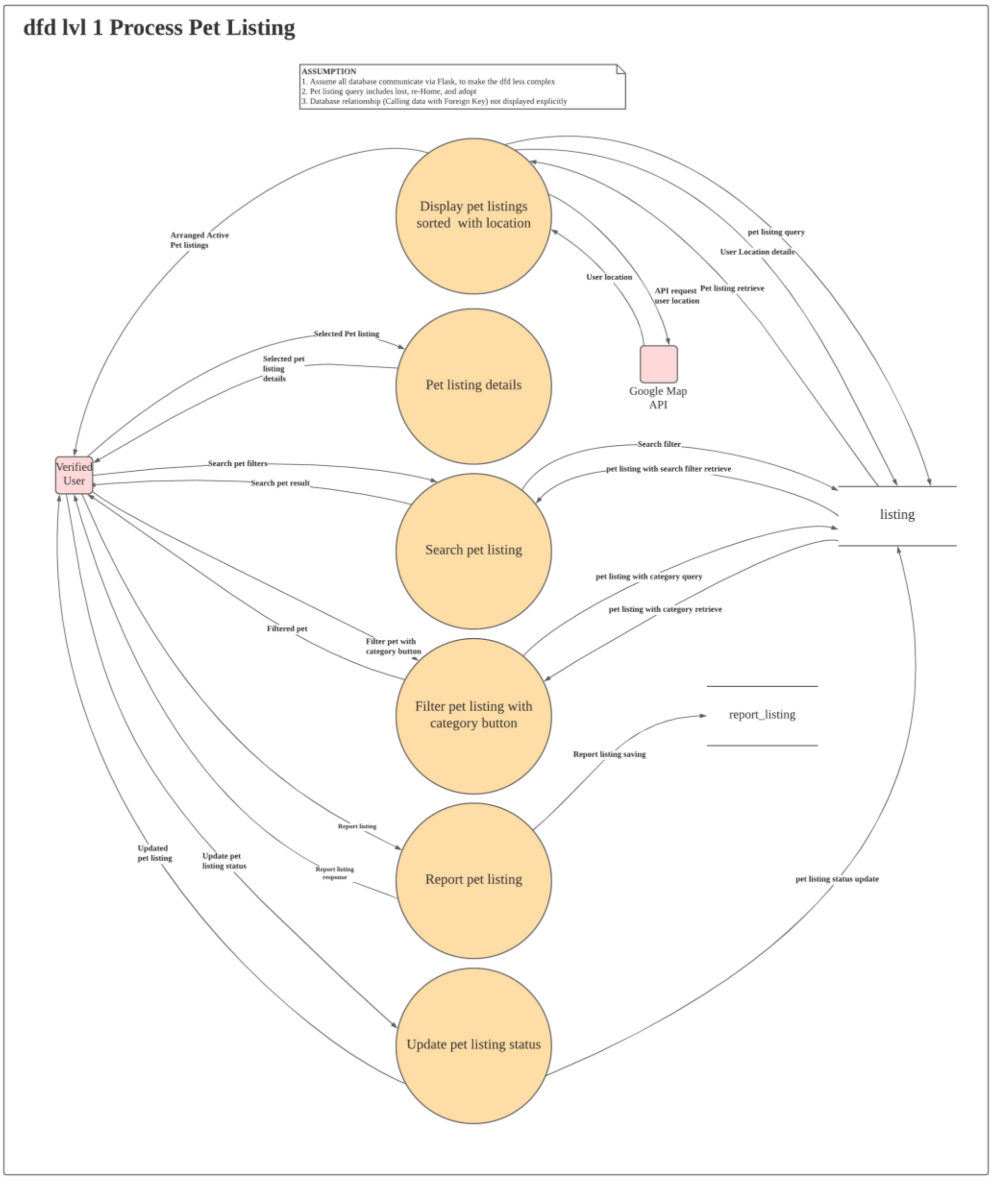


dfd lvl 1 Pet Listing Creation

ASSUMPTION
1. Assume all database communicate via Flask, to make the dfd less complex
2. User will need to upload at least one image
3. User can enter plain address text, Google Map API will take care the rest
3. Database relationship (Calling data with Foreign Key) not displayed explicitly

Figure 5. 5: DFD lvl 1 pet listing creation

5.3.5 Data Flow Diagram level 1 Process Pet Listing

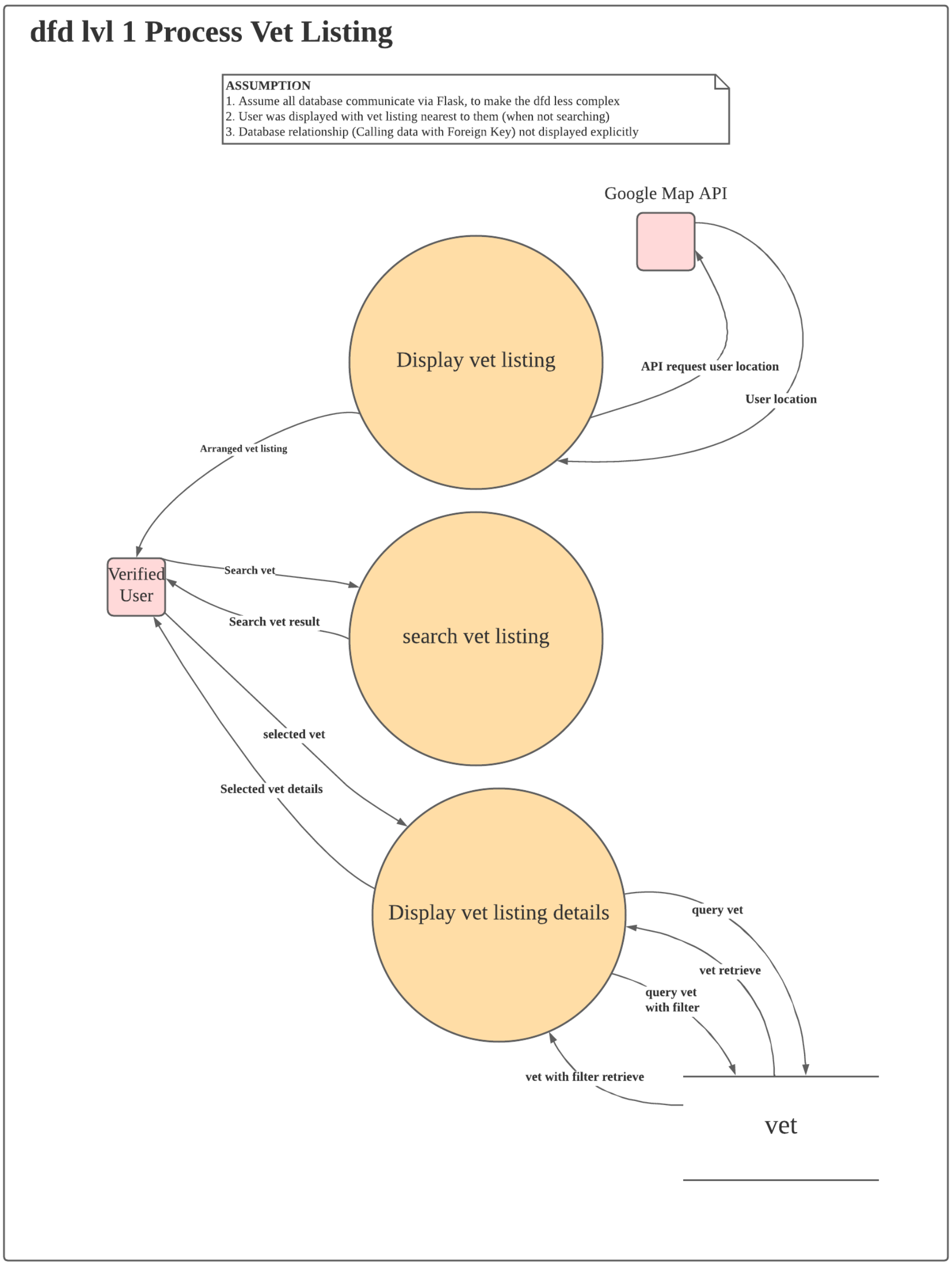

dfd lvl 1 Process Pet Listing

ASSUMPTION
1. Assume all database communicate via Flask, to make the dfd less complex
2. Pet listing query includes lost, re-Home, and adopt
3. Database relationship (Calling data with Foreign Key) not displayed explicitly

Display pet listings sorted with location
Arranged Active Pet listings
pet lisitng query
User Location details
User location
API request user location
Pet listing retrieve
Google Map API
Selected Pet listing
Selected pet listing details
Pet listing details
Verified User
Search pet filters
Search pet result
Search filter
pet listing with search filter retrieve
listing
Search pet listing
pet listing with category query
pet listing with category retrieve
Filtered pet
Filter pet with category button
Filter pet listing with category button
report_listing
Report listing saving
Report listing
Report listing response
Updated pet listing
Update pet listing status
Report pet listing
pet listing status update
Update pet listing status

Figure 5. 6: DFD lvl 1 Process pet listing

5.3.6 Data Flow Diagram level 1 Process Vet Listing



ASSUMPTION
1. Assume all database communicate via Flask, to make the dfd less complex
2. User was displayed with vet listing nearest to them (when not searching)
3. Database relationship (Calling data with Foreign Key) not displayed explicitly

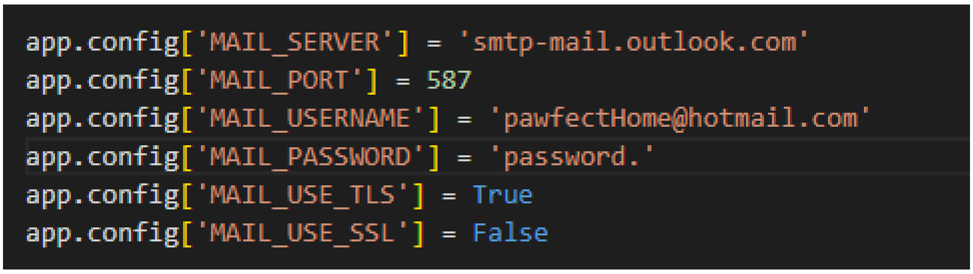
Figure 5. 7: DFD lvl 1 process vet listing

5.4 Email verification approach

For the ease of explanation, account verification process will be used directly to explain how email verification is done.

In the email verification process, when a user initiates the verification from the React Native application, the system first checks if the provided email exists in the database. If the email is recognized, the system generates a unique 6-digit verification code. This code is then dispatched to the user's email address and stored into the database.

The email dispatching is facilitated by an SMTP server setup. SMTP, which stands for Simple Mail Transfer Protocol, is a protocol used to send emails. Before the SMTP server can be used, the project needs an email to send email address. Hence, “pawfecthome@hotmail.com” was created via outlook.com and verified with phone number to avoid getting flagged as spam email. Furthermore, email server, email port, email username, and email password needed to be configured correctly.



```
app.config['MAIL_SERVER'] = 'smtp-mail.outlook.com'
app.config['MAIL_PORT'] = 587
app.config['MAIL_USERNAME'] = 'pawfectHome@hotmail.com'
app.config['MAIL_PASSWORD'] = 'password.'
app.config['MAIL_USE_TLS'] = True
app.config['MAIL_USE_SSL'] = False
```

Figure 5. 8: SMTP setup

Once the user receives the email with the code, they can input the verification code they received into the mobile application. The system then validates the entered code against the one stored in the database. If the code matches and hasn't expired (not exceeding 5 minutes), the user's status in the database will be updated to 'active'. If the code is expired, the user can request a new verification code.

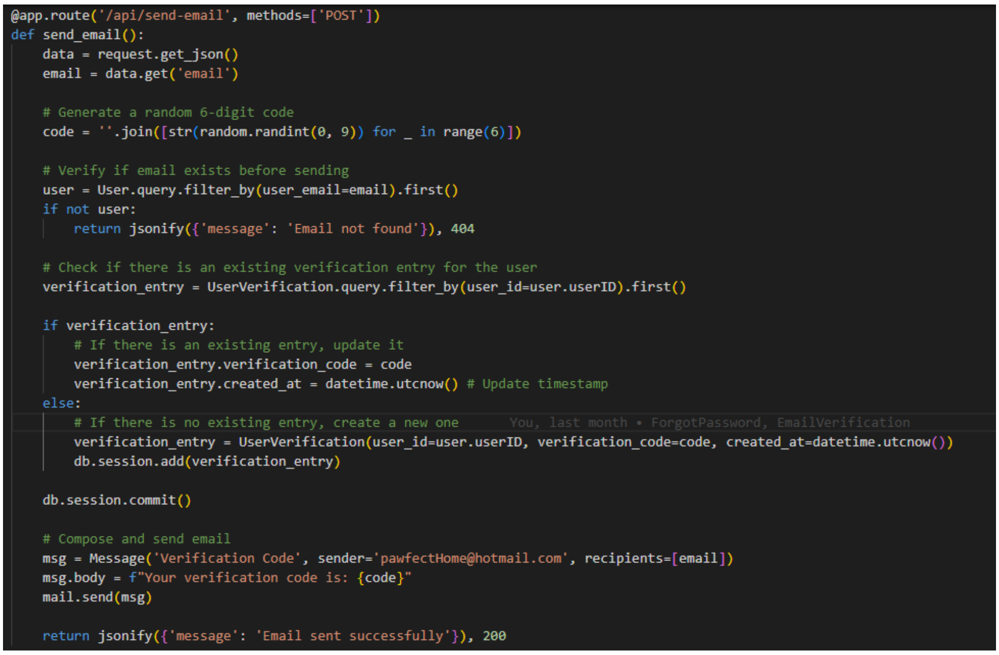
Let’s go in depth by diving into the API in Flask. First, the function starts by extracting the email address from the incoming request. This email address is the one to which the verification code will be sent. After that, a unique 6-digit verification code will be generated randomly. This generated code serves as a verification code for the user to verify their email address.

Before proceeding, the system checks if the provided email address exists in the database just for error proofing. If the email isn't found, the function returns a message indicating the email received by Flask is not found.

After verifying the email existence in database, the system then checks if there's an existing verification entry for the user in the database. This is to determine if the user has previously requested a verification code. If an verification entry exists, the system updates the verification code with the new verification code just generated and refreshes the timestamp to the current time. This ensures that old codes are invalidated. If no verification entry exists, a new verification record is created in the database with the user's ID, the generated code, and the current timestamp.

The system then composes an email with the verification code ready and stored in the database. The email's subject will be "Verification Code" and will be sending from "pawfectHome@hotmail.com". The body of the email contains the generated verification code. The email will then be dispatched to the user. Lastly, after successfully sending the email, the function returns a success message.

This process ensures that the user's email address is both valid and accessible by the user, adding an extra layer of security and authenticity to the user registration process.



```python
@app.route('/api/send-email', methods=['POST'])
def send_email():
    data = request.get_json()
    email = data.get('email')

    # Generate a random 6-digit code
    code = ''.join([str(random.randint(0, 9)) for _ in range(6)])

    # Verify if email exists before sending
    user = User.query.filter_by(user_email=email).first()
    if not user:
        return jsonify({'message': 'Email not found'}), 404

    # Check if there is an existing verification entry for the user
    verification_entry = UserVerification.query.filter_by(user_id=user.userID).first()

    if verification_entry:
        # If there is an existing entry, update it
        verification_entry.verification_code = code
        verification_entry.created_at = datetime.utcnow() # Update timestamp
    else:
        # If there is no existing entry, create a new one      You, last month • ForgotPassword, EmailVerification
        verification_entry = UserVerification(user_id=user.userID, verification_code=code, created_at=datetime.utcnow())
        db.session.add(verification_entry)

    db.session.commit()

    # Compose and send email
    msg = Message('Verification Code', sender='pawfectHome@hotmail.com', recipients=[email])
    msg.body = f"Your verification code is: {code}"
    mail.send(msg)

    return jsonify({'message': 'Email sent successfully'}), 200
```

Figure 5. 9: Send Email API

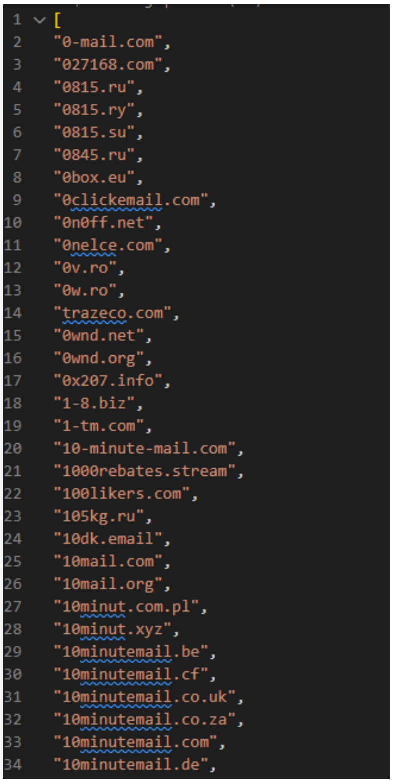
5.5 Email domain verification approach

For the ease of explanation, account registration process will be used directly to explain how email domain verification is done.

When the user tries to register an account, the mobile application captures various user inputs, including the username, email, password, and contact number. The system will be ensuring that the provided email is not only valid but also not from a disposable domain.

When the user enters their email into the input field, the system checks the email against a regular expression pattern to ensure it's a valid email format. If the email is valid, the function then checks if the email's domain is disposable using the written function. The function will check if the email domain by comparing it with the disposable_email_blocklist.json json list with more than 3500 disposable email domains retrieved from Git Hub repository (martenson, 2014). However, it might be not enough to prevent the registration of disposable email. Hence, the project added a second layer to stop the registration of disposable email.

If the email domain is not matched any domain in the json file, the system will then send an API request to the MailCheck.ai API to call https://api.mailcheck.ai/domain/{domain} to verify that if the email is disposable. It then makes an API call to check if the domain is disposable. If the domain is disposable, the API will return true, indicating that the email domain is not acceptable for registration. Then, the email is from a disposable domain, a warning message "Disposable email not allowed." is displayed to the user. This ensures that users are discouraged from using temporary email addresses, which can be a security risk and can compromise the integrity of the user base.



```
[
"0-mail.com",
"027168.com",
"0815.ru",
"0815.ry",
"0815.su",
"0845.ru",
"0box.eu",
"0clickemail.com",
"0n0ff.net",
"0nelce.com",
"0v.ro",
"0w.ro",
"trazeco.com",
"0wnd.net",
"0wnd.org",
"0x207.info",
"1-8.biz",
"1-tm.com",
"10-minute-mail.com",
"1000rebates.stream",
"100likers.com",
"105kg.ru",
"10dk.email",
"10mail.com",
"10mail.org",
"10minut.com.pl",
"10minut.xyz",
"10minutemail.be",
"10minutemail.cf",
"10minutemail.co.uk",
"10minutemail.co.za",
"10minutemail.com",
"10minutemail.de",
```

Figure 5. 10: Disposable email domain list

Table 5. 9: CheckMail.ai API response

Keys	**Values**
status	The status of the request. Possibles values are: 200 The request is successful 400 The request is invalid 429 The rate limit is exceeded
domain	The domain you sent
mx	Whether or not the domain has MX records
disposable	true: the email is disposable false: the email is not disposable
did_you_mean	return suggested valid domain
error	error description

5.6 Location implementation

Several location functions were implemented. These implementations were primarily related to Google's location services, specifically the Google Places API, to provide location-related functionalities.

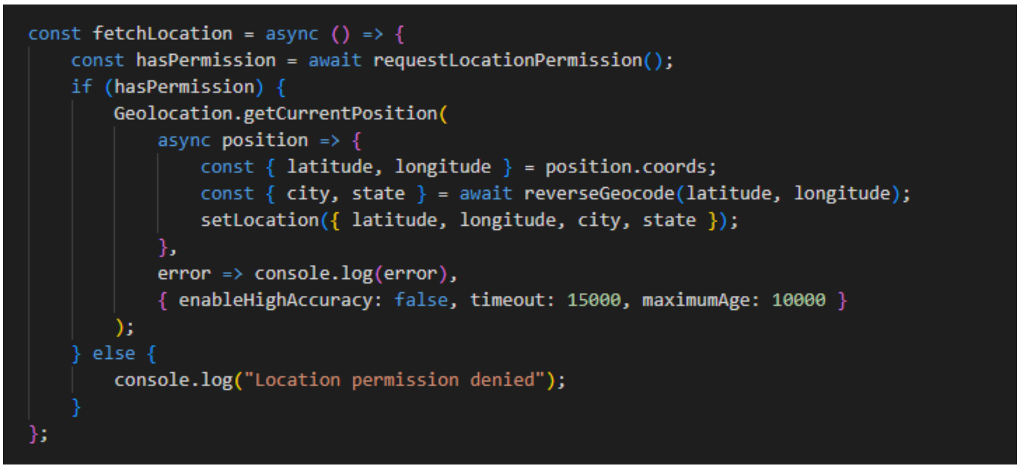
Firstly, before accessing the device’s location, the app requested permission to access the user’s location. If permission was granted, the user’s location was retrieved using the Geolocation.getCurrentPosition method to obtain the user’s longitude and latitude via Google’s location service.

Another core feature was the Google Places Autocomplete. The component Google Places Autocomplete was used to allow users to search for a location. As the user typed, it provided real-time suggestions based on the input. When a user selected a location from the suggestions, a request was made to the Google API. The Google API then responded with the location details, including the city, state, latitude, and longitude of the selected location. To enhance the user experience, the results displayed were restricted to Malaysia and prioritized results within a 10km radius. This was crucial for users to determine their pet's location, facilitating a smoother pet adoption process and enhancing the user experience.

Furthermore, Reverse Geocoding was used to convert a set of latitude and longitude coordinates into a human-readable address. Reverse geocoding was implemented to obtain the user's location details, converting their coordinates to an address after the user had granted location permission, and for error-proofing.

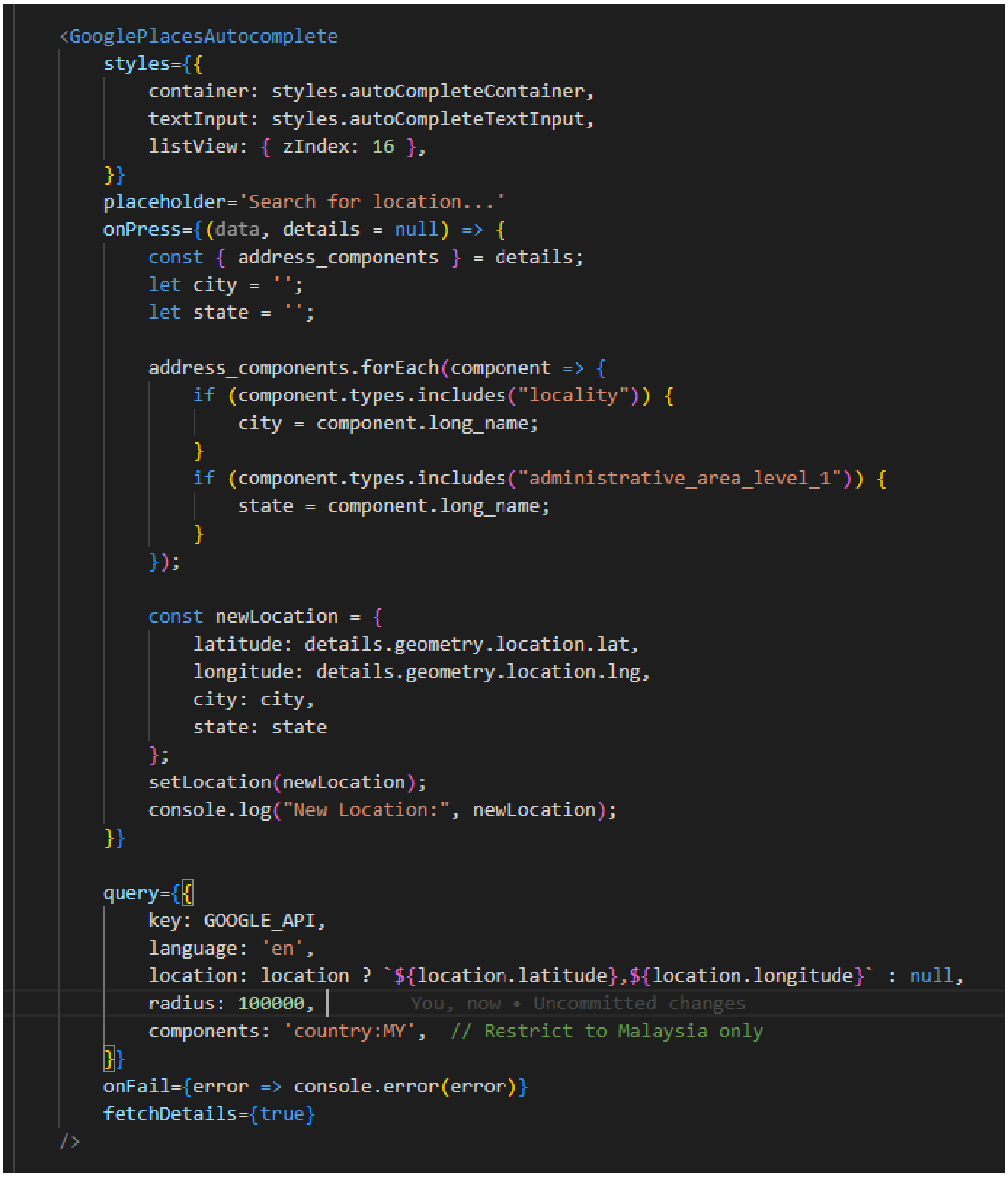
Additionally, the MapView component was implemented. MapView displayed a map centered around the user's selected or current location. A red marker was placed on the map at the specified latitude and longitude. The map also allowed users to select a new location by tapping on it.

If the user's location permission was granted and their latitude and longitude were provided, the distance between the user's location and the listing's location was calculated using the haversine_distance function. This function calculated the distance between two points on the Earth's surface given their latitude and longitude. The results were then sorted by distance in ascending order, meaning the nearest results appeared first.



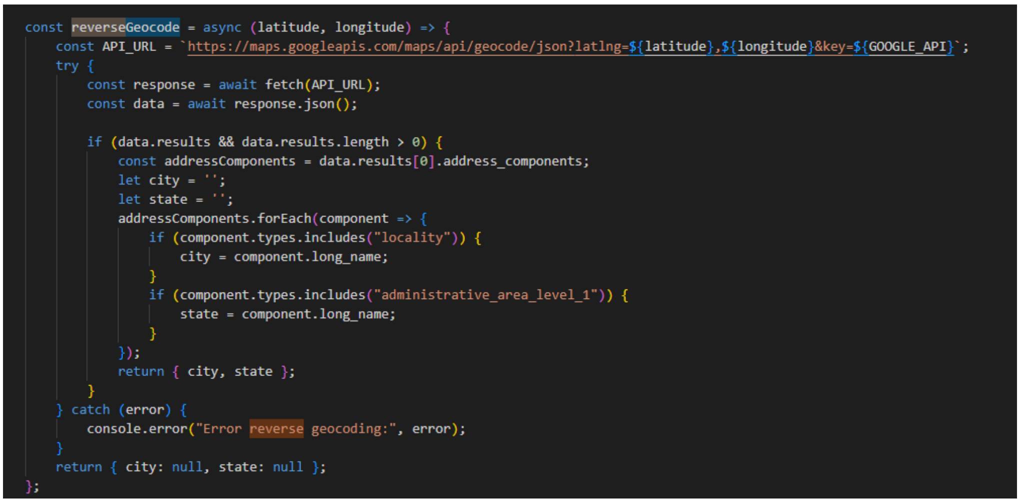
```
const fetchLocation = async () => {
    const hasPermission = await requestLocationPermission();
    if (hasPermission) {
        Geolocation.getCurrentPosition(
            async position => {
                const { latitude, longitude } = position.coords;
                const { city, state } = await reverseGeocode(latitude, longitude);
                setLocation({ latitude, longitude, city, state });
            },
            error => console.log(error),
            { enableHighAccuracy: false, timeout: 15000, maximumAge: 10000 }
        );
    } else {
        console.log("Location permission denied");
    }
};
```

Figure 5. 11: Ask location code



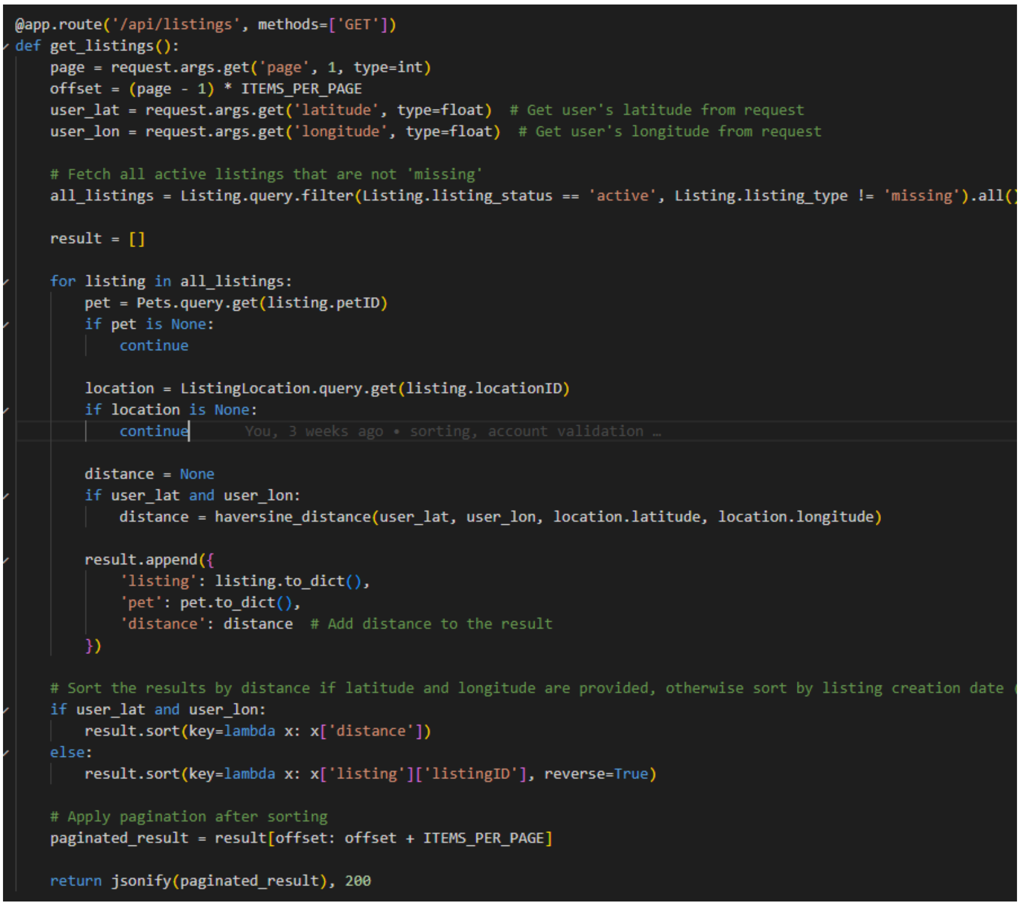
```
    <GooglePlacesAutocomplete
        styles={{
            container: styles.autoCompleteContainer,
            textInput: styles.autoCompleteTextInput,
            listView: { zIndex: 16 },
        }}
        placeholder='Search for location...'
        onPress={(data, details = null) => {
            const { address_components } = details;
            let city = '';
            let state = '';

            address_components.forEach(component => {
                if (component.types.includes("locality")) {
                    city = component.long_name;
                }
                if (component.types.includes("administrative_area_level_1")) {
                    state = component.long_name;
                }
            });

            const newLocation = {
                latitude: details.geometry.location.lat,
                longitude: details.geometry.location.lng,
                city: city,
                state: state
            };
            setLocation(newLocation);
            console.log("New Location:", newLocation);
        }}

        query={{
            key: GOOGLE_API,
            language: 'en',
            location: location ? `${location.latitude},${location.longitude}` : null,
            radius: 100000,          You, now • Uncommitted changes
            components: 'country:MY',  // Restrict to Malaysia only
        }}
        onFail={error => console.error(error)}
        fetchDetails={true}
    />
```

Figure 5. 12: GooglePlacesAutoComplete



```javascript
const reverseGeocode = async (latitude, longitude) => {
    const API_URL = `https://maps.googleapis.com/maps/api/geocode/json?latlng=${latitude},${longitude}&key=${GOOGLE_API}`;
    try {
        const response = await fetch(API_URL);
        const data = await response.json();

        if (data.results && data.results.length > 0) {
            const addressComponents = data.results[0].address_components;
            let city = '';
            let state = '';
            addressComponents.forEach(component => {
                if (component.types.includes("locality")) {
                    city = component.long_name;
                }
                if (component.types.includes("administrative_area_level_1")) {
                    state = component.long_name;
                }
            });
            return { city, state };
        }
    } catch (error) {
        console.error("Error reverse geocoding:", error);
    }
    return { city: null, state: null };
};
```

Figure 5. 13: Reverse Geocode

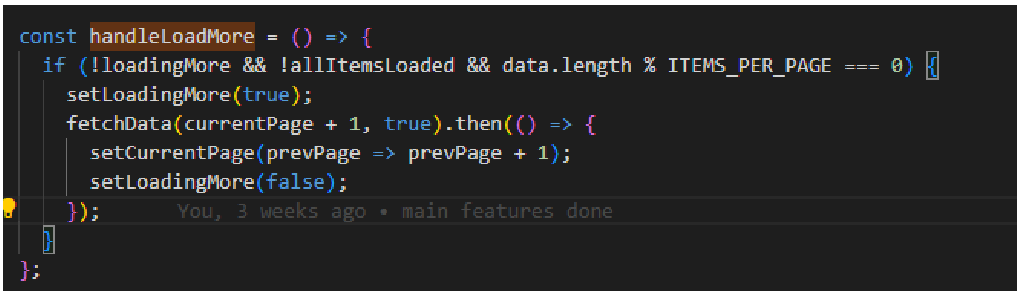


```python
@app.route('/api/listings', methods=['GET'])
def get_listings():
    page = request.args.get('page', 1, type=int)
    offset = (page - 1) * ITEMS_PER_PAGE
    user_lat = request.args.get('latitude', type=float)  # Get user's latitude from request
    user_lon = request.args.get('longitude', type=float)  # Get user's longitude from request

    # Fetch all active listings that are not 'missing'
    all_listings = Listing.query.filter(Listing.listing_status == 'active', Listing.listing_type != 'missing').all()

    result = []

    for listing in all_listings:
        pet = Pets.query.get(listing.petID)
        if pet is None:
            continue

        location = ListingLocation.query.get(listing.locationID)
        if location is None:
            continue        You, 3 weeks ago • sorting, account validation …

        distance = None
        if user_lat and user_lon:
            distance = haversine_distance(user_lat, user_lon, location.latitude, location.longitude)

        result.append({
            'listing': listing.to_dict(),
            'pet': pet.to_dict(),
            'distance': distance  # Add distance to the result
        })

    # Sort the results by distance if latitude and longitude are provided, otherwise sort by listing creation date
    if user_lat and user_lon:
        result.sort(key=lambda x: x['distance'])
    else:
        result.sort(key=lambda x: x['listing']['listingID'], reverse=True)

    # Apply pagination after sorting
    paginated_result = result[offset: offset + ITEMS_PER_PAGE]

    return jsonify(paginated_result), 200
```

Figure 5. 14: Return listings based on Location API

5.7 Pagination

To reduce server loads, the results are paginated based on the page parameter and the constant ITEMS_PER_PAGE after the location sorting. This ensures that only a subset of results is returned, which is useful for performance and user experience. When the user scrolls down to the bottom, the API request will be called to get more data from the server. Then, the API responds with the sorted and paginated listings.



```
const handleLoadMore = () => {
  if (!loadingMore && !allItemsLoaded && data.length % ITEMS_PER_PAGE === 0) {
    setLoadingMore(true);
    fetchData(currentPage + 1, true).then(() => {
      setCurrentPage(prevPage => prevPage + 1);
      setLoadingMore(false);
    });       You, 3 weeks ago • main features done
  }
};
```

Figure 5. 15: Pagination code

5.8 Image storing and retrieving.

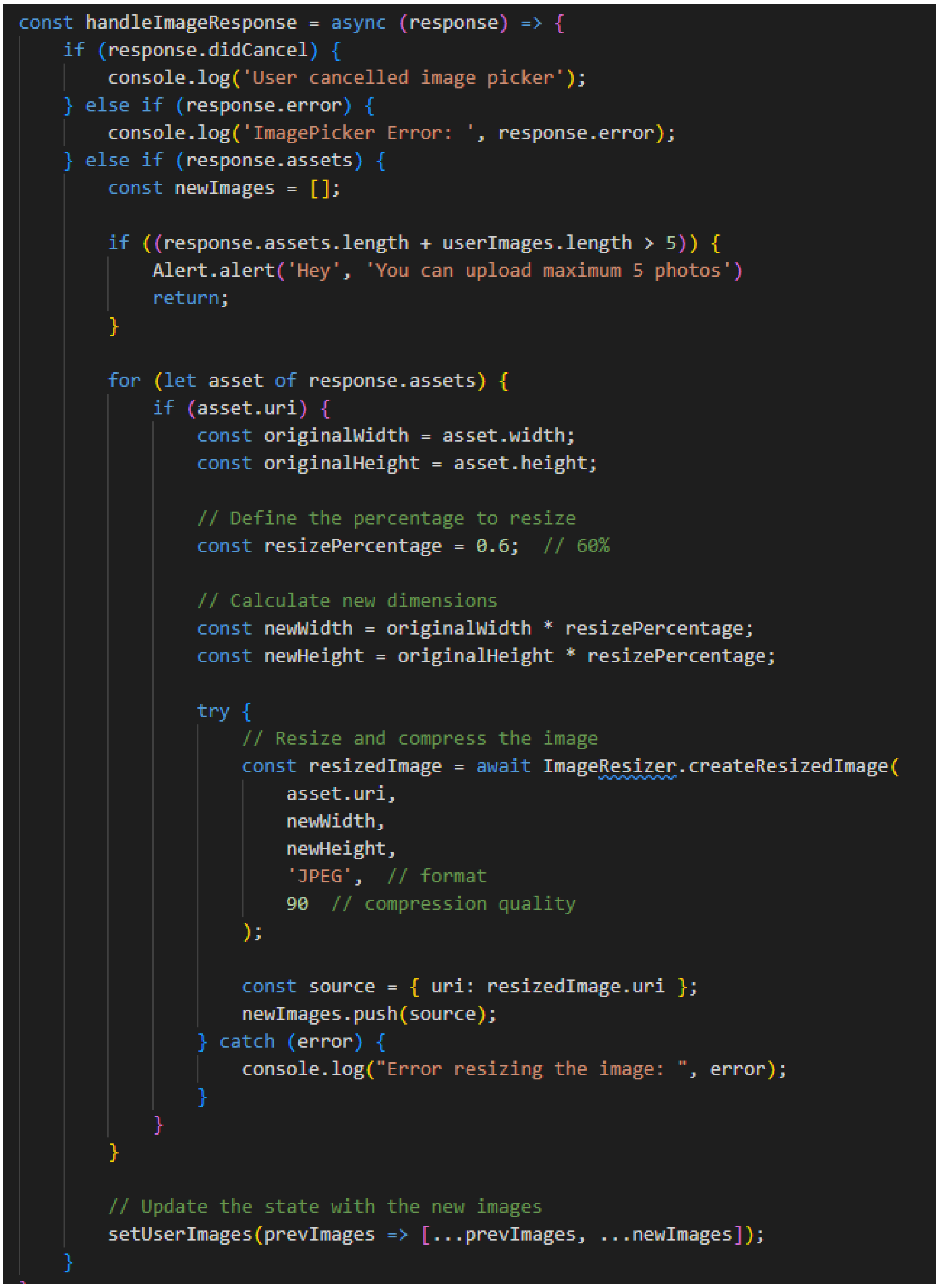
Image uploading is another core function of the mobile application to allow the pet owners to show their pet with the pet photos so that they can attract the attention of the potential adopters.

The user can either choose to upload image from their local storage or take photos directly and upload with their device’s camera. Once the image is selected, its original dimensions are fetched and will be resized to 60% of its original dimensions. The purpose of resizing the image is to reduce the image’s size. The resized image’s URI is then stored for later usage.

After that, the system will name the image. First, a unique timestamp will be generated. Then, the image will be named with the combination of the animal type, the creator’s user ID, and the generated timestamps to ensure the name generated is unique. The image name will look something like this “Cat_1001220230904021929360.jpg”.

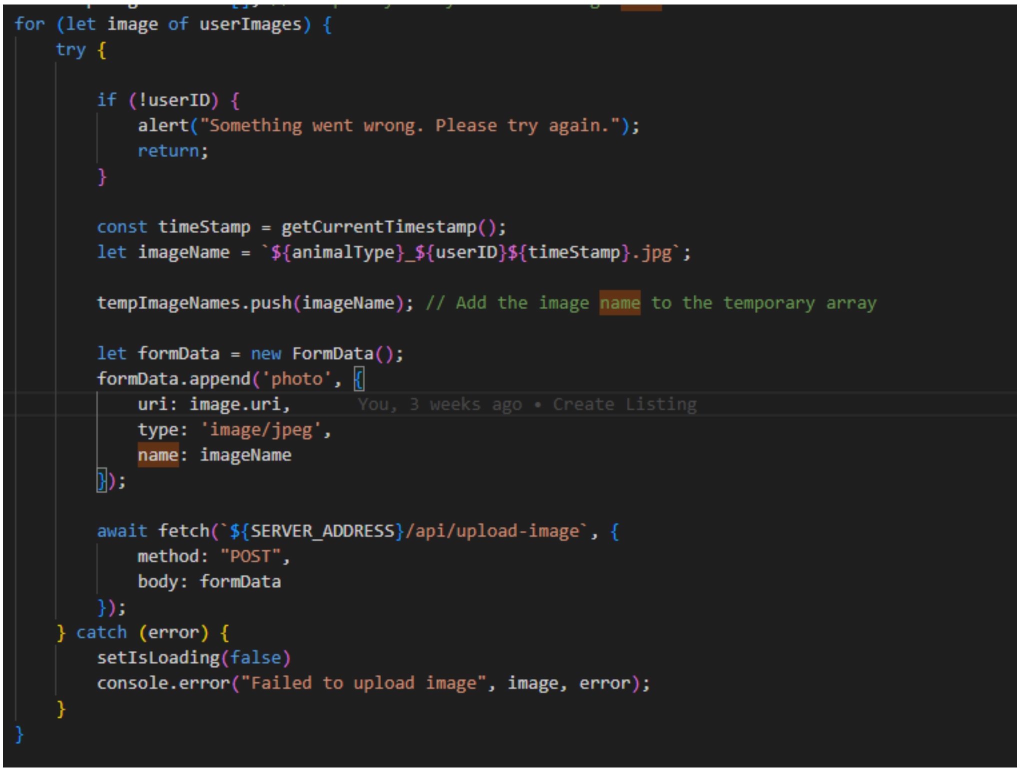
Finally, a new object was created, the image’s URI, image’s type (in this case JPRG), and the generated name will be appended to the object. The object will be sent to the server for saving by using API. If there are multiple images, the image URIs will be appended with semicolon.

When the user requests the image from the server, the server will find the unique name created in the server's storage and return to the user.



```
const handleImageResponse = async (response) => {
    if (response.didCancel) {
        console.log('User cancelled image picker');
    } else if (response.error) {
        console.log('ImagePicker Error: ', response.error);
    } else if (response.assets) {
        const newImages = [];

        if ((response.assets.length + userImages.length > 5)) {
            Alert.alert('Hey', 'You can upload maximum 5 photos')
            return;
        }

        for (let asset of response.assets) {
            if (asset.uri) {
                const originalWidth = asset.width;
                const originalHeight = asset.height;

                // Define the percentage to resize
                const resizePercentage = 0.6;  // 60%

                // Calculate new dimensions
                const newWidth = originalWidth * resizePercentage;
                const newHeight = originalHeight * resizePercentage;

                try {
                    // Resize and compress the image
                    const resizedImage = await ImageResizer.createResizedImage(
                        asset.uri,
                        newWidth,
                        newHeight,
                        'JPEG',  // format
                        90  // compression quality
                    );

                    const source = { uri: resizedImage.uri };
                    newImages.push(source);
                } catch (error) {
                    console.log("Error resizing the image: ", error);
                }
            }
        }

        // Update the state with the new images
        setUserImages(prevImages => [...prevImages, ...newImages]);
    }
```

Figure 5. 16: Image processing code



```
for (let image of userImages) {
    try {

        if (!userID) {
            alert("Something went wrong. Please try again.");
            return;
        }

        const timeStamp = getCurrentTimestamp();
        let imageName = `${animalType}_${userID}${timeStamp}.jpg`;

        tempImageNames.push(imageName); // Add the image name to the temporary array

        let formData = new FormData();
        formData.append('photo', {
            uri: image.uri,        You, 3 weeks ago • Create Listing
            type: 'image/jpeg',
            name: imageName
        });

        await fetch(`${SERVER_ADDRESS}/api/upload-image`, {
            method: "POST",
            body: formData
        });
    } catch (error) {
        setIsLoading(false)
        console.error("Failed to upload image", image, error);
    }
}
```

Figure 5. 17: Image processing code 2

5.9 API endpoints

The following are the API endpoints implemented into the project to communicate with the Flask. GET, POST, PUT, DELTE are included and demonstrated. The reason why some of the updates are using POST instead of PUT is because the user ID required to perform update operation is accessed directly from the session token in Flask, instead of sending from the client side. In addition, if the system check if the record exists in database, with POST operation Flask will just return Boolean value instead of the whole data.

Table 5. 10: Account API endpoints

Account		
Method	**Route**	**Description**
POST	/api/register	To create new account
POST	/api/check-contactNumber	To check if contact number exists in database with he contact number received
POST	/api/ check-email	To check if user email exists in database with the email received
POST	/api/forgotPassword/check-email	To check if user email exists in database during forgot password with the email received
POST	/api/login	To verify the login credential received
POST	/api/upload-image	To add image into the server’s storage
POST	/api/registration/getUserID	To get userID based on the registered email during registration process

POST	/api/reset-password	To reset the user’s password with the password and user email received
POST	/api/change-password	To update user’s password with the password received
GET	/api/get-user-details	To retrieve username at the Profile screen.
POST	/api/user/<int:userID>	To get user contact number and user email
POST	/api/update-userName	To update the username with the username received
POST	/api/update-user_status	To update the user’s status with the status and userID received
DELETE	/api/users/<int:user_id>	To delete user’s account from database
POST	/api/validate-password	To validate the current user’s password in the database with the password received

Table 5. 11: Email API endpoints

Email verification		
Method	**Route**	**Description**
POST	/api/send-email	To call SMTP to send email to the user with the email received
POST	/api/verify-code	To check if the verification code matches the user’s record based on the user ID
POST	/api/delete-verification-code	To roll back record if user quite the mobile application during verification process

Table 5. 12: Listings API endpoints

Listings		
Method	**Route**	**Description**
GET	/api/listings	To retrieve pet listing
PUT	/api/listings/update-status/<int:listingID>	To update the existing listing status
GET	/api/pets/pet_image/<path:filename>	To retrieve image stored in the server's local storage
GET	/api/listing-location/<int:locationID>	To retieve listing's location
POST	/api/report	To add new report listing into database
GET	/api/search_listings	To retrieve result of listing based on the filters received
GET	/api/listings/active	To retrieve current logged in user's created pet listing
GET	/api/listings/history	To retrieve current logged in user's inactive created pet listing
GET	/api/vets	To retrieve vet records
GET	/api/vets/<int:vetID>	To retrieve specific vet record
GET	/api/listings/missing	To retrieve lost pet listings from database
GET	api/listings/<int:listingID>	To retrieve specific listing record with the listing ID

Table 5. 13: Create listing API endpoints

Create Listing		
Method	**Route**	**Description**
POST	/api/add-pet	To add new pet record into the database
POST	/api/add-pet-owner	To add new pet owner record into the database
POST	/api/add-location	To add new location record into the database
POST	/api/add-listing	To add new listing record into the database

CHAPTER 6

IMPLEMENTATION

6.1 Introduction

This chapter mainly explains the implementation result of the design mentioned in the previous chapter. In this chapter, a series of screenshots are obtained, and used the screenshots to showcases the various facets of the application, highlighting its key features and the user experience it offers.

Each group of screenshots is accompanied by a description table, briefly explaining functionality or feature it represents. This not only aids in understanding the visual context but also underscores the design decisions made during the development phase. Furthermore, to ensure a clear linkage between the design and implementation stages, each group of screenshots is mapped to its corresponding Functional Requirement (FR). The linkages validates that the mobile application meets the requirements and allow quick understanding which requirements had been met.

6.2 Registration and Login

Table 6. 1: Registration Screenshots

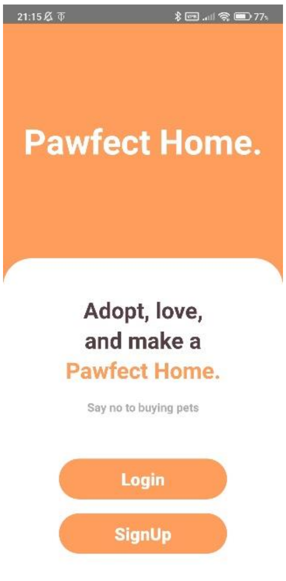
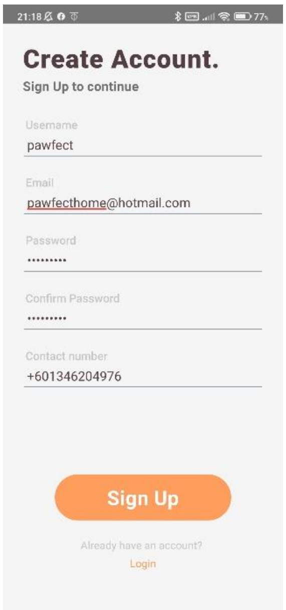
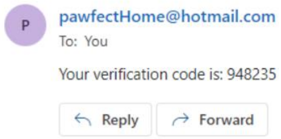
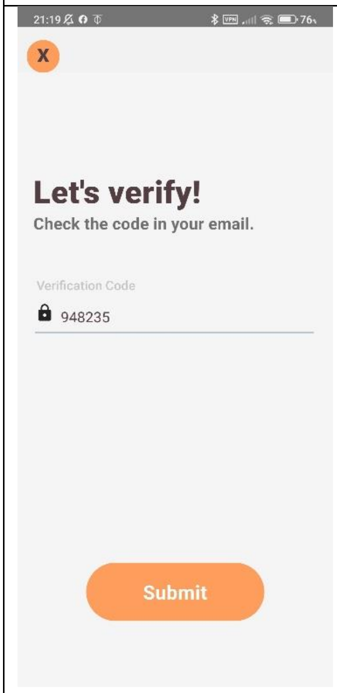
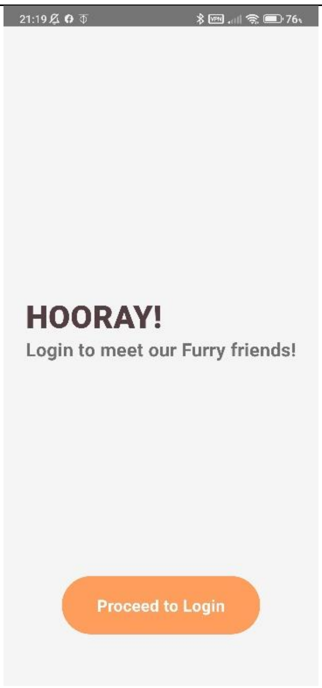
Registration		
 21:15 Pawfect Home. Adopt, love, and make a Pawfect Home. Say no to buying pets Login SignUp Figure 6. 1: Initial Page	 21:18 Create Account. Sign Up to continue Username pawfect Email pawfecthome@hotmail.com Password .... Confirm Password .... Contact number +601346204976 Sign Up Already have an account? Login Figure 6. 2: Create account page	 P pawfectHome@hotmail.com To: You Your verification code is: 948235 Reply Forward Figure 6. 3: Verification email
 21:19 X Let's verify! Check the code in your email. Verification Code 948235 Submit Figure 6. 4: Verification page	 21:19 HOORAY! Login to meet our Furry friends! Proceed to Login Figure 6. 5: Confirmation screen	

Table 6. 2: Login screenshots

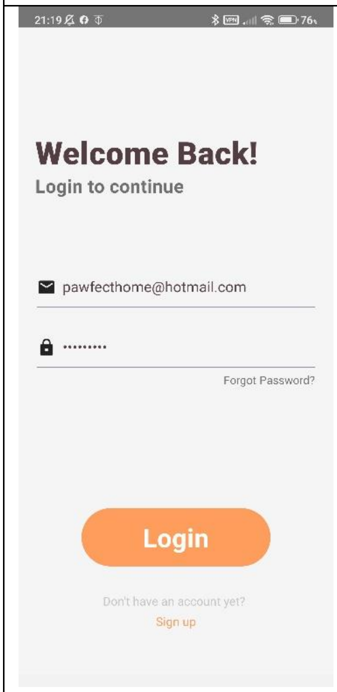
Login		
 Welcome Back! Login to continue pawfecthome@hotmail.com ••••••••• 21:19 Forgot Password? Login Don't have an account yet? Sign up Figure 6. 6: Login Page		

Table 6. 3: Table explaining registration and login

Use case ID	1, 2
Related Functional Requirement ID	FR1.1, FR1.2, FR1.3, FR1.4, FR1.5, FR1.6, FR1.7, FR1.8, FR1.10
Description	Figures above shows the flows of the registration and login. The registration involves creating new account and email verification.

6.3 Disposable email detection

Table 6. 4: Disposable email registration screenshots

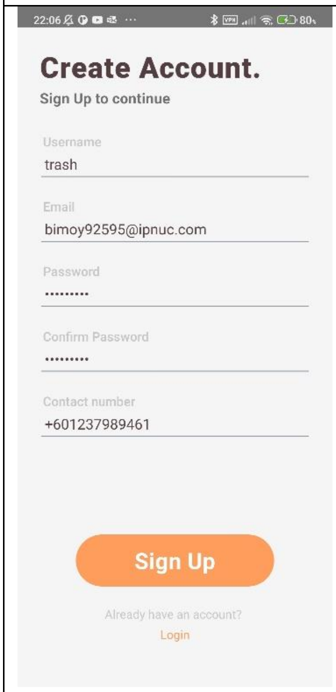
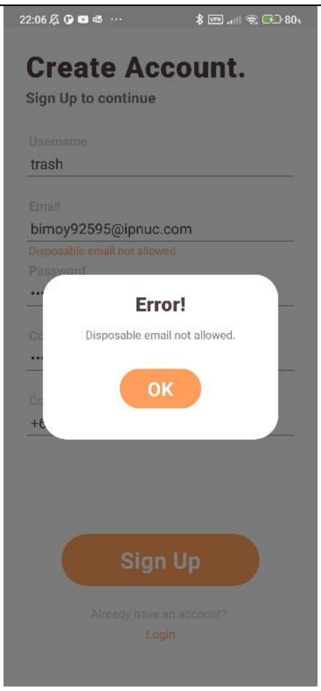
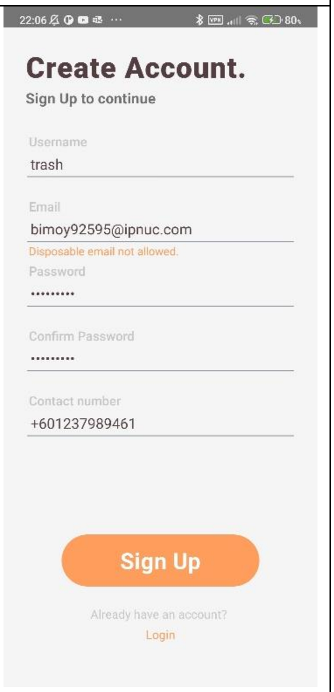
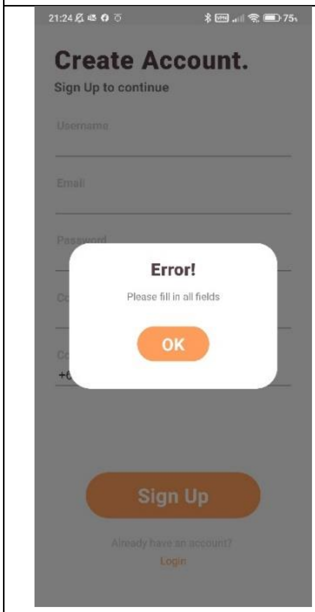
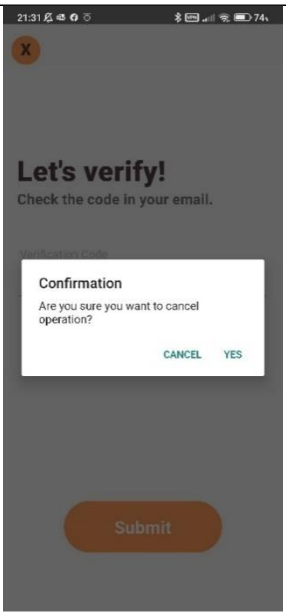
Disposable email registration		
 Create Account. Sign Up to continue Username: trash Email: bimoy92595@ipnuc.com Password: ········· Confirm Password: ········· Contact number: +601237989461 Sign Up Already have an account? Login Figure 6. 7: Create account (disposable email)	 Create Account. Sign Up to continue Username: trash Email: bimoy92595@ipnuc.com Disposable email not allowed. Error! Disposable email not allowed. OK Sign Up Already have an account? Login Figure 6. 8: Disposable email blocked	 Create Account. Sign Up to continue Username: trash Email: bimoy92595@ipnuc.com Disposable email not allowed. Password: ········· Confirm Password: ········· Contact number: +601237989461 Sign Up Already have an account? Login Figure 6. 9: Disposable email error message
 Create Account. Sign Up to continue Username Email Password Error! Please fill in all fields OK Sign Up Already have an account? Login Figure 6. 10: Empty field error message	 X Let's verify! Check the code in your email. Verification Code Confirmation Are you sure you want to cancel operation? CANCEL YES Submit Figure 6. 11: Cancel operation confimation	

Table 6. 5: Table explaining disposable email registration

Use case ID	1, 2
Related Functional Requirement ID	FR1.1, FR1.2, FR1.3, FR1.4, FR1.5, FR1.6, FR1.7, FR1.8
Description	Figures above shows the disposable email detection process. First, the system will check if the email entered is record in the disposable email list. If it’s not, check it with external API. In this case, the figures are showing the email was detected as disposable email.

6.4 Forgot Password

Table 6. 6: Forgot password screenshots

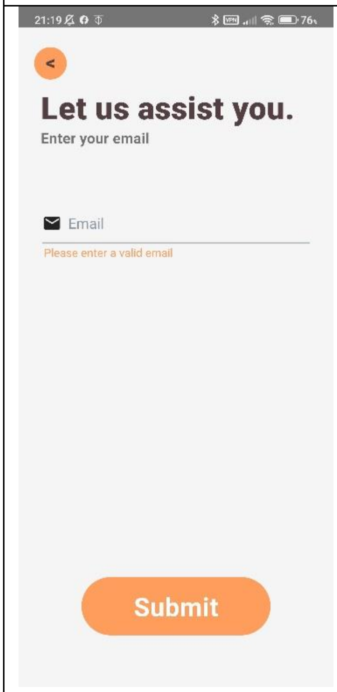
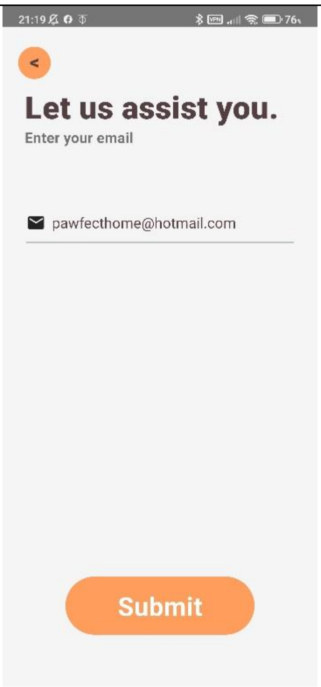
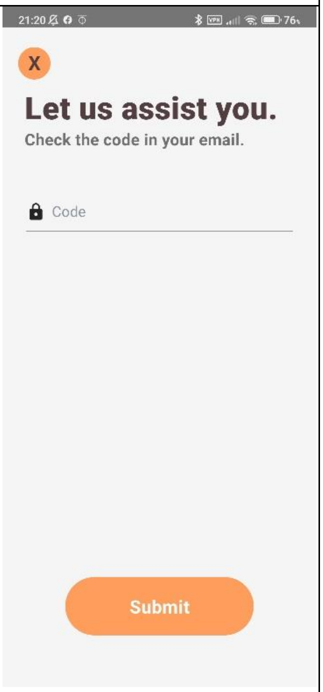
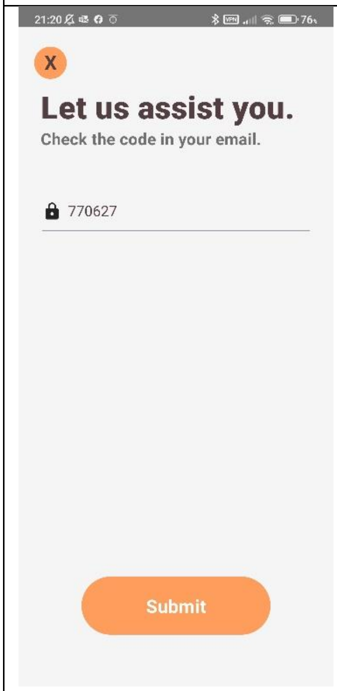
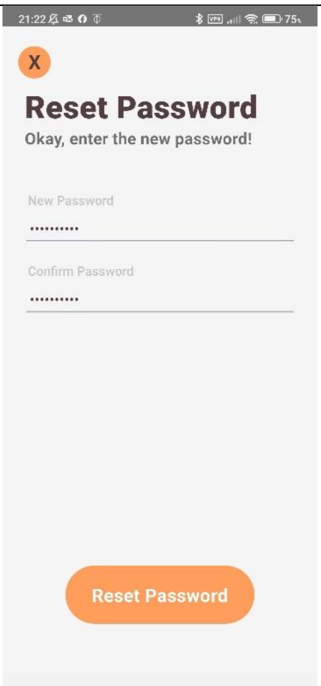
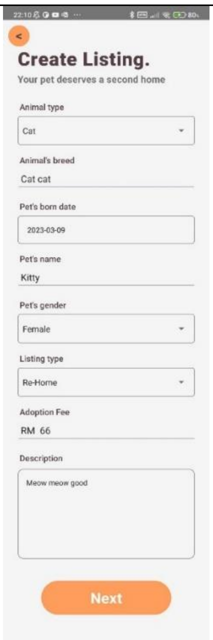
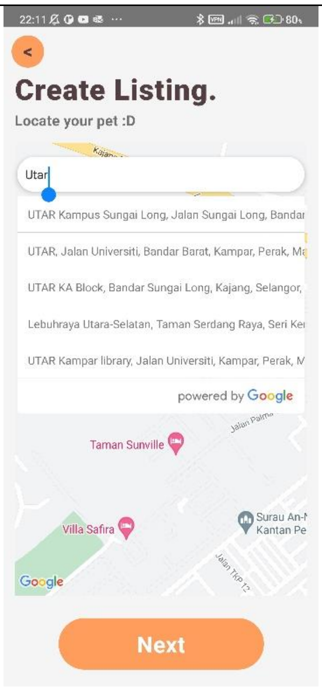
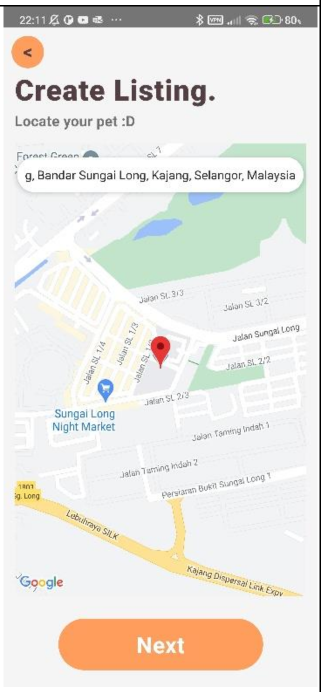
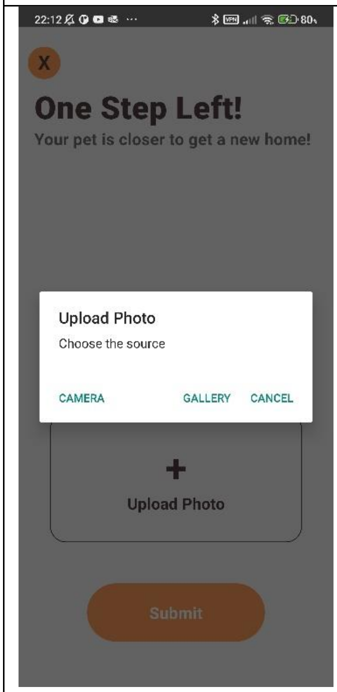
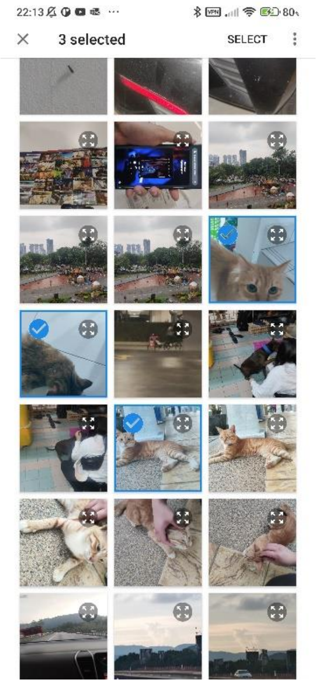
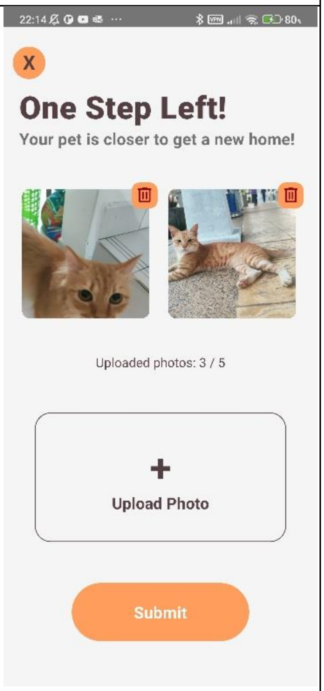
Forgot password		
 21:19 < Let us assist you. Enter your email Email Please enter a valid email Submit Figure 6. 12: Forgot Password	 21:19 < Let us assist you. Enter your email pawfecthome@hotmail.com Submit Figure 6. 13: Forgot Password 2	 21:20 X Let us assist you. Check the code in your email. Code Submit Figure 6. 14: Verification code page
 21:20 X Let us assist you. Check the code in your email. 770627 Submit Figure 6. 15: Filled verification code	 21:22 X Reset Password Okay, enter the new password! New Password .... Confirm Password .... Reset Password Figure 6. 16: Enter new password	

Table 6. 7: Table explaining forgot password

Use case ID	3
Related Functional Requirement ID	FR1.9
Description	Figures above shows the forgot password process. User will need to enter their email, enter the verification code sent to their email, and input the verification code.

6.5 Create Listing

Table 6. 8: Create listing screenshots

Create listing		
 Create Listing. Your pet deserves a second home Animal type: Cat Animal's breed: Cat cat Pet's born date: 2023-03-09 Pet's name: Kitty Pet's gender: Female Listing type: Re-Home Adoption Fee: RM 66 Description: Meow meow good Figure 6. 17: Create listing	 Create Listing. Locate your pet :D Utar UTAR Kampus Sungai Long, Jalan Sungai Long, Bandar UTAR, Jalan Universiti, Bandar Barat, Kampar, Perak, Ma UTAR KA Block, Bandar Sungai Long, Kajang, Selangor, Lebuhraya Utara-Selatan, Taman Serdang Raya, Seri Ke UTAR Kampar library, Jalan Universiti, Kampar, Perak, M powered by Google Taman Sunville Villa Safira Surau An-N Kantan Pe Google Next Figure 6. 18: Create listing search location	 Create Listing. Locate your pet :D g, Bandar Sungai Long, Kajang, Selangor, Malaysia Jalan SL 3/3 Jalan SL 3/2 Jalan Sungai Long Jalan SL 2/2 Jalan SL 2/3 Sungai Long Night Market Jalan Taming Indah 1 Jalan Taming Indah 2 Lebuhraya SILK Kajang Dispersal Link Expy Google Next Figure 6. 19: Create listing search result
 X One Step Left! Your pet is closer to get a new home! Upload Photo Choose the source Figure 6. 20: Upload photo selection	 3 selected Figure 6. 21: Upload with local image	 X One Step Left! Your pet is closer to get a new home! Uploaded photos: 3 / 5 Figure 6. 22: Image uploaded

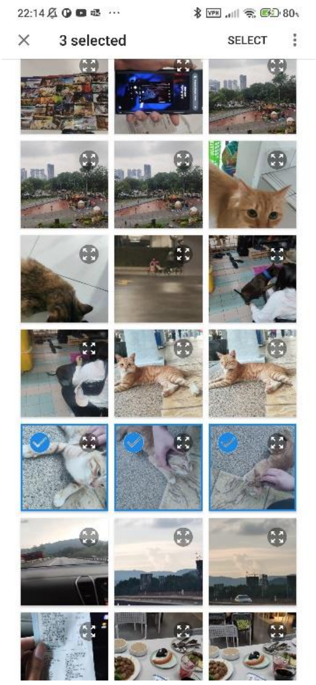
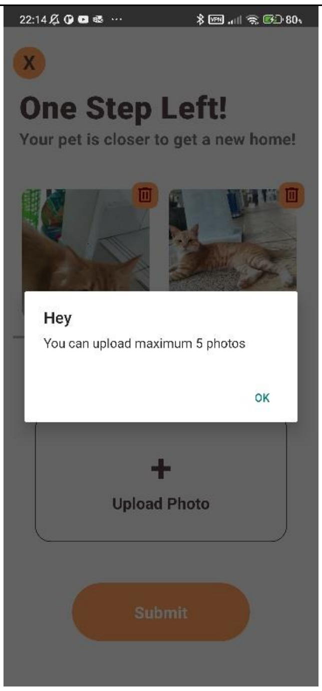


Figure 6. 23: Upload more with local image



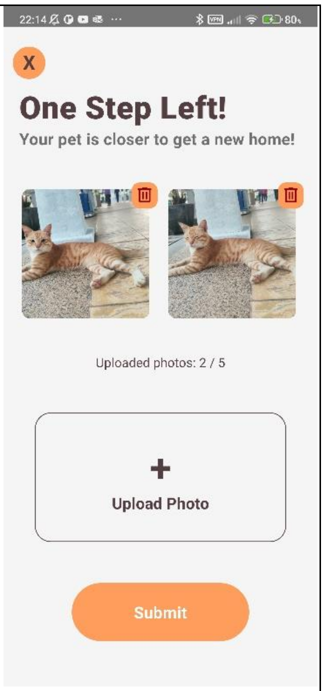
One Step Left!

Your pet is closer to get a new home!

Hey

You can upload maximum 5 photos

Figure 6. 24: Max photo reminder

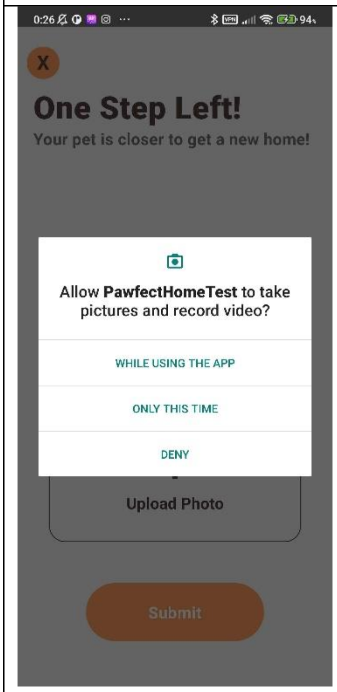


One Step Left!

Your pet is closer to get a new home!

Uploaded photos: 2 / 5

Figure 6. 25: Image removing



One Step Left!

Your pet is closer to get a new home!

Allow **PawfectHomeTest** to take pictures and record video?

Figure 6. 26: Asking permission

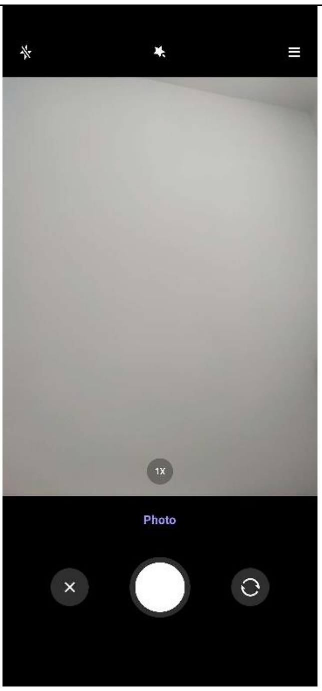
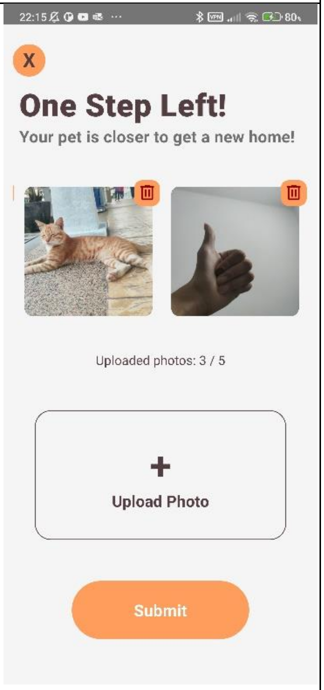


Figure 6. 27: Upload photo with camera

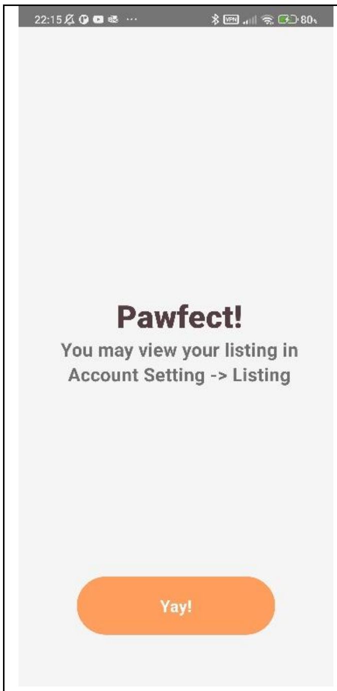


One Step Left!

Your pet is closer to get a new home!

Uploaded photos: 3 / 5

Figure 6. 28: Camera photo uploaded



Pawfect!

You may view your listing in Account Setting -> Listing

Figure 6. 29: Confirmation message

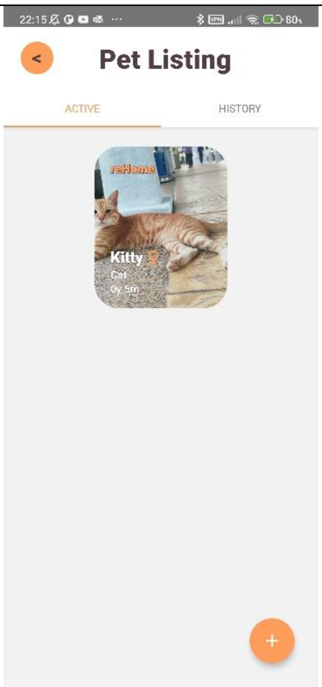


Figure 6. 30: Pet listing created

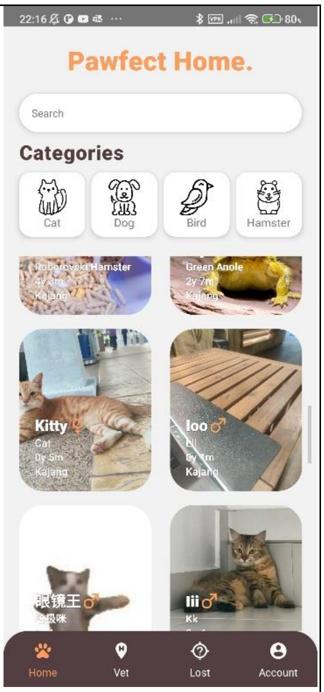


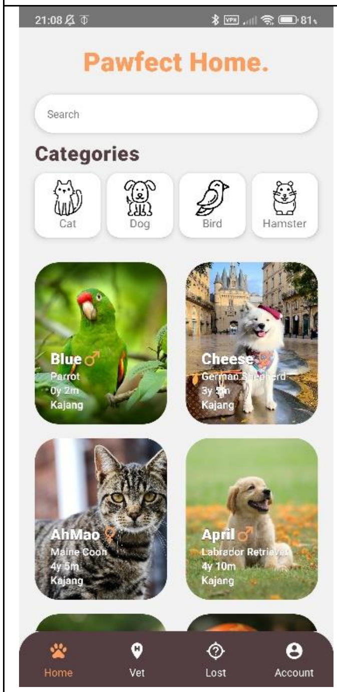
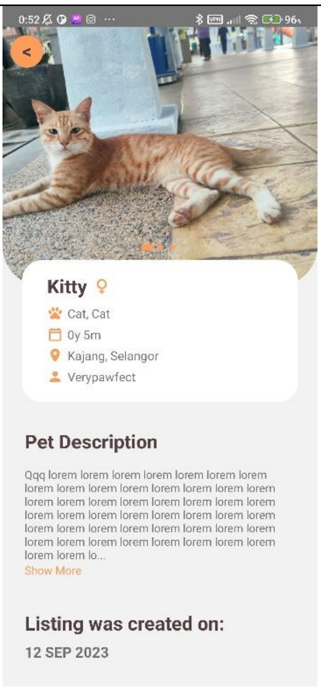
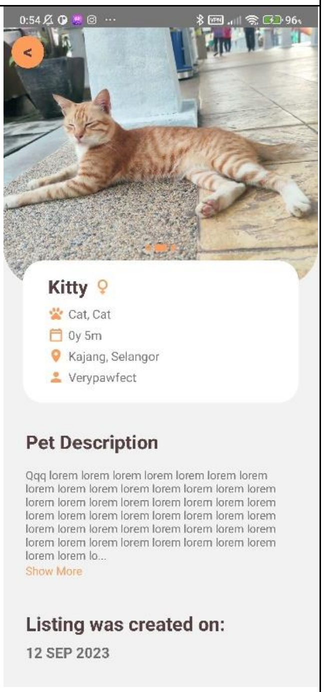
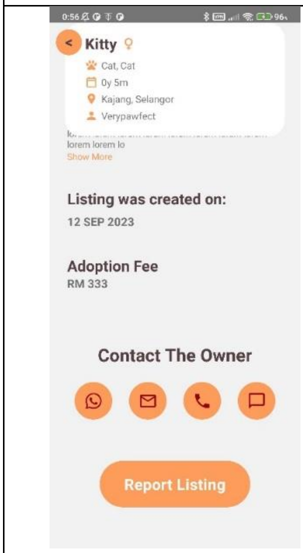
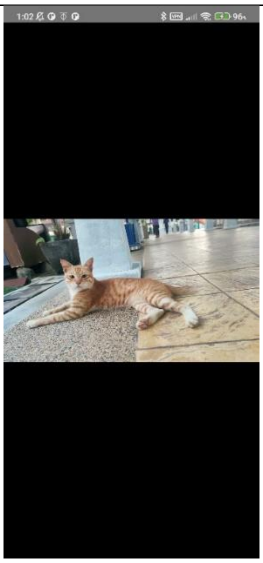
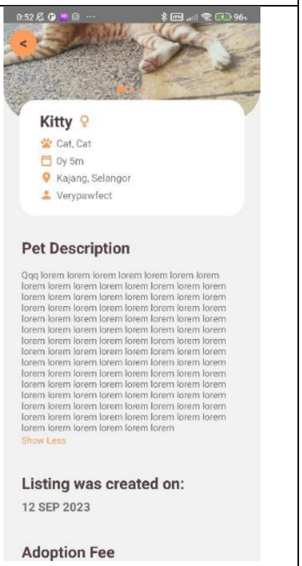
Figure 6. 31: Pet listing created at Home Screen.

Table 6. 9: Create listing explanation

Use case ID	4
Related Functional Requirement ID	FR2.1, FR2.2, FR2.3
Description	Figures above shows the create listing process. First, user will need to select and fills all essential details. Then, user select location. After that, user can upload photo with local storage or use camera. If the image exceeds 5 images, reminder will be displayed like Figure 5-24 do. User can remove uploaded photo by clicking the trash bin icon. Finally, after submitting, the pet listing will be displayed in the user's own pet listing page like Figure 5-30 and displayed in Home Screen like Figure 5-31.

6.6 View pet listing

Table 6. 10: View pet listing screenshots

View pet listing details		
 Pawfect Home. Search Categories Cat Dog Bird Hamster Blue ♂ Parrot 0y 2m Kajang Cheese German Shepherd 3y 5m Kajang AhMao ♀ Maine Coon 4y 6m Kajang April ♂ Labrador Retriever 4y 10m Kajang Home Vet Lost Account Figure 6. 32: Home Screen	 Kitty ♀ Cat, Cat 0y 5m Kajang, Selangor Verypawfect Pet Description Qqq lorem lo... Show More Listing was created on: 12 SEP 2023 Figure 6. 33: Pet image (First)	 Kitty ♀ Cat, Cat 0y 5m Kajang, Selangor Verypawfect Pet Description Qqq lorem lo... Show More Listing was created on: 12 SEP 2023 Figure 6. 34: Pet image (second)
 Kitty ♀ Cat, Cat 0y 5m Kajang, Selangor Verypawfect lorem lorem lo Show More Listing was created on: 12 SEP 2023 Adoption Fee RM 333 Contact The Owner Report Listing Figure 6. 35: Pet details frame topped	 Figure 6. 36: Image enlarged	 Kitty ♀ Cat, Cat 0y 5m Kajang, Selangor Verypawfect Pet Description Qqq lorem Show Less Listing was created on: 12 SEP 2023 Adoption Fee Figure 6. 37: description expanded

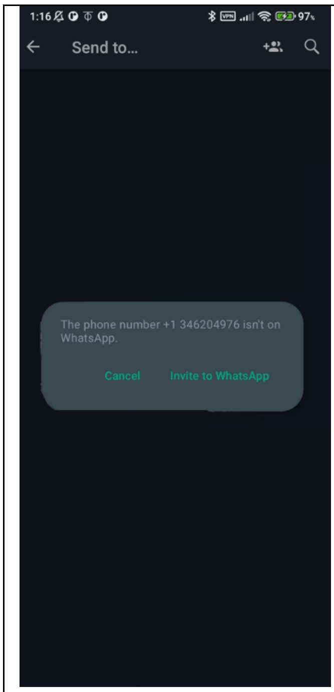
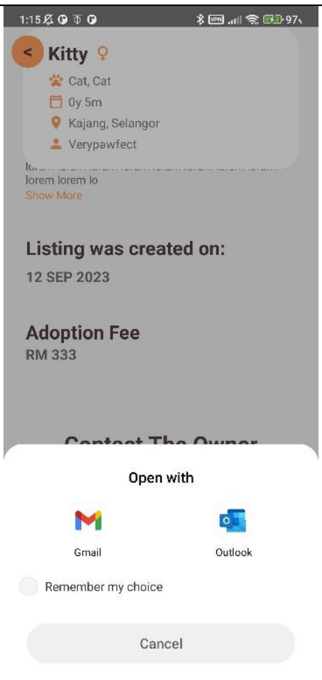
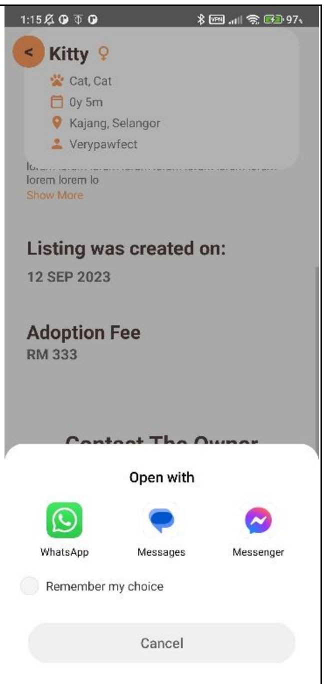
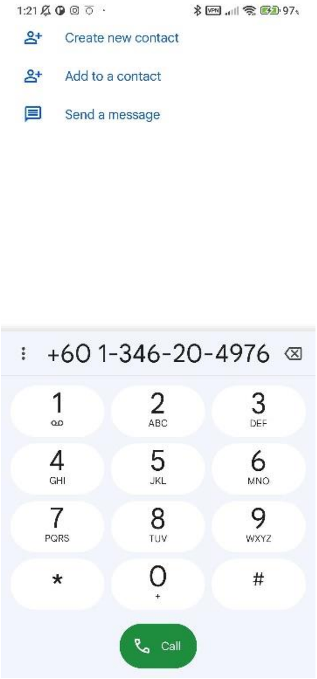
 Send to... The phone number +1 346204976 isn't on WhatsApp. Cancel Invite to WhatsApp Figure 6. 38: WhatsApp button	 Kitty ♀ Cat, Cat 0y 5m Kajang, Selangor Verypawfect lorem lorem lo Show More Listing was created on: 12 SEP 2023 Adoption Fee RM 333 Contact The Owner Open with Gmail Outlook ○ Remember my choice Cancel Figure 6. 39: Email button	 Kitty ♀ Cat, Cat 0y 5m Kajang, Selangor Verypawfect lorem lorem lo Show More Listing was created on: 12 SEP 2023 Adoption Fee RM 333 Contact The Owner Open with WhatsApp Messages Messenger ○ Remember my choice Cancel Figure 6. 40: SMS button
 Create new contact Add to a contact Send a message +60 1-346-20-4976 Call Figure 6. 41: Phone button		

Table 6. 11: View pet listing details explanation

Use case ID	5, 6
Related Functional Requirement ID	FR3.1, FR3.3, FR3.4
Description	Figures above shows the view pet listing details. All the details will be displayed in the page after selection of any pet listing. If the description was truncated, user can click on see more to expand and see less to keep it. Figure 5-38 shows what happen when user click on the WhatsApp button, Figure 5-39 is when user click on the email button, Figure5-40 is SMS button, and Figure5-41 is phone call button.

6.7 Search pet listing

Table 6. 12: Search pet listing screenshots

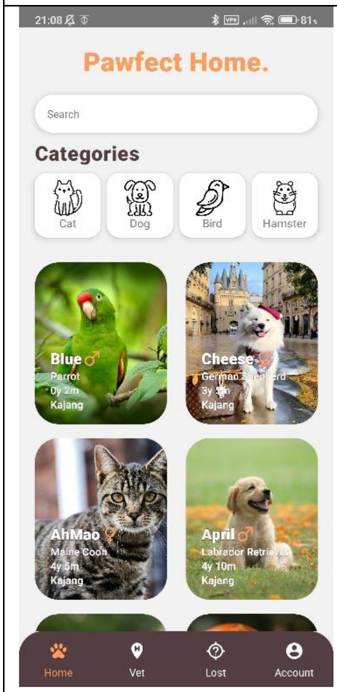
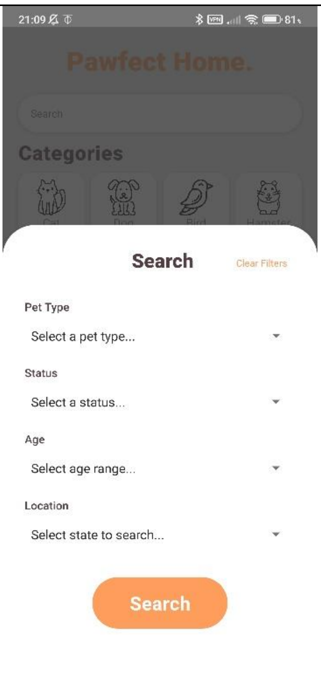
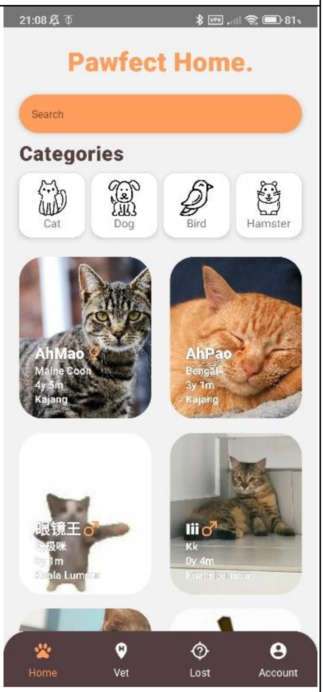
Search pet listing		
 Pawfect Home. Search Categories Cat Dog Bird Hamster Blue ♂ Parrot 0y 2m Kajang Cheese German Shepherd 3y 5m Kajang AhMao ♀ Maine Coon 4y 5m Kajang April ♂ Labrador Retriever 4y 10m Kajang Home Vet Lost Account	 Search Clear Filters Pet Type Select a pet type... Status Select a status... Age Select age range... Location Select state to search... Search	 Pawfect Home. Search Categories Cat Dog Bird Hamster AhMao ♀ Maine Coon 4y 5m Kajang AhPao Bengal 3y 1m Kajang 眼镜王 ♂ Iii ♂ Kk 0y 4m Home Vet Lost Account
Figure 6. 42: Home Screen	Figure 6. 43: Search modal	Figure 6. 44: Search filter applied

Table 6. 13: Search pet listing explanation

Use case ID	7
Related Functional Requirement ID	FR3.2
Description	Figures above shows the search pet listing. Users click on the search button and select cat as filter.

6.8 Report pet listing

Table 6. 14: Report pet listing screenshots

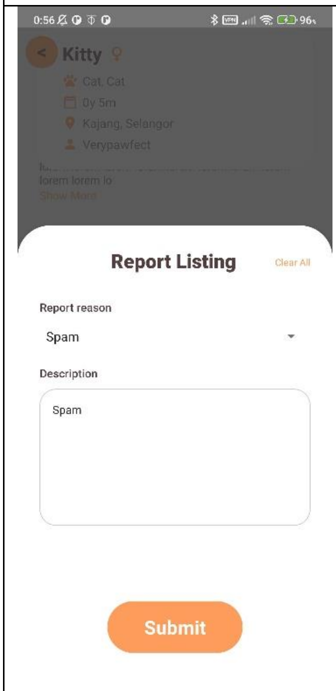
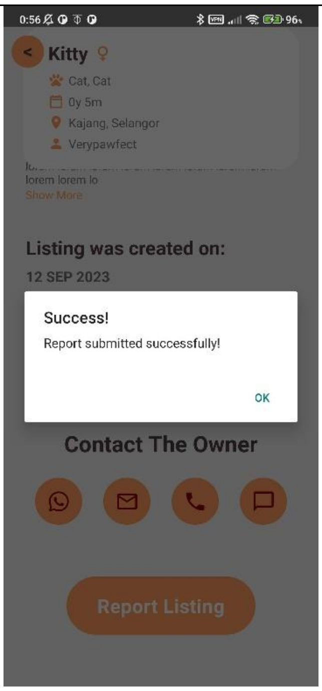
Report listing		
 Kitty Cat, Cat 0y 5m Kajang, Selangor Verypawfect Report Listing Clear All Submit Report reason Spam Description Spam Figure 6. 45: Report listing modal	 Kitty Cat, Cat 0y 5m Kajang, Selangor Verypawfect Contact The Owner Report Listing Listing was created on: 12 SEP 2023 Success! Report submitted successfully! OK Figure 6. 46: Report listing submitted	

Table 6. 15: Report pet listing explanation

Use case ID	8
Related Functional Requirement ID	FR3.5
Description	Figures above shows the report listing. Users click on the report listing button and submit report.

6.9 Vet

Table 6. 16: Vet screenshots

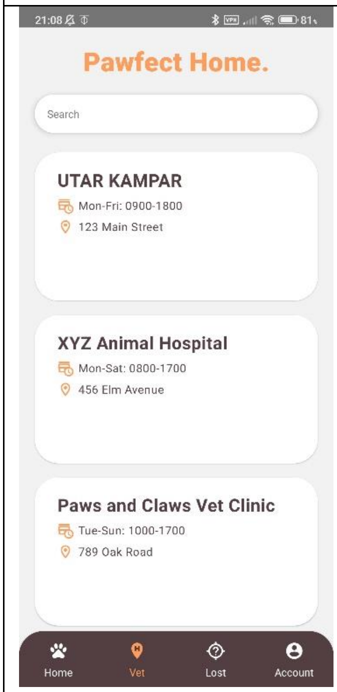
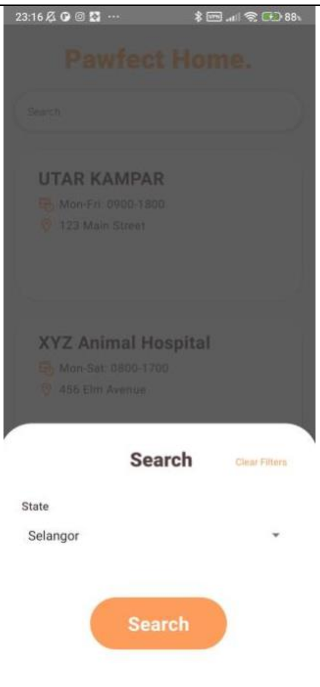
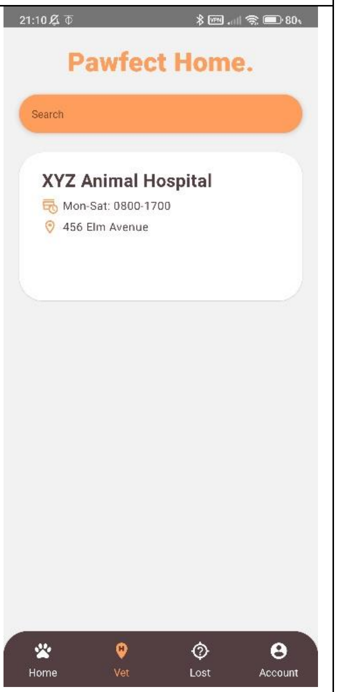
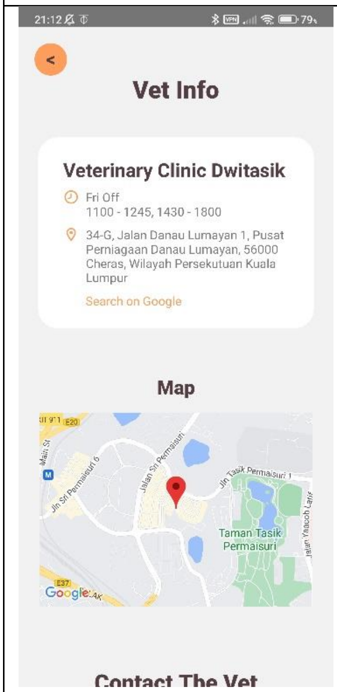
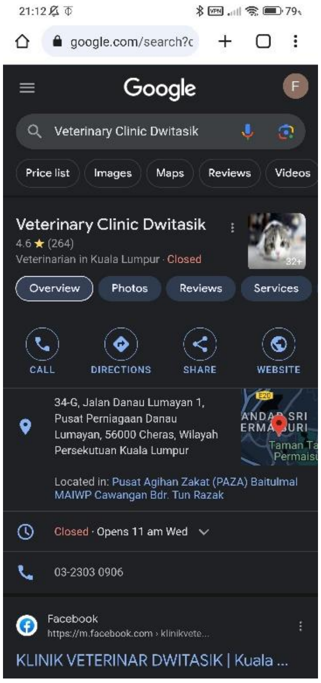
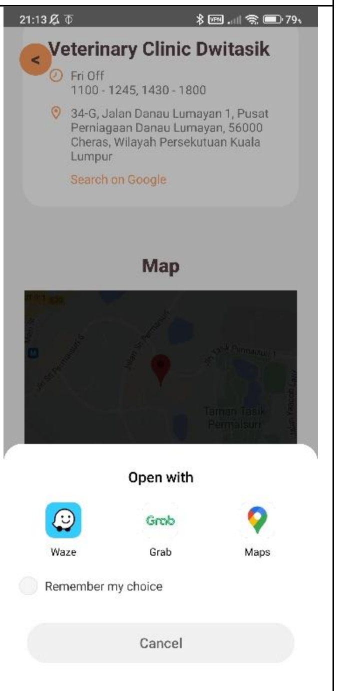
Vet		
 21:08 Pawfect Home. Search UTAR KAMPAR Mon-Fri: 0900-1800 123 Main Street XYZ Animal Hospital Mon-Sat: 0800-1700 456 Elm Avenue Paws and Claws Vet Clinic Tue-Sun: 1000-1700 789 Oak Road Home Vet Lost Account Figure 6. 47: Vet	 23:16 Pawfect Home. Search UTAR KAMPAR Mon-Fri: 0900-1800 123 Main Street XYZ Animal Hospital Mon-Sat: 0800-1700 456 Elm Avenue Search Clear Filters State Selangor Search Figure 6. 48: Search Vet	 21:10 Pawfect Home. Search XYZ Animal Hospital Mon-Sat: 0800-1700 456 Elm Avenue Home Vet Lost Account Figure 6. 49: Search vet result
 21:12 Vet Info Veterinary Clinic Dwitasik Fri Off 1100 - 1245, 1430 - 1800 34-G, Jalan Danau Lumayan 1, Pusat Perniagaan Danau Lumayan, 56000 Cheras, Wilayah Persekutuan Kuala Lumpur Search on Google Map Contact The Vet Figure 6. 50: Vet details	 21:12 google.com/search?c Google Veterinary Clinic Dwitasik Price list Images Maps Reviews Videos Veterinary Clinic Dwitasik 4.6 ★ (264) Veterinarian in Kuala Lumpur · Closed Overview Photos Reviews Services CALL DIRECTIONS SHARE WEBSITE 34-G, Jalan Danau Lumayan 1, Pusat Perniagaan Danau Lumayan, 56000 Cheras, Wilayah Persekutuan Kuala Lumpur Located in: Pusat Agihan Zakat (PAZA) Baitulmal MAIWP Cawangan Bdr. Tun Razak Closed · Opens 11 am Wed 03-2303 0906 Facebook https://m.facebook.com › klinikvete... KLINIK VETERINAR DWITASIK | Kuala ... Figure 6. 51: Search on Google	 21:13 Veterinary Clinic Dwitasik Fri Off 1100 - 1245, 1430 - 1800 34-G, Jalan Danau Lumayan 1, Pusat Perniagaan Danau Lumayan, 56000 Cheras, Wilayah Persekutuan Kuala Lumpur Search on Google Map Open with Waze Grab Maps Remember my choice Cancel Figure 6. 52: Map clicked

Table 6. 17: Vet explanation

Use case ID	9, 10, 11
Related Functional Requirement ID	FR4.1 FR4.2 FR4.3
Description	Figures above shows the vet listing, search vet listing and vet details. When users click on Search On Google button, direct them to browser like Figure 5-51. When users click on the map,

6.10 Lost pet

Table 6. 18: Lost pet screenshots

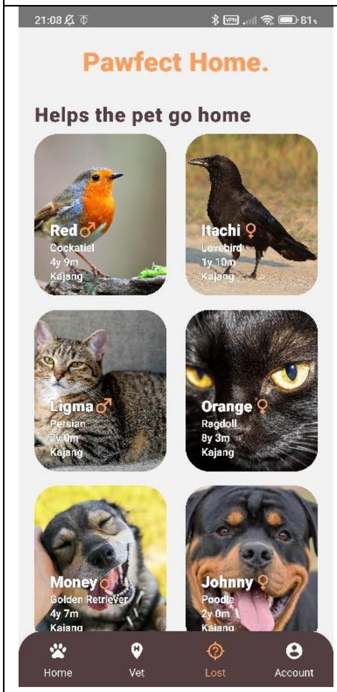
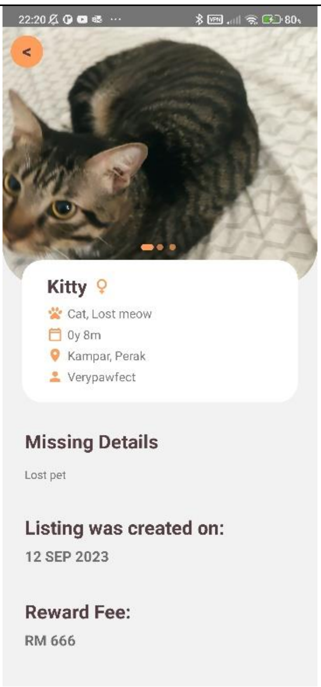
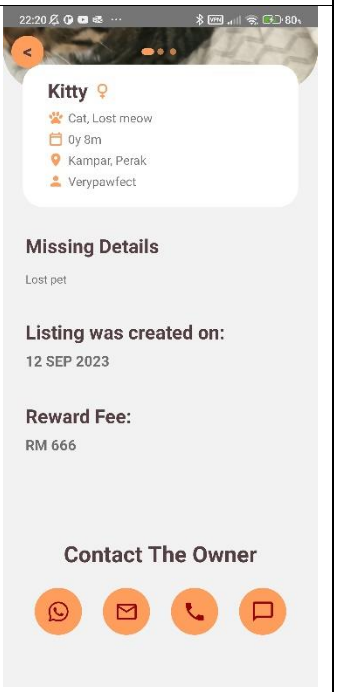
Lost pet		
 Pawfect Home. Helps the pet go home Red ♂ Cockatiel 4y 9m Kajang Itachi ♀ Lovebird 1y 10m Kajang Ligma ♂ Persian 7y 0m Kajang Orange ♀ Ragdoll 8y 3m Kajang Money ♂ Golden Retriever 4y 7m Kajang Johnny ♀ Poodle 2y 0m Kajang Home Vet Lost Account	 Kitty ♀ Cat, Lost meow 0y 8m Kampar, Perak Verypawfect Missing Details Lost pet Listing was created on: 12 SEP 2023 Reward Fee: RM 666	 Kitty ♀ Cat, Lost meow 0y 8m Kampar, Perak Verypawfect Missing Details Lost pet Listing was created on: 12 SEP 2023 Reward Fee: RM 666 Contact The Owner
Figure 6. 53: Lost Pet Page	Figure 6. 54: Lost pet details	Figure 6. 55: Lost pet details (Contact button)

Table 6. 19: Lost pet explanations

Use case ID	12, 13
Related Functional Requirement ID	FR5.1
Description	Figures above shows the lost pet listing and lost pet details.

6.11 Edit Profile

Table 6. 20: Edit Profile screenshots

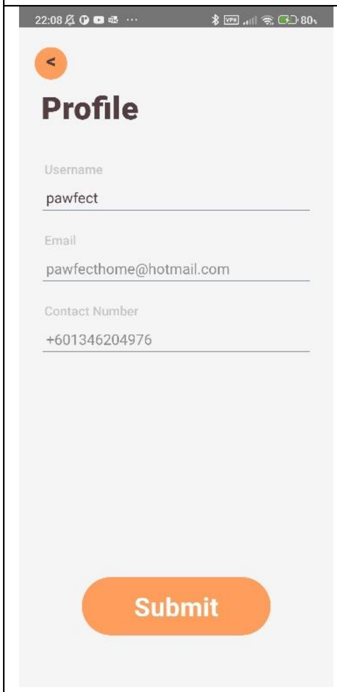
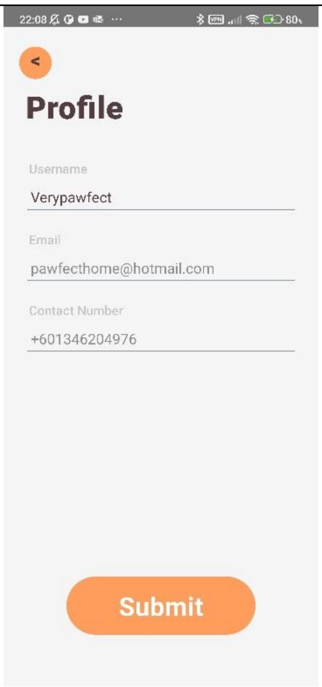
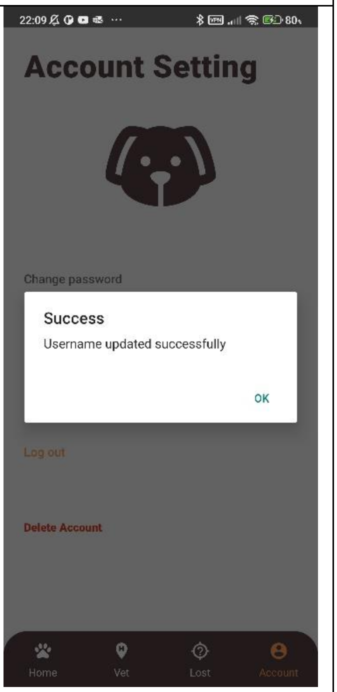
Edit profile		
 Profile Username: pawfect Email: pawfecthome@hotmail.com Contact Number: +601346204976 	 Profile Username: Verypawfect Email: pawfecthome@hotmail.com Contact Number: +601346204976 	 Account Setting Success Username updated successfully Change password OK Log out Delete Account Home Vet Lost Account
Figure 6. 56: Profile page	Figure 6. 57: Edit profile	Figure 6. 58: Edit profile successfully

Table 6. 21: Edit profile explanation

Use case ID	14
Related Functional Requirement ID	FR6.1
Description	Figures above shows the edit profile process. Users can change their username.

6.12 Change Password

Table 6. 22: Change Password screenshots

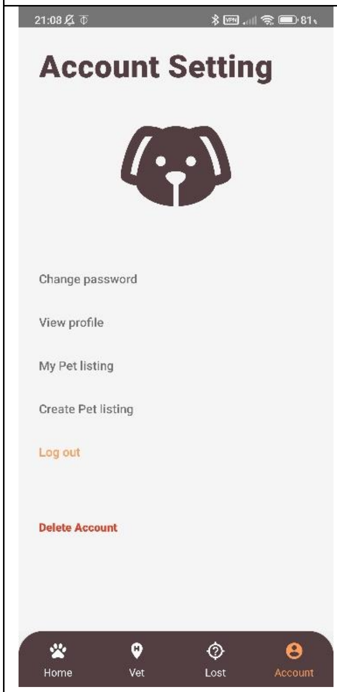
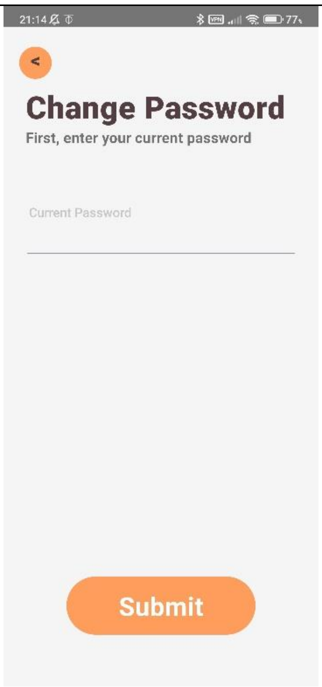
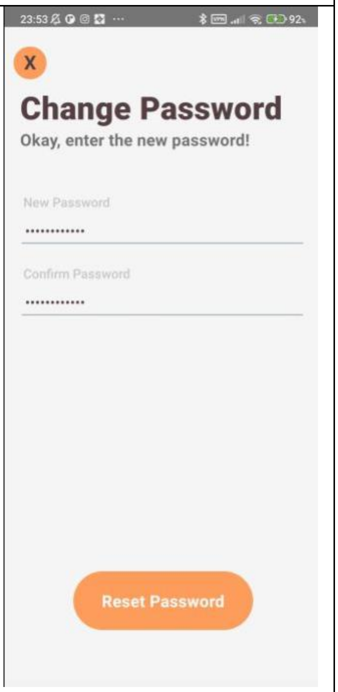
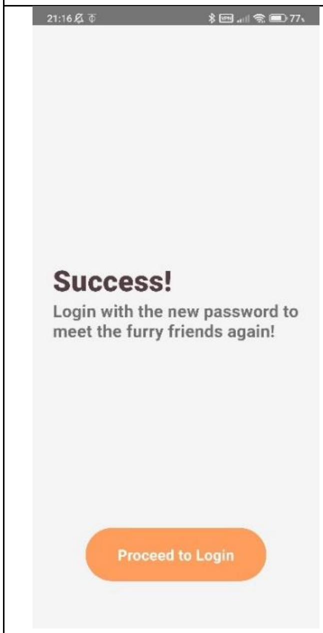
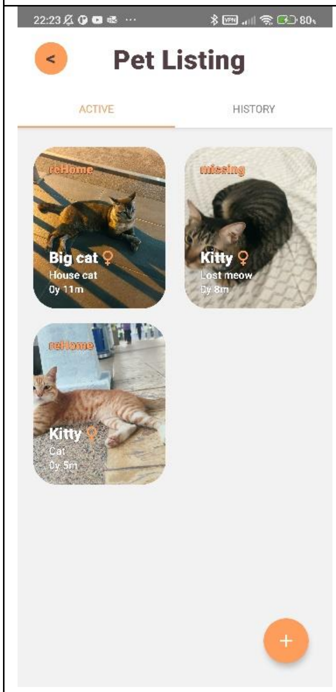
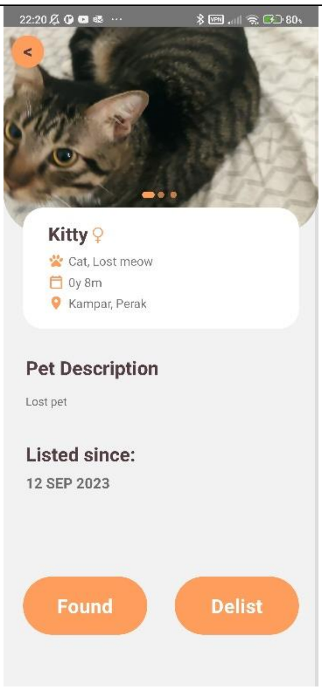
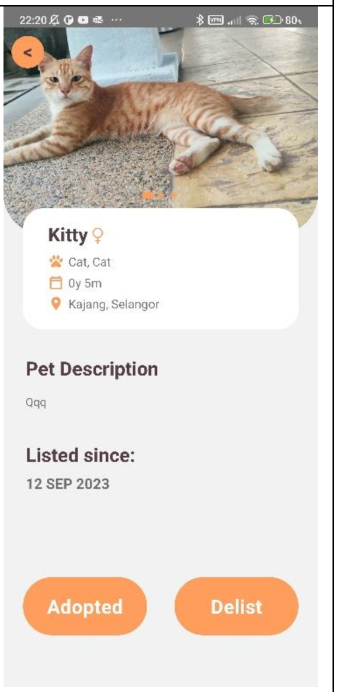
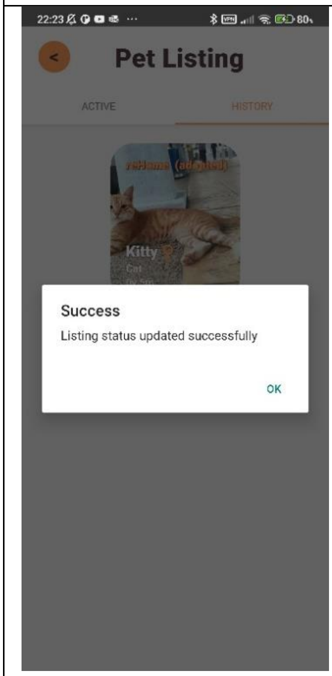
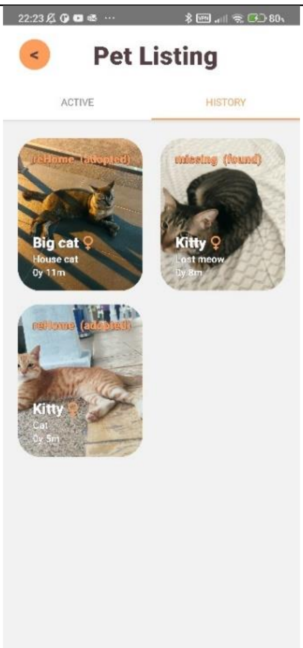
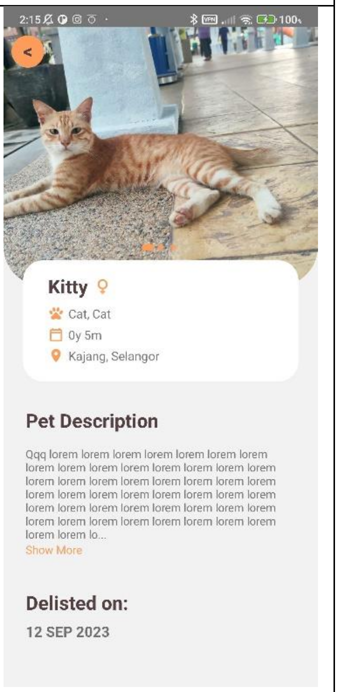
Change Password		
 Account Setting Change password View profile My Pet listing Create Pet listing Log out Delete Account Figure 6. 59: Account setting page	 Change Password First, enter your current password Current Password Figure 6. 60: Change password page	 Change Password Okay, enter the new password! New Password: •••••••••••• Confirm Password: •••••••••••• Figure 6. 61: Change password (Enter password)
 Success! Login with the new password to meet the furry friends again! Figure 6. 62: Success message		

Table 6. 23: Change password explanation

Use case ID	15
Related Functional Requirement ID	FR6.2
Description	Figures above shows the change password process. Users can change their password by validating their current password first, the reset password by entering new password.

6.13 User created pet listing

Table 6. 24: User created pet listing screenshots

User created pet listing		
 22:23 Pet Listing ACTIVE HISTORY reHome Big cat ♀ House cat 0y 11m missing Kitty ♀ Lost meow 0y 8m reHome Kitty ♀ Cat 0y 5m + Figure 6. 63: User created pet listing	 22:20 Kitty ♀ Cat, Lost meow 0y 8m Kampar, Perak Pet Description Lost pet Listed since: 12 SEP 2023 Found Delist Figure 6. 64: User created pet listing details (Lost)	 22:20 Kitty ♀ Cat, Cat 0y 5m Kajang, Selangor Pet Description Qqq Listed since: 12 SEP 2023 Adopted Delist Figure 6. 65: user created pet listing details (Adopt)
 22:23 Pet Listing ACTIVE HISTORY reHome (adopted) Kitty ♀ Cat Success Listing status updated successfully OK Figure 6. 66: Update pet	 22:23 Pet Listing ACTIVE HISTORY reHome (adopted) Big cat ♀ House cat 0y 11m missing (found) Kitty ♀ Lost meow 0y 8m reHome (adopted) Kitty ♀ Cat 0y 5m Figure 6. 67: User	 2:15 Kitty ♀ Cat, Cat 0y 5m Kajang, Selangor Pet Description Qqq lorem lo... Show More Delisted on: 12 SEP 2023

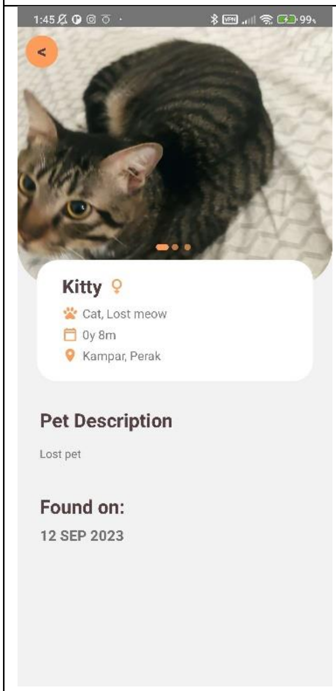
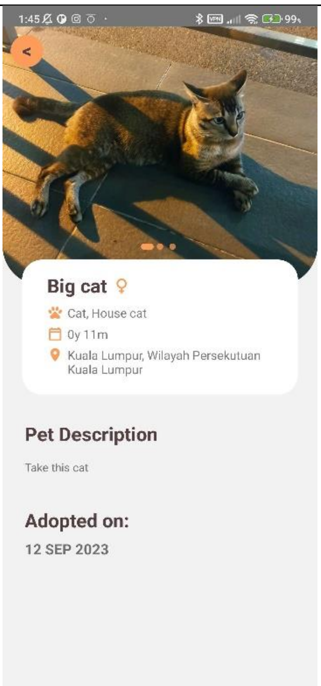
listing success message	created pet listing history	Figure 6. 68: Delisted pet details
 1:45 99% < Kitty ♀ Cat, Lost meow 0y 8m Kampar, Perak Pet Description Lost pet Found on: 12 SEP 2023 Figure 6. 69: Found pet details	 1:45 99% < Big cat ♀ Cat, House cat 0y 11m Kuala Lumpur, Wilayah Persekutuan Kuala Lumpur Pet Description Take this cat Adopted on: 12 SEP 2023 Figure 6. 70: Adopted pet details	

Table 6. 25: User created pet listing explanation

Use case ID	16, 17, 18, 19, 20
Related Functional Requirement ID	FR2.4
Description	Figures above shows the user created pet listing, user created history pet listing, user created pet listing details, user created pet listing history details, and update pet listing. If the pet is re-home or adoption, the user can choose to update it to adopted or delist. If the pet is lost, the user can choose to update it to found or details. After updated, the pet listing will be shown in Figure 5-67.

6.14 Delete account

Table 6. 26: Delete account screenshots

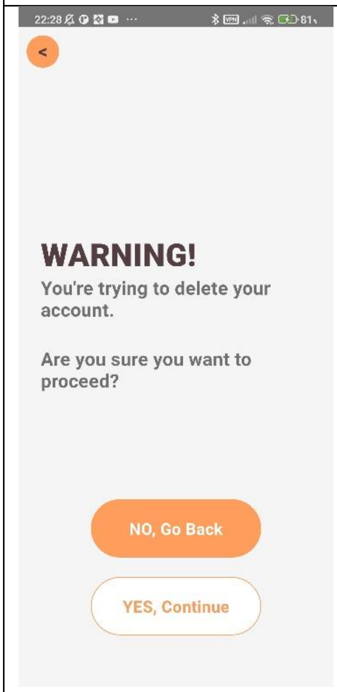
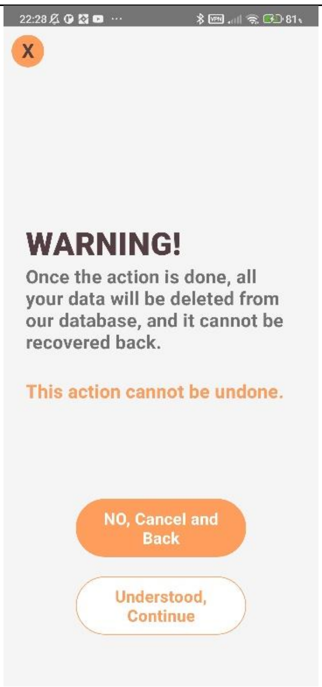
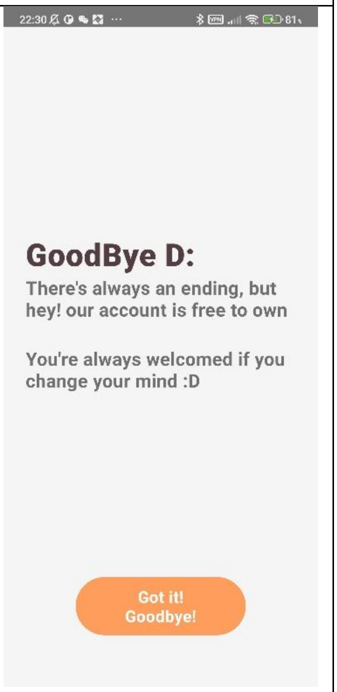
Delete account		
 WARNING! You're trying to delete your account. Are you sure you want to proceed? 	 WARNING! Once the action is done, all your data will be deleted from our database, and it cannot be recovered back. This action cannot be undone. 	 GoodBye D: There's always an ending, but hey! our account is free to own You're always welcomed if you change your mind :D
Figure 6. 71: Delete page 1	Figure 6. 72: Delete page 2	Figure 6. 73: Delete page 3

Table 6. 27: Delete account explanation

Use case ID	21
Related Functional Requirement ID	FR6.3
Description	Figures above shows the account deletion process.

6.15 Logout

Table 6. 28: Logout screenshot

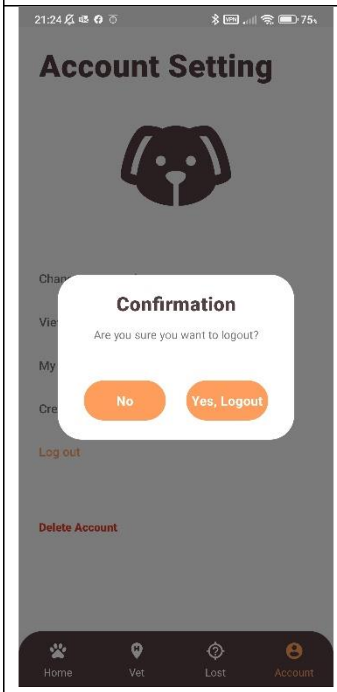
Logout		
 Account Setting Confirmation Are you sure you want to logout? 21:24 75 Chan Vie My Cre No Yes, Logout Log out Delete Account Home Vet Lost Account Figure 6. 74: Logout		

Table 6. 29: Logout explanation

Use case ID	22
Related Functional Requirement ID	FR7.1
Description	Figures above shows the logout operation.

CHAPTER 7

TESTING AND EVALUATION

7.1 Introduction

Testing plays a pivotal role throughout the software development life cycle, including the prototype model. Once the intended prototype is constructed, it undergoes testing on the development device, specifically the laptop designated for mobile application development. The application was executed on an emulator or a physical android device and evaluated by end-users. The testing ensures the system's correct functionality and its alignment with any Android devices. There are four stages of testing, which are unit testing, integration testing, system testing, and user acceptability testing. Each of the test stages will have their own test cases.

7.2 Unit testing

A unit test case was a component of the software testing process in which the single individual component known as units or components, were individually and independently scrutinized for proper operation. These units could be individual functions, methods, procedures, or even modules, depending on the context. Each unit test case was designed to determine whether the specific unit of code behaved as expected in various scenarios.

Unit testing helped validate that each piece of the system operated correctly. By testing each unit in isolation, developers ensured that the individual parts were error-free before they interacted with other components.

Detecting and fixing issues during the unit testing phase was often more cost-effective than addressing them at later stages of the development process. The longer a bug remained undetected, the more costly it became, as it might have led to more complex issues down the line.

In this section, app features such as filtering and sorting pet listings, creating and editing user profiles, and all other features were tested. The application's logic also underwent testing during this phase, especially regarding the accuracy of data retrieval from the database.

Table 7. 1: Account related test cases

Test Case ID	**Test Case**	**Test Steps**	**Expected Result**	**Related FR ID**	**Result**
UTC001	Register account	Register account with valid details	User account registered, navigate user to Email verification page	FR1.1	Pass
UTC002	Register account with username with special character	Input special characters except '-' and '_' to the username field	Error message 'Special characters allowed: -_' displayed	FR1.1 FR8.1 FR8.2	Pass
UTC003	Register account with invalid email format	Input invalid email format to the email field	Error message 'Please enter a valid email address.' displayed	FR1.4 FR8.1 FR8.2	Pass
UTC004	Register account with existing email	Input existing email to the email field	Error message 'Email exist' displayed	FR1.3 FR8.1 FR8.2	Pass
UTC005	Register account with disposable email	Input disposable email address referring and use the local disposable email	Error message 'Disposable email not allowed..' displayed	FR1.4 FR8.1 FR8.2	Pass

	domain in the local disposable email list	list to the email field			
UTC006	Register account with disposable email domain not in the local disposable email list	1. Input disposable email address referring and don't use the local disposable email list to the email field 2. Click SignUp button.	Prompted user with 'Disposable email not allowed' Error message 'Disposable email not allowed..' displayed	FR1.4 FR8.1 FR8.2	Pass
UTC007	Register account with a weak password	Input weak password to the password field. For example: 1234	Error message 'Password must be at least 8 characters, contain 1 number, 1 special character, and 1 capital letter.' Displayed	FR1.2 FR8.1 FR8.2	Pass
UTC008	Register account with an unmatched password	Input different password to the confirm password field	Error message 'Password do not match' displayed	FR1.1 FR8.1 FR8.2	Pass

UTC009	Register account with an existing contact number	Input existing contact number to the contact number field	Error message 'Phone number registered.' displayed.	FR1.3 FR8.1 FR8.2	Pass
UTC010	Register account with a wrong formatted phone number	Input random int into the contact number field	Error message 'Phone number format should be +60123456789 or +601234567890.' displayed.	FR1.3 FR8.1 FR8.2	Pass
UTC011	Register account with empty fields	Leave the fields empty, proceed to register	Prompted user with 'Please fill in all fields'	FR1.1 FR8.1 FR8.2	Pass
UTC012	Register account with any invalid value	Input invalid input into any fields, proceed to register	Prompted user with 'Please meet all the input criteria'	FR1.1 FR8.1 FR8.2	Pass

Table 7. 2: Email verification related test cases

Test Case ID	**Test Case**	**Test Steps**	**Expected Result**	**Related FR ID**	**Result**
UTC013	Verify the email	Verify the email with the verification	Navigate user to success message page.	FR1.5 FR1.6	Pass

		code sent to register email			
UTC014	Verify the email with expired code	Verify the email with the verification code sent to the register email after 5 minutes	Prompt user with ‘The verification code has expired. Please request a new code.’	FR1.7 FR8.1 FR8.2	Pass
UTC015	Request a new verification code	Request a new verification code after expiration of the verification code	New verification code will be sent to the user’s register email	FR1.7 FR1.5	Pass
UTC016	Verify the email with incorrect verification code	Input wrong verification code into the input field	Prompt user with ‘Seems like the verification code entered is incorrect, please try again.’	FR1.6 FR8.1 FR8.2	Pass

Table 7. 3: Login related unit test cases

Test Case ID	Test Case	Test Steps	Expected Result	Related FR ID	Result
UTC017	Login account with valid email and password	Input valid email and password	Navigate user to Home Page	FR1.8 FR8.1 FR8.2	Pass
UTC018	Login account with invalid email and password	Input wrong email or password	Prompt user with 'Invalid email or password'	FR1.8 FR8.1 FR8.2	Pass
UTC019	Forgot password	1. Click on Forgot Password button on Login. 2. Enter Registered Email 3. Check email for the verification code. 4. Enter the verification code into the input field, 5. Reset password.	User password reset, navigate user to success message page.	FR1.9	Pass
UTC020	Forgot Password	Input unregistered email address into	Navigate user to	FR1.9	Pass

	with unregistered account	the input field and proceed	verification page, but without any verification code sent		
UTC021	Forgot password with invalid password format	Input invalid password format to the password field. For example: password1234 Then proceed.	Error message 'Password must be at least 8 characters, contain 1 number, 1 special character, and 1 capital letter.' Displayed Prompt user 'please meet all the criteria'	FR1.9 FR8.1 FR8.2	Pass
UTC022	Login account with status 'unverified'	Input unverified email address and password, proceed to login	Navigate user to email verification screen	FR1.8	Pass

UTC023	Login account with status ‘banned’	Input banned email address and password, proceed to login	Prompt user with ‘Login failed, please contact customer service’	FR1.8	Pass

Table 7. 4: Pet listing related unit test cases

Test Case ID	Test Case	Test Steps	Expected Result	Related FR ID	Result
UTC024	View active pet listing	Navigate to Home Page, view the pet listing	The active pet listing are displaying on Home Screen	FR3.1	Pass
UTC025	View missing pet listing	Navigate to Lost page, view the missing pet listing	The missing pet listing are displaying on Lost page	FR5.1	Pass
UTC026	Filter active listing with search function	1. Click search bar 2. Select filter values of pet type, pet status, pet age, and location	The active pet listing should be filtered according to the filters selected	FR3.2	Pass
UTC027	Filter active listing with	Click on the category button	The active pet listing should be filtered according to	FR3.2	Pass

	category button		the category selected		
UTC028	Check listing pagination	1. Navigate to any page with pet listing. 2. Scroll down to the bottom.	The listing should load more item after 10 items scrolled	FR3.1 FR5.1	Pass
UTC029	Check pet sorting with location	Enable location permission	The listings should be sorted according to distance (ascending order)	FR3.1 FR5.1	Pass
UTC030	Check pet sorting without location	Disable location feature	The listings should be sorted according to time created (descending order)	FR3.1 FR5.1	Pass
UTC031	View specific pet listing	Click on any item of the pet listing	Navigate user to the pet details page with correct details	FR3.3 FR3.4 FR5.1	Pass
UTC032	Check Contact buttons	Click on the contact buttons in the pet details page	Navigate user to the external application accordingly.	FR3.4 FR5.1	Pass

UTC033	Report pet listing	1. Navigate to active pet listing 2. Navigate to any pet details page 3. Click on report listing button 4. Fill in the input fields and submit	Prompt user with ‘Report submitted successfully’	FR.5	Pass
UTC034	Check pet image	1. Navigate to any pet listing 2. Click on the pet image	The pet image was zoomed.	FR3.3 FR5.1	Pass

Table 7. 5: Vet listing related unit test cases

Test Case ID	**Test Case**	**Test Steps**	**Expected Result**	**Related FR ID**	**Result**
UTC035	View vet listings	Navigate to Vet page	The vets are displaying on the Vet page	FR4.1	Pass
UTC036	View vet details	Click on any item of the vet listing	Navigate user to the specific vet with correct details	FR4.1 FR4.2	Pass
UTC037	Search vet on Google	Click on the search on Google in vet details page	Navigate user to external browser to	FR4.2	Pass

			search on Google		
UTC038	Check vet location	Click on the map at the vet details page	Navigate user to Google Map application with vet details	FR4.2	Pass
UTC039	Check vet sorting with location	Enable location permission	The vet listing sorted with distance (ascending order)	FR4.1	Pass
UTC040	Check vet sorting without location	Disable location permission	The vet listing sorted with create date (descending order)	FR4.1	Pass
UTC041	Check contact buttons	Click on the contact buttons at the vet details page	Navigate user to external application accordingly	FR4.2	Pass
UTC042	Search Vet	1. Navigate to Vet screen 2. Click on search bar 3. Select the location	The vet listing should filtered accordingly	FR4.3	Pass

Table 7. 6: Profile related test cases

Test Case ID	**Test Case**	**Test Steps**	**Expected Result**	**Related FR ID**	**Result**
UTC043	Change password	1. Navigate to Account	User password	FR6.2	Pass

		Setting page 2. Input current password 3. Change password	changed, navigate to success message page.		
UTC044	Change password with incorrect password	Input incorrect current password.	Prompt user 'Current password does not match'	FR6.2 FR8.1 FR8.2	Pass
UTC045	Change password with empty fields	Change password with any of the fields empty, then proceed	Prompt user 'Both password fields must be filled in'	FR6.2 FR8.1 FR8.2	Pass
UTC046	Change password with unmatched passwords	Change password with both password and confirm password unmatched. Then proceed.	Error message 'Password do not match displayed' Prompt user 'Please meet all criteria.'	FR6.2 FR8.1 FR8.2	Pass
UTC047	Change password with invalid password format	Input invalid password format to the password field. For example: password1234	Error message 'Password must be at least 8 characters, contain 1	FR6.2 FR8.1 FR8.2	Pass

		Then proceed.	number, 1 special character, and 1 capital letter.' Displayed Prompt user 'please meet all the criteria'		
UTC048	View Profile	1. Navigate to Account Setting page 2. Click on view profile	User details displayed	FR6.1	Pass
UTC049	Change username	1. Navigate to Account Setting Page 2. Navigate to view profile 3. Amend username 4. Submit	Username changed	FR6.1	Pass
UTC050	Log out	1. Navigate to Account Setting Page 2. Click on Log on 3. Click 'yes, logout' button at the prompt	User logged out, navigated to initial page	FR7.1	Pass

UTC051	Delete account	1. Navigate to Account Setting Page 2. Click on Delete account button 3. Click on confirm button	User account deleted, navigated to initial page	FR6.3	Pass

Table 7. 7: User own pet listing related unit test cases

Test Case ID	**Test Case**	**Test Steps**	**Expected Result**	**Related FR ID**	**Result**
UTC052	View user active pet listing	1. Navigate to Account Setting page 2. Click on Pet Listing	User created pet listing displayed	FR2.4	Pass
UTC053	View user history pet listing	1. Navigate to Account Setting page 2. Click on Pet Listing 3. Navigate to History Listing	Deactivated user created pet listing displayed	FR2.4	Pass
UTC054	Deactivate user created pet listing	1. Navigate to Account Setting page 2. Click on Pet Listing 3. Click on any user created pet listing 4. Deactivate the pet listing by pressing Delist or	User created pet listing deactivated, navigate user to history pet listing	FR2.4	Pass

		Adopt/Found button			
UTC055	Create pet listing	1. Navigate to Account Setting page. 2. Click on My Pet Listing / Click on Create Pet Listing (Proceed to step 4) 3. Click on add button. 4. Fill in all fields. 5. Locate your location. 6. Upload photo 7. Submit listing	User pet listing created, navigate user to success message page.	FR2.1	Pass
UTC055	Create pet listing with image uploading	Upload multiple or one image from gallery	Images uploaded will be displayed on the screen.	FR2.3	Pass
UTC055	Create pet listing with camera taking photo	Upload a image by taking a photo via device’s camera	Photo taken will be displayed on the screen.	FR2.3	Pass
UTC056	Create pet listing	Create pet listing with any of the	Prompt user	FR2.1 FR8.1	Pass

	with empty fields	fields empty and proceed	'please fill in all fields'	FR8.2	
UTC057	Create pet listing with invalid pet name value	Input more than 30 characters into pet name field	Error message 'Pet name should not exceed 30 characters' displayed.	FR2.1	Pass
UTC058	Create pet listing with invalid adoption fee value	Input adoption fee greater than 400 or less than 50	Error message 'Adoption Fee needs to be between 50 and 400' displayed.	FR2.1 FR8.1 FR8.2	Pass
UTC059	Create pet listing with invalid breed value	Input more than 30 characters into breed field	Error message 'Pet name should not exceed 30 characters' displayed.	FR2.1 FR8.1 FR8.2	Pass
UTC060	Validate create pet listing date picker	1. Click on the 'select pet's birth date…' button 2. Select any date 3. Validate the date displayed on the button	User chosen date with date picker displayed on the button.		Pass

UTC061	Validate create pet listing location without location access	Disable/deactivate location service	KLCC will be the location on the map	FR2.2	Pass
UTC062	Validate image removal function	1. Upload any image. 2. Remove it with the dustbin button on the uploaded image.	User uploaded image removed from the list	FR2.3	Pass
UTC063	Validate image upload limit	Upload more than 5 images.	Prompt user 'Yu can only upload a maximum of 5 photos'.	FR2.3	Pass
UTC064	Validate image zoom	1. Upload any image. 2. Click on the uploaded image.	User uploaded image zoomed	FR2.3	Pass
UTC065	Validate submission without images	Click on the submit button without uploading any images.	Prompt user 'Please upload at least one image before proceeding'	FR2.1 FR2.3 FR8.1 FR8.2	Pass

UTC066	Validate image resizing	1. Upload any image. 2. Submit create listing. 3. Observe uploaded image size.	User uploaded image size resized to 60% of its original dimensions	FR2.1 FR2.3	Pass

Table 7. 8: Session unit test cases

Test Case ID	Test Case	Test Steps	Expected Result	Related FR ID	Result
UTC067	Validate logged in session	1. Login an account. 2. Close the application directly. 3. Open the application	Navigate user to Home Page with the logged in user account	FR1.10	Pass

Table 7. 9: Back button related unit test cases

Test Case ID	Test Case	Test Steps	Expected Result	Related FR ID	Result
UTC068	Validate Back Button of Active Pet details screen.	Click on the back button in the Active Pet Details Screen	Navigate user to Home Page	NFR1.1 NFR1.2	Pass
UTC069	Validate Back Button of Vet details screen.	Click on the back button in the Vet Details Screen	Navigate user to Vet Page	NFR1.1 NFR1.2	Pass

UTC070	Validate Back Button of Lost Pet details screen.	Click on the back button in the Lost Pet Details Screen	Navigate user to Lost Page	NFR1.1 NFR1.2	Pass
UTC071	Validate Back Button of Change Password screen.	Click on the back button in the Change Password Screen	Navigate user to Account Setting page	NFR1.1 NFR1.2	Pass
UTC072	Validate Back Button of Profile screen.	Click on the back button in the Profile Screen	Navigate user to Account Setting page	NFR1.1 NFR1.2	Pass
UTC073	Validate Back Button of User Pet Listing screen.	Click on the back button in the user Pet Listing Screen	Navigate user to Account Setting page	NFR1.1 NFR1.2	Pass
UTC074	Validate Back Button of Create Pet Listing screen.	Click on the back button in the Create Pet Listing Screen	Navigate user to previous page	NFR1.1 NFR1.2	Pass
UTC075	Validate Back Button of Create Pet Listing Location screen.	Click on the back button in the Create Pet Listing Location Screen	Navigate user to previous page	NFR1.1 NFR1.2	Pass
UTC076	Validate Back Button of Email	Click on the back button in the Email	Navigate user to	NFR1.1 NFR1.2	Pass

	Verification screen.	Verification Screen	previous page		
UTC077	Validate Back Button of Email Verification screen.			NFR1.1 NFR1.2	Pass

Table 7. 10: Cancel button related unit test cases

Test Case ID	**Test Case**	**Test Steps**	**Expected Result**	**Related FR ID**	**Result**
UTC078	Validate Cancel Button of Change Password 2 screen.	Click on the cancel button in the Change Password 2 Screen	Navigate user to Account Setting page	NFR1.1 NFR1.2	Pass
UTC079	Validate Cancel Button of Verification Code screen.	Click on the cancel button in the Verification Code Screen	Navigate user to Login Page	NFR1.1 NFR1.2	Pass

7.3 Integration testing

Integration testing involved testing the integration of the different components and parts to determine if the mobile application worked as intended when the components operated together. In the context of this project, integration testing covered testing scenarios such as user registration and authentication, creating and updating pet listings, and searching and filtering pet listings.

For instance, integration testing ensured that a newly registered user could create a pet listing and have it displayed properly on the pet listing page. Moreover, tests were conducted to verify the accuracy of data such as location, pet name, and age when the searching and filtering functions were used. Overall, integration testing was essential to ensure that the mobile application provided a seamless and cohesive user experience and to confirm that every component worked together effectively.

Table 7. 11: Integration Testing (ITC01)

Test case ID	ITC01
Test case	Register, login and forgot password
Test procedure	1. Register an account by entering a valid username, email, password, and contact number then verify it. 2. Log in to the newly created account. 3. Logout 4. Reset password with forgot password process by entering email and reset password. 5. Login again
Expected result	The new account had been registered, can be logged in, and access forgot password.
Pass/Fail	Pass

Table 7. 12: Integration Testing (ITC02)

Test case ID	ITC02
Test case	View active pet listing, search pet, view active pet details, and report listing
Test procedure	1. View the active pet listing at Home Screen. 2. Search the pet listing with the ‘cat’ filters. 3. Select any returned pet result and check the results. 4. Report the pet listing
Expected result	The pet listing displayed properly and returned all cats result after applying search function. The active pet details were all aligned to the selected pet listing, the report of the pet listing was submitted successfully.

Pass/Fail	Pass

Table 7. 13: Integration Testing (ITC03)

Test case ID	ITC03
Test case	View vet list, view vet details and, search vet:
Test procedure	1. View the vet listings in vet screen. 2. Search the vet with ‘Selangor’ as state. 3. Select any returned vet result and check the result.
Expected result	The vet listing displayed properly and returned all Selangor result, the selected vet details were all aligned with the selected vet listing.
Pass/Fail	Pass

Table 7. 14: Integration Testing (ITC04)

Test case ID	ITC04
Test case	Create pet listing, view user active pet listing, view user active pet listing details, update pet listing status, and view user history pet listing
Test procedure	1. Create a pet listing. 2. Check the user active pet listing page, if the newly created pet listing displayed. 3. Select it, check if the details align with the newly created pet listing. 4. Update it to delisted. 5. Check the user history pet listing page, if the deactivated pet listing displayed.
Expected result	The pet listing was created, the newly created pet listing was displayed in user active pet listing page, the details was aligned with the newly created pet listing, the pet listing was delisted, the pet listing was displayed in the history screen after delisted
Pass/Fail	Pass

7.4 System testing

System testing is a level of software testing where the complete and integrated software system is tested. The primary objective is to evaluate the system's compliance with the specified requirements. During system testing, the software was tested in an environment that closely mirrors production to ensure that it works correctly in real-world scenarios. This testing phase encompasses a range of test types, including functional, performance, usability, and security tests, among others. The main goal is to identify defects that might arise from system behaviours or interactions between integrated components.

Table 7. 15: System Testing (STC01)

Test case ID	STC01
Test case	Location based result
Test procedure	1. Enable location permission. 2. View active pet listing. 3. Check if the pet listings are arranged based on location (nearest first) 4. View vet listing. 5. Check if the vet listings are arranged based on location (nearest first) 6. View lost pet listing. 7. Check if the lost pet listings are arranged based on location (nearest first)
Expected result	1. The active pet listing should be arranged based on location (nearest first) 2. The vet listing should be arranged based on location (nearest first) 3. The lost pet listing should be arranged based on location (nearest first)
Pass/Fail	Pass

Table 7. 16: System Testing (STC02)

Test case ID	STC02
Test case	Full process of create listing, verifying, and modifying
Test procedure	1. Create new pet listing. 2. Check if the listing is displayed in the user create listing page. 3. Check if the listing is displaying in the Home Page. 4. Check if the details are correct in the details page. 5. Check if the contacts are correct in the details page. 6. Delist the pet listing. 7. Check if the pet listing is displaying in the history page. 8. Check if the delist date is correct.
Expected result	1. New pet listing created. 2. The newly created pet listing is displayed in the user create listing page. 3. The newly created pet listing was displayed in the Home Page. 4. The newly create pet details were correct in the details page. 5. The newly created contacts were correct in the details page. 6. The newly created pet listing was delisted. 7. The newly delisted pet listing was displayed in the history page. 8. The delist date was accurate
Pass/Fail	Pass

Table 7. 17: System Testing (STC03)

Test case ID	STC03
Test case	Full process of account management and email verification
Test procedure	1. Register an account with disposable email address in the disposable list. 2. Register an account with disposable email address not in the disposable list. 3. Register an account with a valid email address. 4. Check the valid email address's inbox for verification code to verify account. 5. Input verification code. 6. Check if the account was verified. 7. Navigate to forgot password. 8. Input the newly registered account's email. 9. Check the email address's inbox for the verification code. 10. Input the verification code. 11. Reset password. 12. Login with the new password. 13. Navigate to change password. 14. Enter current password. 15. Enter new password. 16. Log back in. 17. Delete account.
Expected result	1. The system should prevent registration and display an error message indicating that disposable emails are not allowed. 2. The system should prevent registration when user proceed with the unrecorded disposable email and display an error message indicating that disposable emails are not allowed.

	3. The system should successfully register the account and send a verification email to the provided address. 4. A verification email with a code should be present in the inbox. 5. The system should accept the code if it matches and verify the account. 6. The account status should change to "verified" in the system. 7. The system should successfully reset the password and notify the user. 8. The system should allow the user to log in using the newly set password. 9. The system should validate the current password. 10. The system should accept the new password and update the user's credentials. Then, log the user out. 11. The user should be able to log in using the newly changed password. 12. The system should successfully delete the account and remove all associated data.
Pass/Fail	Pass

Table 7. 18: System Testing (STC04)

Test case ID	STC04
Test case	Password hashing
Test procedure	1. Navigate to Sign Up page. 2. Sign up an account. 3. Check if the registered password is hashed.
Expected result	1. The password should be hashed with SHA256 and stored in database.
Pass/Fail	Pass

Table 7. 19: System Testing (STC05)

Test case ID	STC05
Test case	Loading screen
Test procedure	1. Login account. 2. When system is loading, display loading screen.
Expected result	1. The loading screen displayed when system fetching data.
Pass/Fail	Pass

7.5 User Acceptance testing

Incorporating UAT in the system development process can lead to more successful software deployments. By understanding and addressing user requirements and concerns during UAT, developers can ensure that the system aligns with user expectations and business objectives. This not only improves user satisfaction but also reduces the costs associated with post-deployment fixes and modifications (Al-Hurmuzi et al., 2018).

The purpose of the user acceptance testing was to evaluate the usability, functionality, and overall user experience of our product. The usability testing is aimed to ensure that it meets the expectations and requirements of its intended audience. The test also plays an important role in determining whether Pawfect Home is a user-friendly mobile application. Furthermore, the UAT will increase the user's confidence about the system's usability and functionality.

The testers were carefully chosen to represent different target user group. This included normal end-users like normal people without much information technology knowledge, IT students including software engineering student, IT professionals, and elderly individuals like those are more than 50 years old. The diversity of the user group ensured that the feedback received was comprehensive and representative of the entire user base.

The testing was conducted in different places. It was conducted remotely, with testers accessing the system via an APK with minimum setup or test the system with physically meeting up with the testers' own Android phone or the author's Android phone for those who did not have an Android phone.

Before conducting the tests, the testers were provided with the UAT test cases document, which outlined the various tasks and scenarios they needed to complete. This structured approach ensured that all main functionalities and features of the system were thoroughly evaluated. The Table 7.20 is the test case used by the testers to conduct the user acceptance testing, the tests were all passed.

Table 7. 20: UAT Test cases

Test Case ID	**Test Case**	**Test Steps**	**Expected Result**	**Precondition**	**Pass / Fail**

UAT001	Account registration	Navigate to sign up page. Fill in username, email, password, confirm password, and contact number. Click Sign Up button. Check email for verification code. Input the verification code into the field. Click submit.	Navigate user to success message page.	-	P
UAT002	Login account	Navigate to login page. Fill in email and password. Click login button.	Navigate user to Home Screen	Have a registered and verified account	P
UAT003	Forgot password	Navigate to forgot password page. Enter email.	Navigate user to success message page.	Have a registered account	P

		Check email for verification code. Input the verification code into the field. Click submit button.			
UAT004	Search listing	Navigate to Home Screen. Click on the search bar. Select value of filters. Click search button.	Pet listing sorted according to the filters value selected	User logged in	P
UAT005	Filter with category listing	Navigate to Home Screen. Click on the category buttons.	Pet listing sorted according to the category button selected	User logged in	P
UAT006	View pet details	Navigate to Home Screen. Click on any active pet listing.	Navigate user to the pet details page user clicked	User logged in	P

UAT007	View lost pet details	Navigate to Lost Screen. Click on any lost pet listing.	Navigate user to the lost pet details page user clicked	User logged in	P
UAT008	View vet details	Navigate to Vet Screen. Click on any vet listing.	Navigate user to the vet details page	User logged in	P
UAT009	Validate contact buttons of active pet listing details	Navigate to Home Screen. Click on any active pet listing. Click on any contact buttons.	Navigate user to external applicatio n according to contact button user clicked	User logged in	P
UAT010	Validate contact buttons of lost pet details	Navigate to Lost Screen. Click on any lost pet listing. Click on any contact buttons.	Navigate user to external applicatio n according to contact button user clicked	User logged in	P
UAT011	Validate contact buttons of vet details	Navigate to Vet Screen.	Navigate user to external applicatio	User logged in	P

		Click on any vet listing. Click on any contact buttons.	n according to contact button user clicked		
UAT012	Report Listing	Navigate to Home Screen. Click on any active pet listing. Click on Report Listing. Select report type and fill in description.	Report submitted, close report listing window automatically	User logged in	P
UAT013	Validate map of vet	Navigate to Vet Screen. Click on any vet listing. Click on Map.	Navigate user to map application with the vet details	User logged in	P
UAT014	View profile	Navigate to Account Setting. Click on view profile.	User details displayed	User logged in	P
UAT015	Update profile	Navigate to Account Setting.	Username updated, navigate user to	User logged in	P

		Click on view profile. Amend username. Click Submit button.	Account Setting		
UAT016	Change password	Navigate to Account Setting. Input current password. Click Submit button. Input new password and confirm password. Click Submit.	Navigate user to success message page	User can access to account's current password	P
UAT017	View pet active listing	Navigate to Account Setting. Click pet listing.	User created listing displayed	User did created listing before	P
UAT018	View pet history listing	Navigate to Account Setting. Click pet listing. Navigate to history Page.	User deactivated listing displayed	User did deactivated listing before	P

UAT019	Create Listing	Navigate to Account Setting. Click pet listing. Click + button. Fill in animal type, animal's breed, pet's born data, pet's name, pet's gender, adoption fee, listing type, and description. Click next button. Locate location. Click next button. Upload image. Click Submit button.	Listing created, navigate user to user created active listing screen.	User has a image in their device. User logged in.	P
UAT020	Log out	Navigate to Account Setting. Click log out button.	User logged out, navigate user to initial page.	User logged in	P

		Click ‘yes, logout’ at the prompt window.			
UAT021	Delete account	Navigate to Account Setting. Click on delete account button. Click ‘Yes Continue’ button. Click ‘Understood continue’ button.	User account deleted, navigate user to delete success message page.	User logged in	P

7.5.1 System usability test

Table 7. 21: SUS Scores

Tester no.	**Questions no. and score**										**Total**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
1	4	1	5	1	5	1	5	1	4	2	92.5
2	5	1	5	1	5	1	5	1	5	1	100
3	5	1	5	1	5	1	5	1	4	1	97.5
4	4	1	4	1	4	1	5	1	4	1	90
5	3	2	5	1	4	1	5	1	4	1	87.5
6	5	1	4	1	5	2	4	1	5	1	92.5
7	4	2	4	2	4	3	4	1	4	2	75
8	5	1	5	3	5	1	4	1	5	1	92.5
9	4	2	5	1	3	2	5	1	4	1	85
10	5	1	5	1	5	1	5	1	5	1	100
11	4	1	4	1	5	1	5	1	5	1	95
12	3	1	5	1	4	1	5	1	4	1	90
13	5	1	5	3	4	1	5	1	4	1	90
14	3	2	5	1	5	1	5	1	5	2	90
15	4	2	5	1	5	2	4	1	5	1	90
16	5	1	5	1	4	1	5	1	5	2	95
17	5	1	5	1	4	2	4	1	5	1	92.5
18	5	1	4	1	5	1	4	1	5	1	95
19	3	1	5	1	3	1	5	1	4	1	87.5
20	5	1	5	1	5	1	5	1	5	1	100
21	3	1	5	1	3	1	5	1	4	1	87.5
22	3	1	5	1	3	1	5	1	4	5	77.5
23	3	1	5	2	4	2	4	1	4	5	72.5
24	4	1	5	1	5	2	5	1	4	2	90
25	4	1	5	1	5	2	5	1	4	2	90
26	5	1	5	2	5	1	4	1	4	2	90
27	5	2	5	2	5	2	4	2	5	1	87.5

28	4	1	5	1	4	1	5	1	5	1	95
											90.09

The System Usability Scale (SUS) is a widely recognized tool for assessing the usability of a system. Originating in the 1980s, it offers a reliable measure of a system's usability. The SUS is often termed as a "quick and dirty" usability scale, but despite its simplicity, it provides a robust representation of a system's usability through a single score.

The SUS score is derived from responses to a ten-item questionnaire. Each of these questions is standardized and contributes to the final cumulative score, which can range from 0 to 100 (though it's not a percentage).

The project’s target was to achieve an SUS score greater than 80, which is often considered the benchmark for "Excellent" usability. After conducted the tests, the system achieved an SUS score of 90.09, which significantly surpassing the project’s target. The SUS score indicates the system’s high level of usability and satisfaction.

Although the overall feedback was positive, some constructive feedback provided by the testers did contribute to the improvement of the system. For example, some of the testers found it difficult in locating the "create pet listing" option. To address this, the option was integrated directly into the account settings page to make it more visible and accessible.

The user acceptance testing provided invaluable insights into the system's strengths and areas of potential enhancement. The impressive SUS score of 90.09 is a testament to the system's robust design and user-centric approach. For further information, the test cases can be found in Appendix C.

7.5.2 UI Usability score

Table 7. 22: Usability scores

Tester no.	Questions no. and score										Total
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
1	5	5	5	5	5	2	4	1	2	5	94
2	5	5	5	5	5	1	5	1	1	5	100
3	5	5	5	5	5	2	4	1	2	5	94
4	5	4	4	4	4	2	4	4	3	4	76
5	5	5	5	5	5	1	5	1	1	5	100
6	5	5	5	5	5	1	5	1	1	5	100
7	5	3	5	5	4	2	4	1	2	5	88
8	5	4	5	5	5	1	4	2	2	4	90
9	5	4	5	2	5	2	4	2	1	3	82
10	5	5	5	5	5	1	5	1	1	5	100
11	5	5	5	5	4	1	5	1	2	5	96
12	5	5	5	4	4	1	5	1	2	5	94
13	5	5	5	5	5	2	4	1	1	5	96
14	5	5	5	5	5	1	5	1	2	5	98
15	5	4	4	5	5	1	4	1	1	5	94
16	5	4	4	5	5	2	4	1	1	5	92
17	5	5	5	5	5	1	5	3	2	5	94
18	4	5	4	5	4	2	5	1	1	5	92
19	5	4	5	5	4	1	4	1	2	5	92
20	4	3	4	4	4	1	3	2	2	4	78
21	4	5	5	4	4	1	5	1	1	3	90
22	4	5	5	4	4	1	5	1	1	3	90
23	5	4	4	4	4	2	5	1	2	3	84
24	5	5	5	5	5	2	5	2	2	4	92
25	5	5	5	4	5	2	5	1	5	5	88
26	4	5	5	5	5	2	4	1	3	5	90

27	5	4	5	2	5	2	4	2	2	3	80
28	5	4	5	1	5	1	4	1	1	3	84
											91

The primary goal of this test was to evaluate the prototype UI's usability. By conducting this test at the prototype stage, the potential design flaws or areas of improvement can be identified and fixed. During development phase or post development phase, addressing UI changes can be time-consuming and costly. Hence, testing at the early phase of the project and gain early feedback is invaluable.

The test was tailored specifically to assess the UI, focusing on its design, layout, and user-friendliness. This was a prototype UI test, meaning it was conducted on a preliminary version of the UI, not the final product.

The test consisted of 10 questions, with scores ranging from 1 to 5 for each. For questions 6, 8, and 9, the score was calculated as (6 - the score gained). This inversion likely aimed to account for negatively phrased questions. For all other questions, the score gained was taken directly. The scores from all 10 questions were summed up and then multiplied by two. This scaling ensured the maximum possible score was 100, making it easier to visualize and interpret. After collating scores from all respondents, an average was taken to get the final usability score.

In this project, the target UI usability score was set for at least greater than 80, ensuring quality and user-friendliness and intuitiveness was desired. After conducted the test, the prototype UI achieved 91 as the final test score, surpassing the target and indicating a high level of user satisfaction with the design.

While the score of 91 is commendable, changes had been made to improve the design of the UI. For example, tester 19 recommended that labels can be added to the categorize button at Home Screen and after careful consideration, the recommendation was added to the Pawfect Home.

In a nutshell, the prototype UI has demonstrated excellent usability, as reflected in its high score. This early testing phase's feedback will be invaluable in refining the design, ensuring that the final product offers an optimal user experience. The proactive approach of testing at the prototype stage will likely save significant time and resources in the later stages of development.

CHAPTER 8

CONCLUSION OF THE REPORT

8.1 Conclusion

The "Pawfect Home" mobile application was developed to streamline the pet adoption process, bridging the gap between potential adopters and pets in need of loving homes. Throughout its development, various challenges were identified and addressed using distinct design principles. The application's functionalities, including its critical use cases, were meticulously examined, and crafted using specific tools. Feedback from user testing was instrumental in refining the application, with many users valuing its efficiency and the promotion of the adoption concept.

8.2 Limitation

Although the project was completed with meeting all the requirements identified, the limitation still exist in the system mainly due to time and financial constraints. The limitations mentioned below can be improved in the future to make the mobile application more complete and better.

The limitations identified:

1. MailChecker.ai Limitations, the free version of MailChecker.ai, which is shared with other users, has a restriction of 120 requests per hour. This limitation can hinder the application's email verification process during peak usage times.
2. Google API Limitations: The free tier of Google API is capped at $200 per month. This budgetary constraint can impact the application's location-based services and other functionalities that rely on Google's services.
3. Limited user feedback. There are only 28 testers attended the UAT the limited user feedback might result in unaddressed usability issues or unanticipated user needs.

4. Data Privacy Concerns. Although there are security practices, the mobile application might not be as secure as the software or mobile application with the attendance of cyber security professional.
5. No admin site to manage Report Listing. The mobile application came with Report Listing function where the users can report the pet listing. However, due to the time constraints, the admin site did not developed in the project to handle it.

8.3 Recommendation for future improvements

There are still a lot more space to improve the mobile application by adding new major and minor features and refining the current system. Assuming there are no time and financial limitation below are the recommendations for the future improvements of “Pawfect Home”.

1. Phone Number Verification: Implementing phone number verification can greatly enhance user security and reduce the potential for spam or malicious accounts.
2. Paid Version for Email Domain Verification: Upgrading to a paid version of an email verification service can ensure consistent and reliable email domain verification, enhancing the overall user experience and security of the platform.
3. Admin Site: Developing a dedicated admin site can provide a centralized platform for managing user accounts, pet listings, and other essential functionalities. By implementing admin site, the report sent from user can now be reviewed.
4. Built-in Chat: Incorporating a built-in chat feature can facilitate direct communication between potential adopters and pet owners, making the adoption process more personal and efficient.
5. Auto Fetching Nearby Vet: An automatic feature to fetch nearby veterinary clinics can provide users with essential information about local vet services, ensuring the well-being of the adopted pets.

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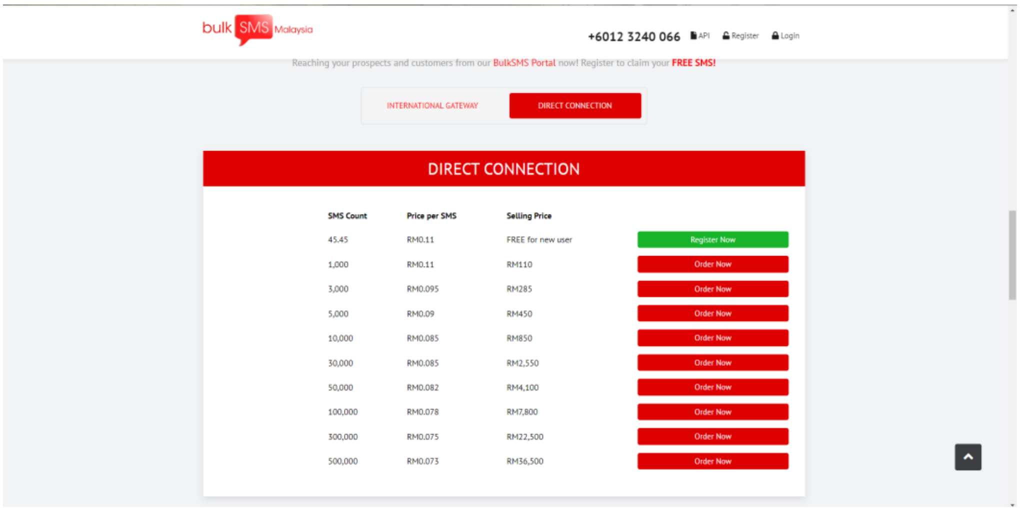
APPENDICIES

APPENDIX A: WEB SCREENSHOT



Reaching your prospects and customers from our BulkSMS Portal now! Register to claim your FREE SMS!

DIRECT CONNECTION

SMS Count	Price per SMS	Selling Price	
45.45	RM0.11	FREE for new user	Register Now
1,000	RM0.11	RM110	Order Now
3,000	RM0.095	RM285	Order Now
5,000	RM0.09	RM450	Order Now
10,000	RM0.085	RM850	Order Now
30,000	RM0.085	RM2,550	Order Now
50,000	RM0.082	RM4,100	Order Now
100,000	RM0.078	RM7,800	Order Now
300,000	RM0.075	RM22,500	Order Now
500,000	RM0.073	RM36,500	Order Now

APPENDIX B: TESTER CONSENT FORM

User Testing Consent Form

Date: __20 JULY 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Abbie____

Participant's Signature: _______ _____________

Date: _____20 JULY 2023_______

User Testing Consent Form

Date: __20/7/2023___

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ___Ho Ai Ning________

Participant's Signature: _____ ____________________

Date: __20/7/23__________

User Testing Consent Form

Date: 20/7/2023

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: Alvin Hai Yong Guang

Participant's Signature: Alvin

Date: 20/7/2023

User Testing Consent Form

Date: _27 JULY 2023_____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Chloe________

Participant's Signature: _______ Chole _______________

Date: ____27 JULY 2023_________

User Testing Consent Form

Date: __30 AUGUST 2023__

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: _____Darren_______

Participant's Signature: ___ _________

Date: ____30 AUGUST 2023_______

User Testing Consent Form

Date: ___20/7/2023_________

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Lew Fung Lim____________________

Participant's Signature: _____ ____________________

Date: ______20/7/23___________________

User Testing Consent Form

Date: _1 SEP 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Hong Ooi_________

Participant's Signature: ____Hongooi___________

Date: ____1 SEP 2023___________

User Testing Consent Form

Date: _25 AUGUST 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Hui Wen_________

Participant's Signature: ____ Huiwen ___________

Date: ____25 AUGUST 2023___________

User Testing Consent Form

Date: __26 JULY 2023__

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: _____Chia Inn Zhan_______

Participant's Signature: ___ Chia _________

Date: ____26 JULY 2023_______

User Testing Consent Form

Date: _____20 JULY 2023_______

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

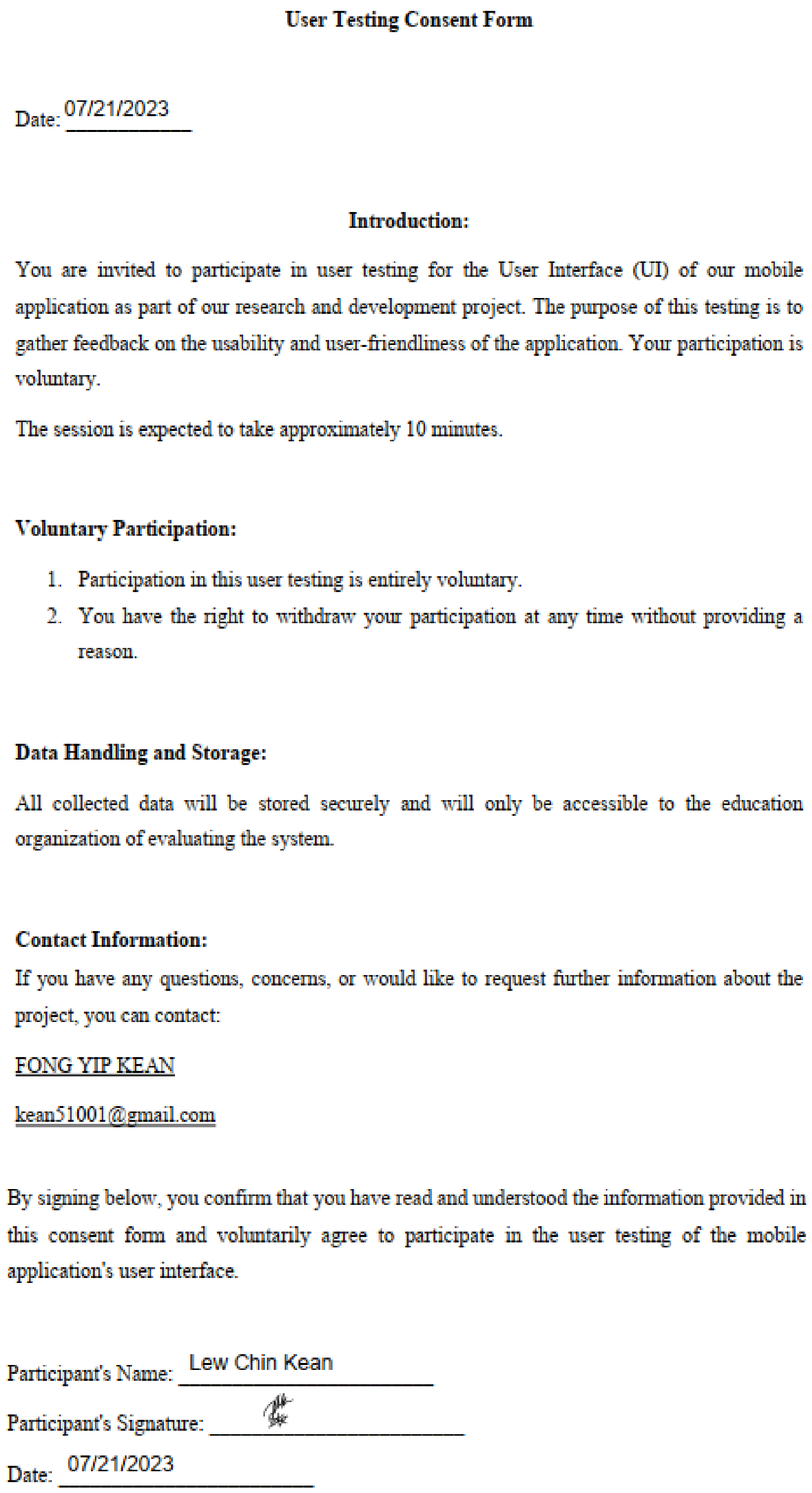
kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Gan Zhi Ying______

Participant's Signature: _____ _________

Date: ___20 JULY 2023_____



User Testing Consent Form

Date: 07/21/2023

Introduction:

You are invited to participate in user testing for the User Interface (UI) of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the usability and user-friendliness of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application's user interface.

Participant's Name: Lew Chin Kean

Participant's Signature: ______________________

Date: 07/21/2023

User Testing Consent Form

Date: _____3 SEP 2023_______

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Jin Hao______

Participant's Signature: _____JIN HAO_________

Date: ___3 SEP 2023_____

User Testing Consent Form

Date: ____20 JULY 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ___JOE__________

Participant's Signature: _____ Joe ________

Date: _____20 JULY 2023_________

User Testing Consent Form

Date: __25 JULY 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Keng Yen____

Participant's Signature: _______ _____________

Date: _____25 JULY 2023_______

User Testing Consent Form

Date: ____20 JULY 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ___Koon Qi__________

Participant's Signature: _____ KoonQi. ________

Date: _____20 JULY 2023_________

User Testing Consent Form

Date: ____4 SEP 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ___Liau__________

Participant's Signature: _____ Liau ________

Date: _____4 SEP 2023_________

User Testing Consent Form

Date: ___28/7/2023___

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Mabel Pang____________

Participant's Signature: _____ ___________________

Date: ______28/7/2023_________

User Testing Consent Form

Date: 1/8/2023

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN
kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: Chen Hao Cheng

Participant's Signature:

1/8/2023

User Testing Consent Form

Date: __20 JULY 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ________Nicholas__________

Participant's Signature: ______Nicholas_________

Date: _______20 JULY 2023__________

User Testing Consent Form

Date: ___4 AUG 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: __Shao Yang____

Participant's Signature: _____ ________

Date: ____4AUG2023_________

User Testing Consent Form

Date: __26 JULY 2023___

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

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kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Teng Jun Zek_______

Participant's Signature: ______ _______________

Date: ____26 JULY 2023________

User Testing Consent Form

Date: __26 JULY 2023___

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

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2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

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Contact Information:

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kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Ng Teng Wei_______

Participant's Signature: ____ Nick ____________

Date: ____26 JULY 2023________

User Testing Consent Form

Date: 5 September 2023

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

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Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: Ching Zhen Yi

Participant's Signature:

Date: 5 September 2023

User Testing Consent Form

Date: 20.7.2023

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

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2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

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Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: YAP WEN JIUN
Participant's Signature: yap
Date: 20.7.2023

User Testing Consent Form

Date: __25 AUGUST 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: _____Yen Khai_______

Participant's Signature: _____ __________

Date: _____25 AUGUST 2023_______

User Testing Consent Form

Date: __20 JULY 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

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2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

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Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Thim____

Participant's Signature: _______ _____________

Date: _____20 JULY 2023_______

User Testing Consent Form

Date: _28 JULY 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Ang Zhi Heng_________

Participant's Signature: ____ ZH ___________

Date: ____28 JULY 2023___________

User Testing Consent Form

Date: _4 SEP 2023____

Introduction:

You are invited to participate in user testing for the of our mobile application as part of our research and development project. The purpose of this testing is to gather feedback on the functionality and usability of the application. Your participation is voluntary.

The session is expected to take approximately 10 minutes.

Voluntary Participation:

1. Participation in this user testing is entirely voluntary.
2. You have the right to withdraw your participation at any time without providing a reason.

Data Handling and Storage:

All collected data will be stored securely and will only be accessible to the education organization of evaluating the system.

Contact Information:

If you have any questions, concerns, or would like to request further information about the project, you can contact:

FONG YIP KEAN

kean51001@gmail.com

By signing below, you confirm that you have read and understood the information provided in this consent form and voluntarily agree to participate in the user testing of the mobile application.

Participant's Name: ____Zhi Jie_________

Participant's Signature: ____ ___________

Date: ____4 SEP 2023___________

APPENDIX C: SUS Test Form

User satisfaction survey for mobile application						
Please rate the following statements						
5- Strongly agree 1- Strongly disagree		1	2	3	4	5
1	I think that I would like to use this system frequently.					
2	I found the system unnecessarily complex.					
3	I thought the system was easy to use.					
4	I think that I would need the support of a technical person to be able to use this system.					
5	I found the various functions in this system were well integrated.					
6	I thought there was too much inconsistency in this system.					
7	I would imagine that most people would learn to use this system very quickly.					
8	I found the system very cumbersome to use.					
9	I felt very confident using the system.					
10	I needed to learn a lot of things before I could get going with this system.					

Optional	
What did you like the system the most	
What did you like the least for this system	
Do you have any additional comments on the system?	

APPENDIX D: UI Usability Test Form

User satisfaction survey for mobile application						
Please rate the following statements						
5- Strongly agree 1- Strongly disagree		1	2	3	4	5
1	The overall user interface of the application is visually appealing.					
2	The navigation within the application is intuitive and easy to understand.					
3	The mobile application is consistent in terms of design					
4	The layout and organization of information within the application is clear and logical.					
5	The application provides relevant and helpful feedback to user actions.					/
6	I found the system is awkward to use					
7	I felt confident to use the system					
8	It takes me a lot of time to learn to use this system					

9	I think that I need guidance to learn to use the system					
10	Overall, I would recommend the mobile application to others.					
Optional						
What did you like the system the most						
What did you like the least for this system						
Do you have any additional comments on the system?						