

Interactive Android Application as an Assistant to care for Cat's Health

by

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the requirements for the
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CERTIFICATION OF APPROVAL

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Approved by,

(Dr. Rohiza Binti Ahmad)

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TRONOH, PERAK

September 2012

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgement, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

NOOR SHAMEEM BINTI ROSLAN

ABSTRACT

Cats or domesticated cats have been one of the common pets among Malaysians. It is often called as housecats or simply the cats when there is no need to distinguish it from other felids and felines. Although cats had been ranked as one of the most popular pets among Malaysians besides other domesticated pets, not every individual especially the cat owners will be able to grow a healthy cat. Most of them will wait for their cats to become ill before they think about their health care. In other words, this is a wasteful and dangerous way to ensure a good health for the cats.

According to the results of surveys that had been conducted, almost every of the respondents especially those who have and own cats did agreed that financial constraints would be one of the main factors that resist an individual from bringing the cats to the veterinary clinics or hospitals to have health examination and receive the necessary treatments. With the desire to fulfill the tight schedule in everyday's life, it is impossible for an individual who have null knowledge on cats' health to glance through the books or the internet in searching for information on how to grow a healthy cat.

As a result, with the objective to provide a portable assistant with information and guidance on cats' health, an interactive Android application will be developed to assist every individual especially cat owners to grow up a healthy cat. This application will eventually cover up every aspects of cats' health like cats' diseases diagnosis, information on diseases that will affect the cats, list and steps of first-aids that should be given based on different cases, and basic procedures to give medicine to the cats. Together with this application, since it will be linked to Global Positioning System (GPS), every cat owners can easily identify the locations of veterinary clinics.

Interactive Android Application as an Assistant to care for Cat's Health will be developed based on System Development Life Cycle (SDLC). All of the requirements will be gathered through different methods like distribution of questionnaires to the individuals especially cat owners as well as experts' interviews.

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ABBREVIATIONS AND NOMENCLATURES

GPS	Global Positioning System
GIA	Global Intelligence Alliance
OS	Operating System
AI	Artificial Intelligence
DSS	Decision Support System
SDLC	System Development Life Cycle
FYP	Final Year Project
GUI	Graphical User Interface
RAD	Rapid Application Development
UAT	User Acceptance Testing

CHAPTER 1

INTRODUCTION

Cats are extraordinarily appealing little bundles of fun in a person's life. Unfortunately, a large number of people impulsively acquire cats without considering what they are taking on. Therefore, before a person decides to get a cat as its pet and become a responsible cat owner, he or she should be willing to house, feed, and maintain the cat for the next ten to fifteen years. In addition, the costs of vaccination and neutering the cat will have to be met by every cat owner especially when it could have extra occasional problems such as fleas, worms, and sickness. Since thousands of cats were being destroyed and died in almost every major city in the world, this can be considered as an appealing situation which required a cat owner to play its major role by being a responsible owner to the cats.

1.1 Background of Study

Cats have become the most favorite pet among humans as they are fairly easy pets to keep. It is enjoyable for a cat owner to understand how this originally wild animal able to adapt so well to live side-by-side with humans especially the way a cat thinks is dramatically different from the way we think. According to Dr. Bruce Fogle as a veterinarian and prolific author of pet care books and travel narratives, the relationship between a cat owner and its cats will be at its most intense emotionally when a cat is unwell. Hence, it is up to the cat owners in ensuring a healthy lifestyle for the cats [1].

Based on the opinion from Dr. Bruce Fogle also, when a cat is unwell, its natural behavior is to withdraw and hide. The ill cat does not want its predators to know that it is debilitated. This can be considered as a great survival tactic, but can be a real nuisance for the cat owner, as it means that he or she may be unaware of a medical problem suffered by the cat. The signals that a cat gives out when it is unwell are far more subtle,

and frequently occur later in an illness [1]. In other words, not much can be done at the point when a little problem faced by the cats turns into a killer disease.

By developing Interactive Android Application as an Assistant to care for Cat's Health, every individual especially the cat owners will have a new medium and channel in accessing towards the information on cats' health. With cats as the subject of this application, this will eventually become the main platform of research and study that need to be conducted besides the technology that will be implemented. Based on the surveys that had been done, there are already web-based systems as well as mobile native applications on veterinary that had been widely developed but with different focus. Nonetheless, this to-be application will be built differently from them.

Through this application, varieties of information relating to cats' health will come to the users. Apparently, a healthy cat will always has the habit of eating well, active, alert, playful, and responding to calls. It should also have a smooth urinary system, and good body conditions. In the case that the cat shows changes in either one of the behavioral, a cat owner should be alert enough towards identifying the changes as these can be classified as the identifiers that the cat is suffering from any health issues. With the features of changes in cat's behavior together with diseases related to the changes provided in this application, a cat owner will be able to determine the health level of their cats before brings them to the clinics or hospitals.

Apart of that, this application will teach every individual especially the cat owners on the right way to carry out the first-aids on the cats based on different emergency cases like broken fractures due to being knocked by the vehicles. Basic procedures to give medicine to the cats will be included as well in the application. Since an individual cannot easily replace the position of the veterinarians especially in terms of diagnosing the diseases of the cats, only information on the diseases will be provided in the application like the symptoms and causes of the diseases.

With the focus to provide a portable and handy medium to help every individual particularly the cat owners to grow a healthy cat, Interactive Android Application as an Assistant to care for Cat's Health will cover every aspects of the cats' health starting from the cats' diseases diagnosis, the information about the diseases that can affect the cats, the steps to carry out the first-aids to the cats based on different cases, and the correct procedures to supply medicine to the cats. To make this application more intelligent, it will be integrated with Global Positioning System (GPS) to help the cat owners in searching for the locations of veterinary clinics.

1.2 Problem Statement

In today's urbanization world, the implementation of technology in every aspect of a person's life received the highest demand from everybody especially to those who are affordable and capable enough in adapting themselves easily with the new come out of technology. With the existence of internet, users can easily carry out their tasks as well as getting tremendous of information from around the world. These have made their life much simpler as everything needs not to be done manually anymore. In advance, inventors have successfully come out with a new technology which allows people to have a more flexible medium in accessing to the internet which is through the phone.

Since cats had been ranked as the most popular pets with global population of 202 millions [2], it showed how humans are able to develop a unique relationship with this kind of animal species. Nevertheless, it is the responsibility of every cat owner to play their main role in maintaining a healthy life for the cats either by examining the cats thoroughly as well as understand the diseases that might affect them. According to the results of surveys that had been conducted, it showed that how the mentality of an individual especially the cat owners can affect them from paying high concern towards growing up a healthy cat.

With the perception that cats can easily be replaced, most of the cat owners are eventually not appreciating the life of the cats especially when they did realize about the

high financial cost required to treat the cats in the case that the cats are suffering from any health problems. In other words, it has become a culture among the cat owners' for not adapting a healthy lifestyle to the cats. In addition, without any internet connection and access in the previous days of life, this has become another strong reason that causes the cats' owners to have difficulty in learning about the right ways and having the guidance to grow a healthy cat in terms of cat's cares.

Even if there are already existing web-based systems or mobile native applications on cats, the information provided is not reaching the necessity of the cat owners. For an instance, a mobile native application on Android called Cat Owners Veterinary Handbook that covers up to 650 pages on cats' health. How can this application easily help the cat owners in identifying ways to grow up a healthy cat as it requires them to read word by word? Based on the results of interview that had been done with a veterinarian, in order to identify whether a cat is suffering from any health problems, a cat owner can monitor its cat through the habits and daily behavioral that should be shown by a healthy cat.

In the case that there are any changes on the behavioral of the cats like not eating well or not responding to calls, a cat owner can use this application to identify the right ways to examine the health of the cats. Therefore, with the development of Interactive Android Application as an Assistant to care for Cat's Health, every individual especially those who have and own a cat can easily retrieve the information relating to cats' health specifically in terms of how to identify suspected diseases suffered by the cats based on symptoms shown, the information of diseases that usually affecting the cats, the changes in behavior shown by the cats, list and steps of first-aids that can be applied on the cats based on different emergency cases, and the right procedures to supply medicine to it.

There should be no more excuses saying that a cat owner is unable to grow a healthy cat due to the lack of knowledge about cats' health as this application will provide and show all of the necessary and related information. In addition, with the aim to replace books and meeting the revolution of internet through Smartphone, Interactive Android

Application as an Assistant to care for Cat's Health will be developed as a mobile native application for the usability of the users as it will be much more handy and portable in retrieving the information from anywhere and any when.

1.3 Objectives and Scope of Study

In conjunction with the revolution of internet that can be accessed through Smartphone or tablets as well as to provide a portable and handy assistant to the individuals or cat owners who have and own a cat, this project is aimed to develop an Android application which can help every users to retrieve information easily about the cats' health. Therefore, below shows the main objective of this project:

To develop a mobile native application in Android with the information on cats' health as well as locations of veterinary clinics in order to help every individual especially the cat owners in growing up a healthy cat.

Nevertheless, before the main objective can be achieved, the author has to achieve all of the sub-objectives first before a complete Android Application on cats' health can be developed successfully. Below is the list of the sub-objectives for this application:

- To have and acquire better understanding on the knowledge regarding to the development of mobile native application especially on Android.
- To identify suspected diseases suffered by a cat based on symptoms shown.
- To provide information on the diseases that usually affecting the cats in terms of how it affects the cats and the symptoms.
- To identify suspected diseases suffered by a cat based on changes in behaviors.
- To list out the guidelines on how to carry out the first-aids on the cats based on different emergency cases.
- To give an insight on the right procedures to supply medicine to the cats.
- To identify the locations of veterinary clinics through the GPS in the case that the cat owners want to bring their cats to see the veterinarians.

In order to achieve the above objectives through the development of Interactive Android Application as an Assistant to care for Cat's Health, a deep research regarding to the different scopes of study need to be conducted. In deep, below is the list of the different scopes of study that will be involved throughout the development of the application:

- Knowledge acquiring and understanding on the development of mobile native application particularly Android.
- Integration of GPS onto the application to trace the locations of veterinary clinics based on the location of the users.
- Health aspects of the cats including diagnose cats' diseases, the changes of behaviors in the cats, information on diseases that usually affecting the cats, the list of steps on how to carry out the first-aids on the cats based on different emergency cases, and the right procedures to supply medicine to a cat.
- An understanding towards the necessity of the ill cats in meeting the veterinarians based on the heath conditions of the cats.
- An understanding towards the flow of the to-be application including all of the scopes of the study before being developed for the users.
- Interactive Android Application as an Assistant to care for Cat's Health is developed for individuals who loves and owns cats.

1.4 Relevancy of the Project

As being stated previously where cats had been ranked as the most popular pets throughout the world, it is always been the responsibility of the cats' owners in ensuring the physical and emotional well-being of their cats. Based on the results of surveys that had been conducted, most of the respondents did agreed that financial constraints as well as the unsure locations of veterinary clinics become the factors of resistant for them to bring the cats to the veterinarians. As the simplest way to identify the health problems suffer by the cats, a cat owner should be alert enough to monitor the behavioral changes shown by the cats.

According to the results of the surveys that had been conducted also, although majority of the respondents were able to detect the behavioral changes shown by their cats, the tendency for them to bring the cats to the veterinarians are still depending on the level of illness of the cats. As a result, they did agree that a portable and handy assistant with information on cats' health can help them to eventually grow a healthy cat. By growing a healthy cat, the possibilities for the cats to be infected by diseases will be lesser and this will help the cat owners from spending their time and money on the treatments that need to be given to the cats.

Consequently, with the development of Interactive Android Application as an Assistant to care for Cat's Health, the cats' owners will have a medium or an alternative in maintaining and sustaining the health of the cats especially when they have the medium and channel to retrieve the information on cats' health easily. By having the feature of Diagnose Your Cat, the cats' owners will be able to identify any related diseases suffered by the cats based on the symptoms shown as well as changes in the behaviors of the cats. In the case that the cats show the symptoms and behaviors' changes, this application will help the users by providing the information on the related diseases.

Apart of that, during the emergency cases like accidents with the vehicles, before directly bring the cats to the veterinary clinics, this application will teach the users on the steps to carry out the necessary first-aids onto the cats. In addition, in the situation where the users are unable to search for the locations of clinics, the first-aids that have been applied onto the cats will more or less reduce the illness or sickness of the cats. Nevertheless, as the author did realize about the importance of GPS integration, this application will have the features of locating the locations of veterinary clinics based on the location of the users.

Due to the limitation of the users' knowledge as well as the application, it is impossible to strongly assure and highly guarantee that a cat is being infected by a disease based on the symptoms shown by the cats since a symptom can be referring to one or more diseases. As a result, the author had decided to only provide the information on the

diseases which are usually affecting the cats and the urgency of the cat owners to bring the cats to the veterinarians. Hence, rather than conducting self-treatment onto the cats, it is advisable for the cat owners to bring the cats to the veterinarians and receive the right treatments.

1.5 Feasibility of the Project within the Scope and Time Frame

Before deciding and developing a system or an application, a Feasibility Analysis needs to be conducted in ensuring a smooth development of the project. Below are the details of the Feasibility Analysis that had been carried out:

- **Feasibility of Time Frame**

An application will usually being built on the basis of yearly. As the author has made the decision to finish up her final year of study between three semesters, Interactive Android Application as an Assistant to care for Cats' Health will be built within eight months of time frame. This will allow the author to have much more time in conducting the research related to every aspects of the project and able to develop the application successfully with the necessary requirements that had been identified during the research.

- **Feasibility of Scope**

Since Interactive Android Application as an Assistant to care for Cat's Health is targeted to be used by every individual who have and own a cat especially the cat owners, the author has to ensure that this application will be built on the basis of the scope that had been identified previously. It is good to have sudden of additional or extra features during the development of the application especially when it brings benefits to the users but with an absent of any of the requirements or features that had been identified previously which should be built into the application, this will make the users to have lower impression towards Interactive Android Application as an Assistant to care for Cat's Health.

Nevertheless, all of the identified scopes should be able to be built successfully in the application throughout the eight months of time frame.

- **Feasibility of Technology**

As Interactive Android Application as an Assistant to care for Cat's Health is targeted to be built as an interactive mobile native application rather than web-based system or mobile web application, the author will have to learn deeply about the development of mobile native application in order to build the application successfully. With the help from the lecturers as well as the researches, this application should be able to be developed within the time frame. In addition, as location-based applications have been widely developed for different purposes, therefore, the author should be able to integrate this application as well with the GPS. Throughout the eight months of time-frame, a complete Interactive Android Application as an Assistant to care for Cat's Health integrated with GPS should be able to be built successfully.

CHAPTER 2

LITERATURE REVIEW

In the opinion of Dr. Bruce Fogle, pain is a perception where there are no specific pain pathways in the nervous system. The perception of the pain varies between the different species. For an instance, cats are better at concealing their pain than dogs. This ability is both good and bad. On one hand, it means that the cat does not develop pain-induced clinical shock as quickly as dogs. On the other hand, it means that a cat is likely to reveal that they feel pain but in the absence of complaint, the cats' owners may fail to realize that their cats are seriously ill. Therefore, it is the responsibility of the cats' owners to be alert with any change in their cats' routines like the way it sits, the amount it eats, and its relationship with the owners [1]. If the cats' owners do detect any significant changes in the cats' routines or behaviors, Interactive Android Application as an Assistant to care for Cat's Health will help the cats' owners in identifying the curiosity towards the changing.

2.1 Interactive Android Application as an Assistant to care for Cat's Health in Mobile

In conjunction with the revolution of the internet and technology industry, numbers of Smartphone's users have increased more rapidly in comparison with the numbers of computers, laptops, and notebooks' users. Due to this phenomenon, development of mobile native applications has become so lucrative. It is a huge market where the users keep demanding for more powerful and functional applications bridging the gap between Smartphone and computers [3].

On the other hand, with the rapid development of Smartphone also, this has eventually overcome the market of featured phones. More and more users of mobile phones are shifting from this kind of phones into the Smartphone due to the available native applications that can be easily downloaded as well as its powerful features. The figures

below show the percentage of featured phones' users who migrated to be the Smartphone's users in United States and the percentage of the Smartphone's sales around the world in February 2012 according to the different manufacturers.

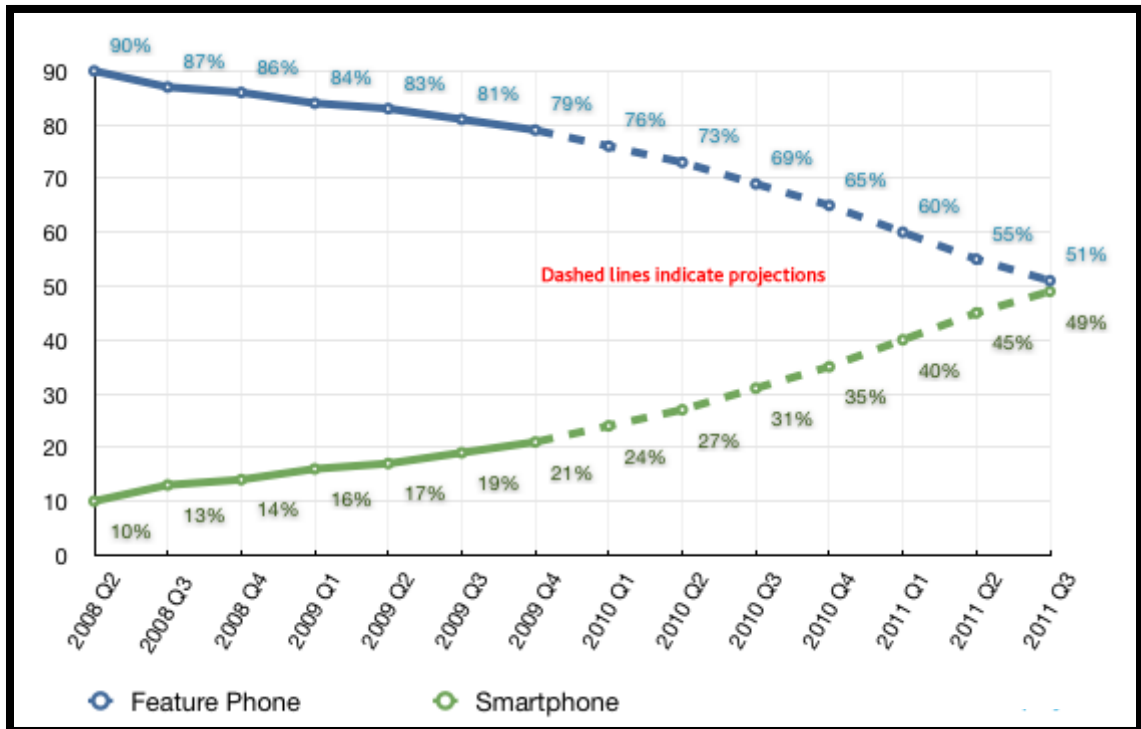


Figure 1: Percentage of Featured Phones' Users who migrated to be the Smartphone's Users from year and year (Source: The Nielsen Company)

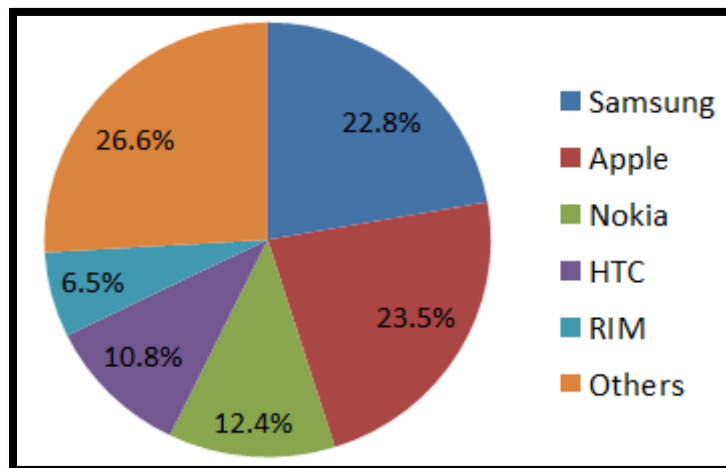


Figure 2: Percentage of Smartphone's Sales based on Different Manufactures around the world (Source: International Data Corporation)

Based on the percentage shows in both of the figures, these proved that Smartphone has become the fastest online space. Due to this reason, the author has decided to develop the application as a mobile native application rather than a typical web-based system or mobile web application. According to Lie Luo as the Head of Telcom, Technology, and Media Practice at Global Intelligence Alliance (GIA), a mobile native application is a software written for mobile devices that performs a specific task. It is specifically designed to run on a device’s operating system and machine firmware which typically needs to be adapted for different devices [4].

Based on Lie Luo, most of the developers of application saw higher user adoptions, usage volumes, and user engagement over mobile native applications. To be more specific, 30% of the developers did saw over 100% higher usage volumes and engagement on mobile native applications as compared to mobile web applications. These can be seen from the line charts shown below. In addition, according to the research done by Lei Luo also, mobile web applications are less known largely due to a relative lack of commercial interest from vendors in promoting their usage [4]. Therefore, these situations have eventually encouraging the author to develop the application as a mobile native application rather than mobile web application.

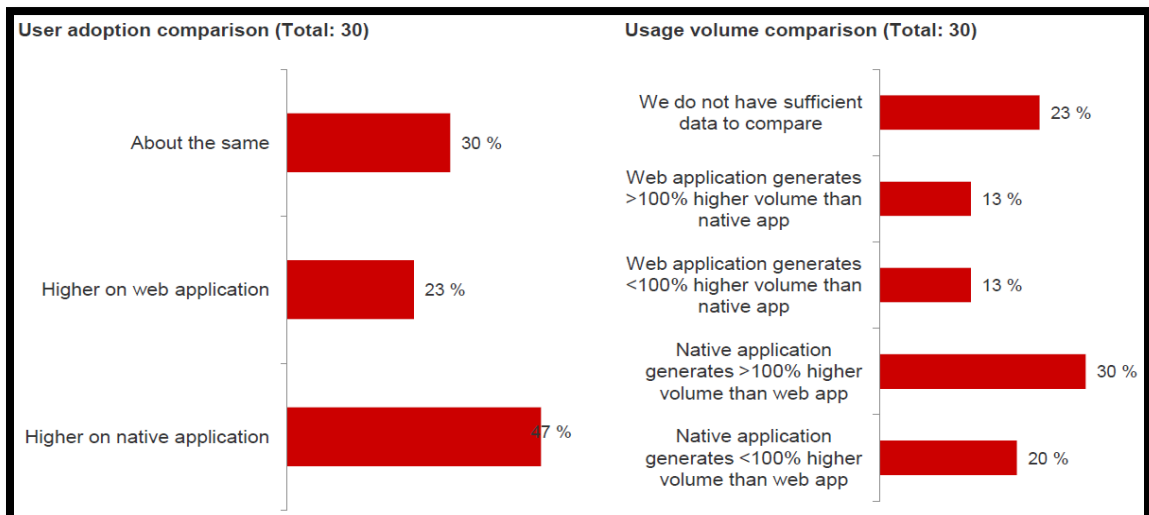


Figure 3: Percentage on the Comparisons between User Adoption and Usage Volume of Mobile Web Applications VS. Mobile Native Applications (Source: GIA Native VS. Web Application Industry Survey, February – March 2010)

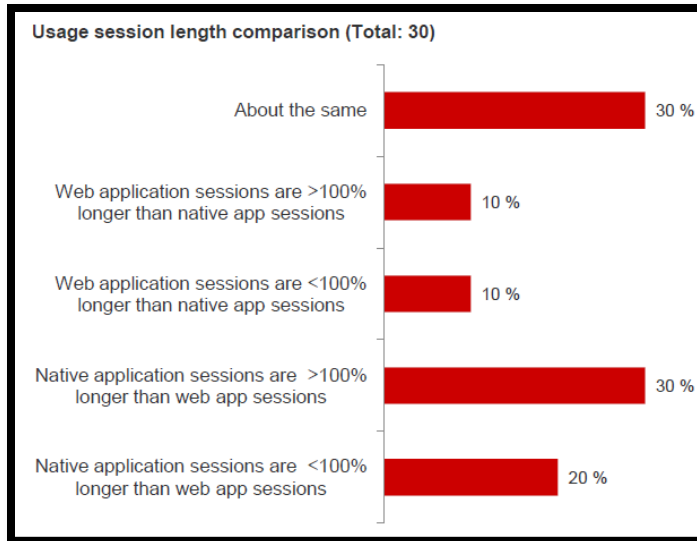


Figure 4: Percentage on the Comparisons between User Engagements of Mobile Web Applications VS. Mobile Native Applications (Source: GIA Native VS. Web Application Industry Survey, February – March 2010)

Apart of that, a mobile native application has a major advantage over a mobile web application which is the ability to leverage device-specific hardware and software. This means that a mobile native application can take advantage over the latest technology available on mobile devices and can integrate with on-board application like the calendars, contacts, and E-Mail. The list below shows the advantages of mobile native application which have encouraged the author to develop the application on cats' health as a mobile native application rather than mobile web application [5]:

- Offers a richer and more compelling user experience
- Have the ability to run offline
- Provide better “Front of Mind” penetration
- Easier to be monetized

2.2 Interactive Android Application as an Assistant to care for Cat's Health in Operating System of Android

Mobile phones are different from computers where a user is unable to install a different operating system (OS) if he or she dislikes the one that came preloaded. Frequently, a

phones' OS will reflect a user's lifestyle as it determines the choice of applications to be downloaded and the functionality of the phones. According to Dave Coustan and Jonathan Strickland as the editors of howstuffworks? website, an OS manages the hardware and software resources of a Smartphone. Some OS platforms cover the entire range of the software stack while others may only include the lower levels which are typically the kernel and middleware layers and have to rely on additional software platforms to provide a user interface framework or AEE [6].

According to the research that had been done, throughout the world of the Smartphone today, the OS has been divided into several different platforms which are WebOS, Blackberry OS, Windows Mobile, Symbian OS, Anroid OS, and iPhone OS. Essentially, Palm OS or WebOS, Android OS, and iPhone OS are frequently updated with new software features, followed by Blackberry OS and Windows Mobile updates. On the other hand, Symbian is updated irregularly and it is a bit clunky when installing the latest updates. The table below describes the details of each OS.

Table 1: Details of Different Mobile Phone's OS

WebOS	The WebOS runs on Linux Kernel with the proprietary components developed by Palm [7]. The Palm Pre was the first device with WebOS and both were released in June 2009. Another software development kit for WebOS is Mojo which has a built-in application catalog and Application Programming Interfaces (APIs) for extending JavaScript in order to access to hardware features of the devices [8].
Blackberry OS	The Blackberry OS follows the same proprietary model of iOS where it is only available for Blackberry Smartphone. It has an application store which is relatively new and small in comparison with Android Market and Apple's Application Store. With this kind of operating system, Blackberry Smartphone are especially successful and appealing to security conscious users as it is the only platform that supports full device encryption and encrypted communication [9].
Windows Mobile	Windows Mobile is a new mobile's operating system which includes a complete new over-hauled user interfaces inspired by Microsoft's "Metro Design Language". It includes full integration of Microsoft services like Windows Live, Zune, Xbox, and Live and Bing. In addition, Windows Phone does integrate with other non-Microsoft services such as Facebook and Google accounts [7].

Symbian OS	Symbian OS is the dominant platform in the market which is available in around more than 120 different models of phones. This platform only covered up to two lower level software stacks which are Kernel and Middleware layers as well as application platforms like User Interface Quartz (UIQ) and MOAP. On the other hand, a Series 60 provides the upper layer for Symbian OS [7].
Android OS	Android was developed by a small startup company that was purchased by Google Incorporation which then continues to update this software. It is a Linux-derived operating system backed by Google along with major hardware and software developers like Intel, HTC, ARM, Samsung, Motorola, and eBay which later formed the Open Handset Alliance. According to the statistic taken from the Wikipedia, from the second quarter of 2009 to the second quarter of 2010, Android's worldwide market share rose from 1.8% to 17.2%. On November 15, 2011, Android had successfully reached the global Smartphone' market share [7].
iPhone OS	iPhone OS is the Apple's mobile operating system. This operating system was originally being developed to support the iPhone before being extended to support others Apple Incorporation's devices like iPod Touch, iPad, and Apple TV [10].

Among all of the available mobile phone's OS as described above, Android has been the top Smartphone's OS during 2011. Based on the research that had been done by Canals Corporation, 48.8% of Smartphone shipped worldwide throughout 2011 had been shipped together with Google's free Android OS. In addition, as Android can be considered as the leader in Smartphone nowadays, Nokia had made its surprise decision to drop its Symbian OS in 2011. These situations have eventually led the author to make a firm decision to develop the application in Android rather than other OS. The table below shows the statistic of Smartphone's OS in 2011 [11].

Table 2: Worldwide Smartphone's Market based on Operating System in 2011 (Source: Canals, February 2011)

Worldwide Smartphones' Market based on Operating System in 2011			
Operating System	Shipments 2011 (millions)	Market share 2011	Annual growth
Android	237.7	48.8%	244%
iOS	93.1	19.1%	96%
Symbian	80.1	16.4%	-29.1%

BlackBerry	51.4	10.5%	5.0%
Bada	13.2	2.7%	183.1%
Windows Phone	6.8	1.4%	-43.3%
Others	5.4	1.1%	14.4%
Total	487.7	100%	62.7%

Apart of that, based on the research done by Destimo, a company built with the aim to solve the challenges created by a widely fragmented application store filled with equally fragmented information and statistics, the average price of a mobile native application was falling rapidly on all vendors' application stores, except Android. During December 2010, the average cost of downloading a mobile native application was considerably cheaper than it was in January 2010. The table below shows the changes of price in downloading a mobile native application over the year of 2010 based on different application stores [11].

Table 3: Changes in Price of a Download Application over 12 months in 2010 (Source: The Destimo Report, January 2011)

Change in price of a download app over 12 months, 2010 according to Distimo					
App store		Apple	Blackberry	Ovi (Nokia)	Android
Number of apps		300,000	18,000	130,000	25,000
Price change	All apps	-12	-24	+1	-29
	Top 100 apps	-19	-24	-9	-61

In addition, according to the surveys done by Business Insider, 54.4% out of the 2,000 respondents did agree to purchase a Smartphone with Android OS while 33.6% preferred to buy a Smartphone with iOS. This has become another strong point that encouraged the author to develop the application as an Android Application rather than other OSs. The figure below shows the percentage of the respondents who plan to buy a new Smartphone in the future based on different OS [12].

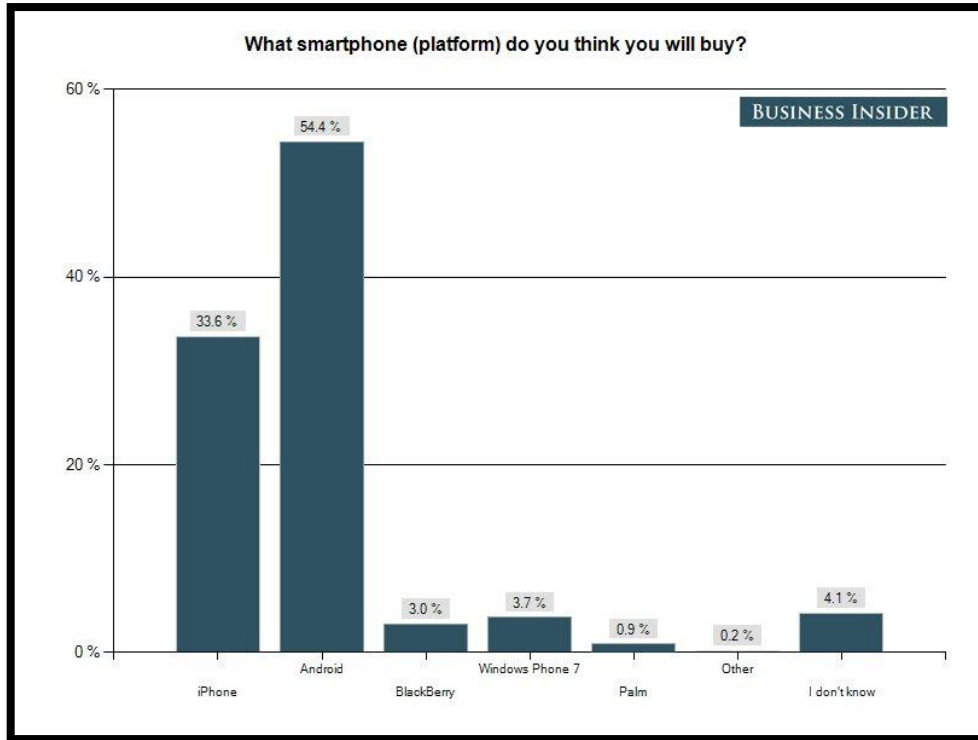


Figure 5: Percentage of the Respondents who plan to buy a new Smartphone in the future based on different OS (Source: Business Insider, April 2011)

2.3 An Expert System of Interactive Android Application as an Assistant to care for Cat's Health

An Expert System is a computer application that performs a task that would otherwise be performed by a human expert. Some Expert Systems are designed to take the place of human experts, while others are designed to aid them. Moreover, Expert Systems are parts of a general category of computer applications known as Artificial Intelligence (AI). To design an Expert System, a developer needs a Knowledge Engineer, an individual who studies how human experts make decisions and translates the rules into the terms that can be understood by a computer [13].

Based on the researches that had been done, most of the Expert Systems are developed to diagnose human illnesses, make financial forecasts, and schedule routes for delivery vehicles. Some of the current Expert Systems are Expert System for Mortgages and

Expert System for Trading Recommendations in various Marketplaces. In addition, there are researchers who currently conducting research on developing Expert Systems as a mobile native application. For examples, Mobile Islamic Medication Expert System and Expert-System Based Interpretation of Hepatitis Serology Test Results as an iPhone Application in Apple's Store.

Besides diagnosing human illnesses, Expert Systems can be developed to diagnose veterinary's illnesses as well. From the surveys that had been done, some researches related to the development of Expert Systems for animals had been conducted like FELINE – A Case Study in the Design and Implementation of a Co-Operating Expert System and The Development of a Decision Support System (DSS) for an Animal Disease Emergency. Therefore, based on the objective of the application to be developed by the author, since it will be used to provide the users with the information and guidelines on cats' health, Interactive Android Application as an Assistant to grow Healthy Cats will then be considered as an Expert System.

Generally, an Expert System is made up of three parts which are a User Interface, a Knowledge Base, and an Inference Engine. A User Interface will allow the non-expert users to query the Expert System and to receive necessary advice. It should be designed as simple as possible for the convenience of the users. Meanwhile, a Knowledge Base is a collection of facts and rules provided by the human experts. With an Inference Engine which acts more or less like a Search Engine, it will examine the Knowledge Base for information that matches the user's query. The figure below shows the architecture of Expert System that usually being implemented in its development [14].

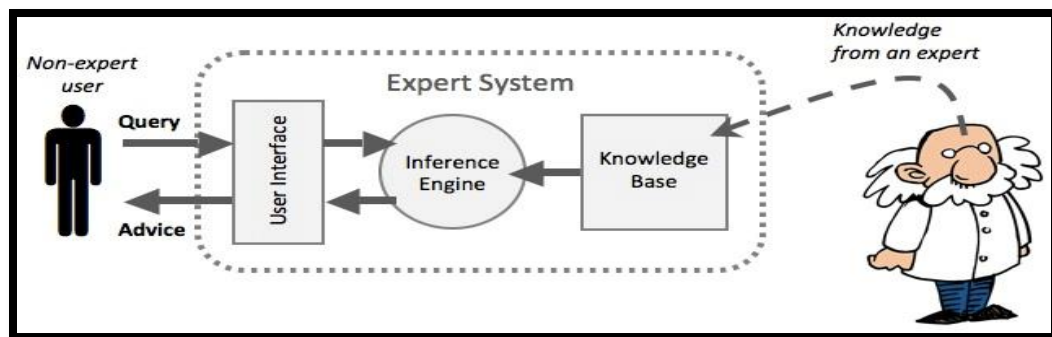


Figure 6: Architecture of Expert System

Since Interactive Android Application as an Assistant to care for Cat's Health is developed to help the users especially the cat owners to grow healthy cats, hence, from the user interface, the users will experience the process of examining the health conditions of their cats. By identifying symptoms of diseases and changes in behaviors shown by a cat, this expert system will help the users to answer the curiosity towards the changes by listing out the related diseases which being stored in the Knowledge Base. The Inference Engine will then have to play its role to provide the correct information.

On the other hand, from the User Interface, the users will be provided with the information of diseases that usually affecting the cats as well as the right ways of carrying the first-aids onto the cats. By selecting the cases from the User Interface, the Inference Engine will help the users to select the appropriate steps of first-aids stored in the Knowledge Base that can be applied onto the cats. Apart of that, the steps involved in providing medicine to the cats will be stored in the Knowledge Base of this Expert System as well in the case that the users want to have extra knowledge for it.

Based on the descriptions above about the flows of the application intended to be developed by the author, it is clearly shows that Interactive Android Application as an Assistant to care for Cat's Health can be considered as an Expert System as the knowledge of the veterinarians will eventually being captured and stored in the Knowledge Based to be used by the users. In addition, for the convenience of the users, this application will be integrated with GPS to help them in locating the veterinary clinics in the case that the cats really need treatments from the experts.

2.4 Cats as the subject for Interactive Android Application as an Assistant to care for Cat's Health

Generally, before deciding on the subject for the application to be developed, the author had conducted few researches to help her in making the right decision. The results of the researches can be used as one of the defensive point when presenting the project to the examiners either internally or externally. Therefore, throughout the surveys that had

been done, after analyzing the pros and cons of every result, the author had decided to select cats as the subject for the application to be developed rather than other pets like dogs, rabbits, and birds.

According to one of the results from the researches that had been done, around 63% of all United States households have pets and more than half of these households have more than one animals. To be more specific, the two most popular pets in most Western countries have been cats and dogs. During the year of 2007 till 2010, the dog-owning households had already outnumbered those cat-owning households. Nevertheless, the total number of pet cats was still higher than the pet dogs as shown in the table below [15]. Hence, these numbers had led the author to make decision in choosing cats as the subject for this application with the aim that the users of the application will be as much as the number of cats' population.

Table 4: Most Popular Pets in United States (Source: Wikipedia)

Most Popular Pets in the U.S (millions)					
Rank	Pet	Global population	U.S. population	U.S. inhabited households	U.S. average per inhabited household
1	Cat	202	93.6	38.2	2.45
2	Dog	171	77.5	45.6	1.70
3	Fish	N/A	171.7	13.3	12.86
4	Small mammals	N/A	15.9	5.3	3.00
5	Birds	N/A	15.0	6.0	2.50
6	Reptiles & Amphibians	N/A	13.6	4.7	2.89
7	Equine	N/A	13.3	3.9	3.41

Apart of that, in conjunction with the statistics shown above, according to MapXL Incorporation, United States was the first major country with the highest pet cat population followed by China, Russia, Brazil, France, Italy, United Kingdom (UK), Ukraine, Japan, and Germany [16]. These proved that citizens in almost every major

country throughout the world prefers housecats to be their pet as this kind of mammalian has been categorized as the best companionship for humans. Who knows, Interactive Android Application as an Assistant to care for Cat's Health will be demanded by almost every cat owners later. The table below shows the statistics of top ten countries with most pet cats' population.

Table 5: Top Ten Countries with Most Pet Cats' Population (Source: Maps of World)

Top Ten Countries With Most Pet Cat Population	
Country	No. of Cat
USA	76,430,000
China	53,100,000
Russia	12,700,000
<u>Brazil</u>	12,466,000
France	9,600,000
<u>Italy</u>	9,400,000
United Kingdom	7,700,000
Ukraine	7,350,000
Japan	7,300,000
Germany	7,700,000

2.5 Related Web-Based System, Mobile Web Application, and Mobile Native Application to Interactive Android Application as an Assistant to care for Cat's Health

Essentially, every individual will be attracted towards unique stuffs especially when it is different from the existing ones. Therefore, in conjunction with the big numbers of pet cats' population around the world, the author has to identify ways in differentiating her application with the current and existing applications either typical web-based systems, mobile web applications, and mobile native applications. Lots of researches have to be conducted in identifying the weaknesses of the current applications.

Based on the interview that had been done with the veterinarians, an application will never be able to replace the doctors no matter how advanced it is. It is impossible to strongly assure that a cat is being affected by a disease based on the symptoms shown as a symptom might be related to one or more diseases. As a result, rather than developing a mobile native application which aims to diagnose cats' diseases as well as providing information on the suitable treatments that can be given onto the cats, the veterinarians advised the author to develop an application to help the cat owners to grow healthy cats.

As a result, from the discussion with the veterinarians, the author has decided to develop an application that can help every individual especially the cat owners to care for their cats' health. On the basis of detecting the symptoms and changes in behaviors shown by the cats, Interactive Android Application as an Assistant to care for Cat's Health will provide information on related diseases that can possibly cause the symptoms. On the other hand, this application will also teach the users on how to apply different first-aids onto the sick cats based on different cases. Based on the researches and surveys that had been done, there are still an absent of this kind of application in Android. Even if there are existing applications related to this application, most of them are not having complete functionalities as offered by Interactive Android Application as an Assistant to care for Cat's Health.

As a prove, the table below shows some of the existing systems and applications related to cats but with different features from Interactive Android Application as an Assistant to care for Cat's Health.

Table 6: Existing Systems and Applications related to Cats

Web-Based Systems	
Title of Systems	Features of Systems
HelpMyCat.com (www.helpmycat.com)	<ul style="list-style-type: none"> • An online medical reference to help the users to find a possible diagnosis for their cats. • It allows the users to find the possible causes of their cats' symptoms by selecting an area of the body where the primary medical symptom is located. • The selected symptom is viewed in combination with

	<p>other secondary symptoms to find a possible diagnosis.</p> <ul style="list-style-type: none"> • Treatments will be derived based on the symptoms.
<p>CATS – Australia & the World (www.catsofaustralia.com)</p>	<ul style="list-style-type: none"> • It provides the users with information on cats’ breeds and cats’ breeders. • It provides the users with advice on cats’ care as well as articles on cats’ health and behavior. • It allows the users to search for products or services based on necessity for their cats.
<p>PetPlace.com (www.petplace.com)</p>	<ul style="list-style-type: none"> • Although this website does not focus only on cats but it does provide the users with the information on cats’ health and cats’ behavior. • It also allows the users to identify the diseases affecting the cats based on the symptoms shown.

Web-Based Systems and Mobile Web Applications

Title of Applications	Features of Applications
<p>petMD (www.petmd.com)</p>	<ul style="list-style-type: none"> • Similarly as the above system, this system or application does not focus only on cats but it does provide the users with the information on first-aids that can be carried out on cats based on different cases. • It provides the users with information on cats’ diseases as well as cats’ care. • It allows the users to identify their cats’ diseases based on symptoms shown as it has the functionality of “Symptom Checker”. By selecting the area of the body that is being affected to check off any appropriate symptoms, articles relevant to them will be appeared.

Mobile Native Applications

Title of Applications	Features of Applications
<p>Cats Care Guide</p>	<ul style="list-style-type: none"> • It provides the users with hundreds of advices in terms of articles about how to take care of their cats. Some of them are: <ul style="list-style-type: none"> - Recognize illness in cats - First-aid kit - Keep your cats healthy and safe - Easy ways to get your cats to take medication
<p>Total Cat Care</p>	<ul style="list-style-type: none"> • It contains a number of sections on cats’ health including information on cats’ care techniques, common health issues, homemade cats’ food recipes, and 20 video clips explaining and answering a number of common cats’ questions. • It gives the users with some insight into simple but effective ways to ensure their cats to stay happy and healthy, both inside and out.
<p>Caring for Your Cat</p>	<ul style="list-style-type: none"> • More or less like a book as the features are divided into

	<p>chapters. Some of the chapters are about:</p> <ul style="list-style-type: none"> - Safety is most important for your pet - Preventing your pet from high temperature in warm hot months - How to care for your diabetic cats
<p>Cat, Dog, Pet & I, iPetBrand</p>	<ul style="list-style-type: none"> • This application does not only focus on cats but it offers the users with various features which are “Pet Diary”, vaccination and anti-parasitic information, medical services, age calculations, “Whistlers Sound”, hertz dogs music for the animals, and the “Pet Mobile Shop”. • It comes with four different languages which are English, Chinese, Korean, and Japanese.

CHAPTER 3

METHODOLOGY

Methodology is generally a guideline system for solving a problem with specific components such as phases, tasks, methods, techniques, and tools. In other words, it is the analysis of the principles of methods, rules, and postulates employed by a discipline [17]. Before a system or an application is able to be developed, a developer has to identify the right methodology to be used during the development as well as before the development which will usually be called as Research Methodology. This kind of methodology requires techniques to be used to conduct research prior to the development of the system or application. It includes the type of data to be collected, the method of data collection and other variables that may help to the research and development processes.

3.1 Project Activities

Frequently, a web-based system or an application no matter mobile web application or mobile native application will be developed based on System Development Life Cycle (SDLC) which made up of different phases like Planning Phase, Analysis Phase, Design Phase, Build Phase, Testing Phase, Implementation Phase, and Maintenance Phase. As the author has decided to finish up her final year of study within three semesters, therefore, this project will be developed between two of the semesters of time frame which broke up into Final Year Project (FYP) I and Final Year Project (FYP) II. It is suggested that the author should be able to carry out her FYP I till the Design Phase of the SDLC follow by FYP II for the rest of the phases as shown in the figure below.

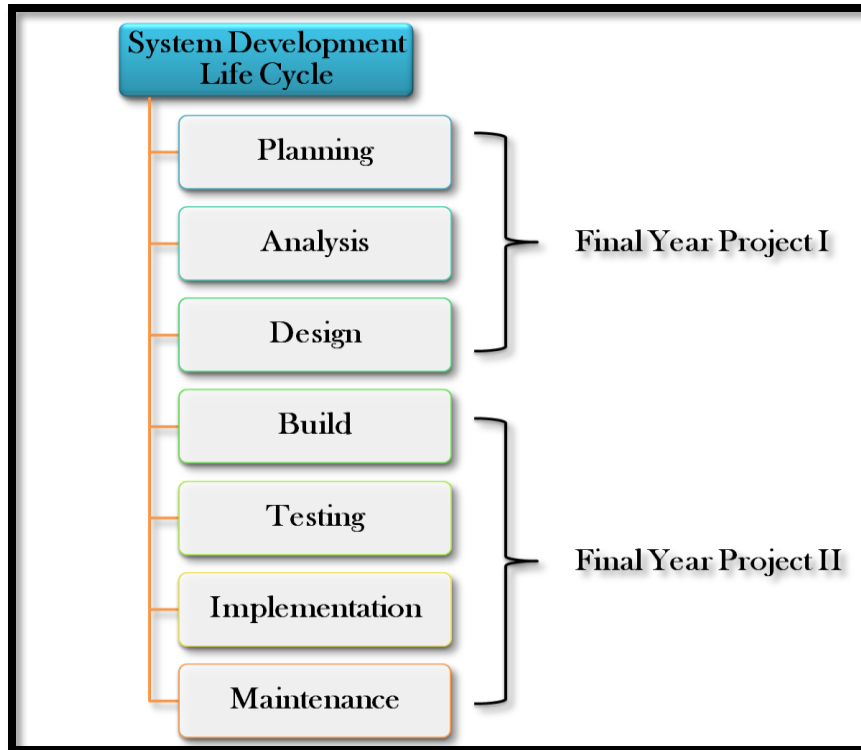


Figure 7: Implementation of SDLC in the development of Interactive Android Application as an Assistant to care for Cat's Health

As there are different types of methodologies to conduct a complete SDLC for the development of typical web-based systems, mobile web applications or mobile native applications, the author has decided to use Rapid Application Development (RAD) methodology which is Prototyping in order to develop Interactive Android Application as an Assistant to care for Cat's Health. Since this kind of methodology allows the author to perform the Analysis Phase, Design Phase, and Implementation Phase concurrently throughout the development of the application until it is completed, it eventually helps the author to more quickly refine the application's real requirements. Rather than attempting to understand a system specification on paper, the users can interact with the prototype to better understand what it can and cannot do.

Nevertheless, the author would have to bear in mind about the risks of using this methodology where its fast-paced application releases challenges attempts to conduct careful, methodical analysis. Often the prototype undergoes such significant changes

that many initial design decisions become poor ones. This can cause problems in the development of the application because fundamental issues and problems are not recognized until well into the development process. The figure below shows the Prototyping Methodology being applied for the development of Interactive Android Application as an Assistant to care for Cat's Health.

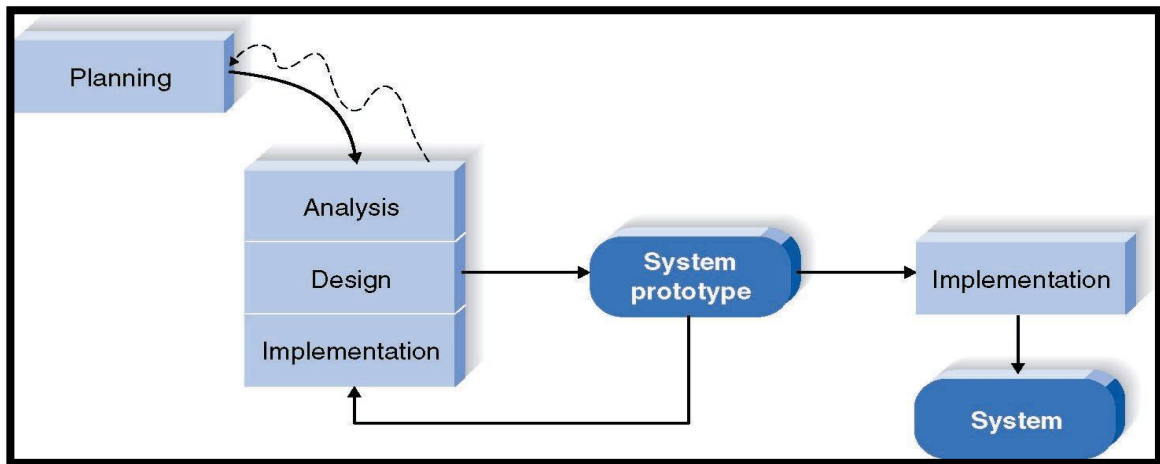


Figure 8: Prototyping Methodology for the development of Interactive Android Application as an Assistant to care for Cat's Health

3.1.1 Planning Phase

With a big number of pet cats population throughout the world, the author has successfully identified the opportunity lied underneath the numbers. As a result, with the target to assist every individual especially the cat owners to grow a healthy cat, the author has decided to develop an interactive Android application with information on cat's health like steps involved in diagnosing diseases that might be suffered by a cat based on the symptoms shown , information of diseases that can easily affecting the cat, changes in behaviors of a cat, guidelines to apply first-aids onto the cat based on different cases as well as procedures to supply medicine to the cat.

Nevertheless, before this native mobile application is able to be developed, the author has to conduct a feasibility analysis in ensuring a smooth development on it. This has

been described in Chapter 1 Section 1.5 where the results show that the author should proceed with the development of the application. In addition, during this phase also, the author has to schedule a proper planning in ensuring a successful development of the application. This can include the development of the Key Milestones as well as Gantt Chart where both of these can become a reference to the author in ensuring the completeness of every single task on particular time frame. The figures below show the Key Milestones and Gantt Chart for respective semesters for the development of Interactive Android Application as an Assistant to care for Cat's Health.

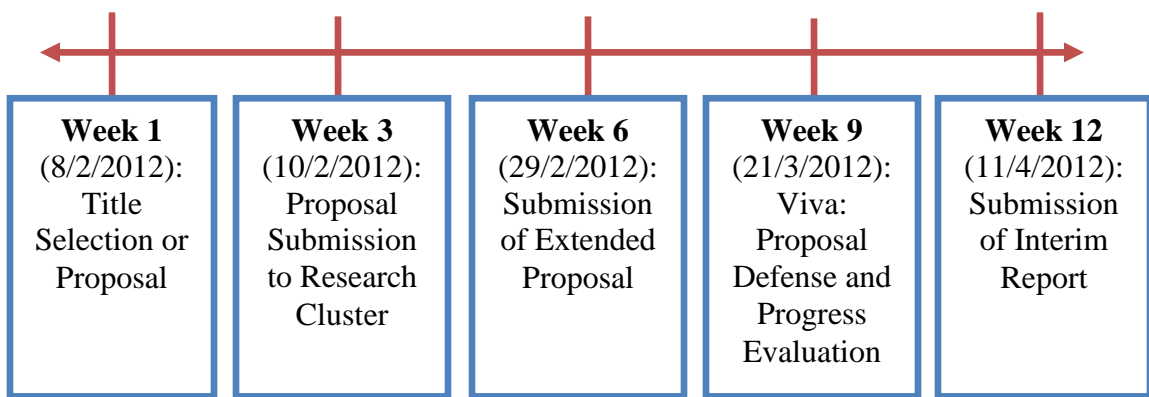


Figure 9: Key Milestones for the development of Interactive Android Application as an Assistant to care for Cat's Health in 1st Semester (FYP I)

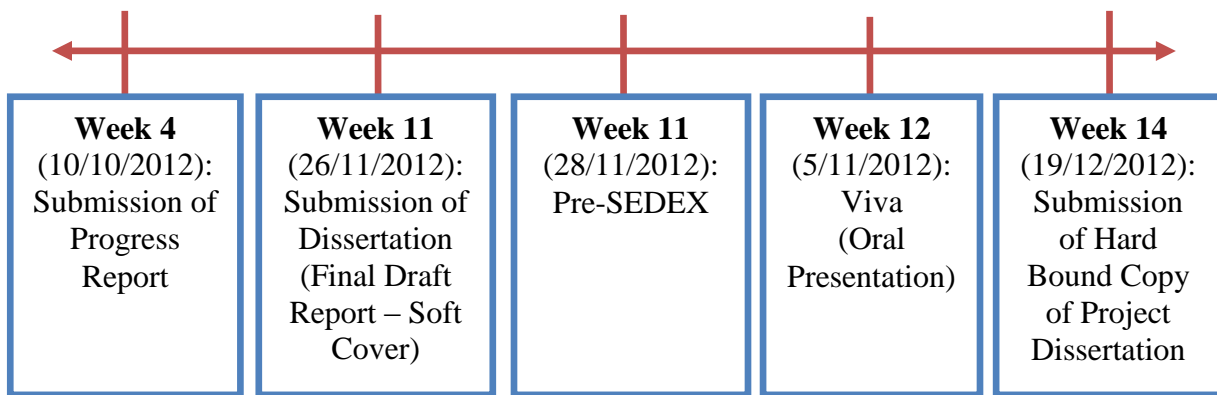


Figure 10: Key Milestones for the development of Interactive Android Application as an Assistant to care for Cat's Health in 3rd Semester (FYP II)

Activities	January				February				March				April					
	1	2	3	4	1	2	3	4	1	2	3	4	1	2				
Propose Project Title	Semester Breaks										Mid - Semester Break							
Approval of Project Title																		
Preliminary of Research Work																		
Preparation of Extended Proposal																		
Submission of Extended Proposal																		
Continuation of Research Work																		
Preparation for Proposal Defense and Progress Evaluation																		
Proposal Defense and Progress Evaluation																		
Data Collection and Data Analysis																		
Preparation for Interim Report																		
Submission of Interim Report																		

Figure 11: Gantt Chart for the development of Interactive Android Application to care for Cat's Health in 1st Semester (FYP I)

Activities	September		October					November					December			
	1	2	1	2	3	4	5	1	2	3	4	5	1	2	3	4
Continuation of Project Work																
Preparation for Progress Report																
Submission of Progress Report																
Continuation of Project Work																
Preparation for Pre-SEDEX																
Pre-SEDEX																
Preparation for Dissertation																
Submission of Dissertation (Final Draft Report - Soft Cover)																
Preparation for Viva - Oral Presentation																
Viva - Oral Presentation																
Preparation for Technical Report																
Preparation for Final Dissertation (Hard Cover)																
Submission of Final Dissertation (Hard Cover) and Technical Report																

Figure 12: Gantt Chart for the development of Interactive Android Application to care for Cat's Health in 3rd Semester (FYP II)

3.1.2 Analyze Phase

As the author has successfully identified the application to be developed as her FYP and passed through the Planning Phase of SDLC, she will then have to move on to the next phase which is the Analyze Phase in ensuring a successful development of Interactive Android Application as an Assistant to care for Cat's Health. During this phase, the most important thing that has to be conducted by the author will be the requirements determination for the application. One of the deliverables will be the requirements definition as shown in the figure below followed by the creation of functional model. In other words, she will have to identify the things that should be done by the application. There will be two different categories of requirements that have to be gathered by the author which are functional and non-functional requirements.

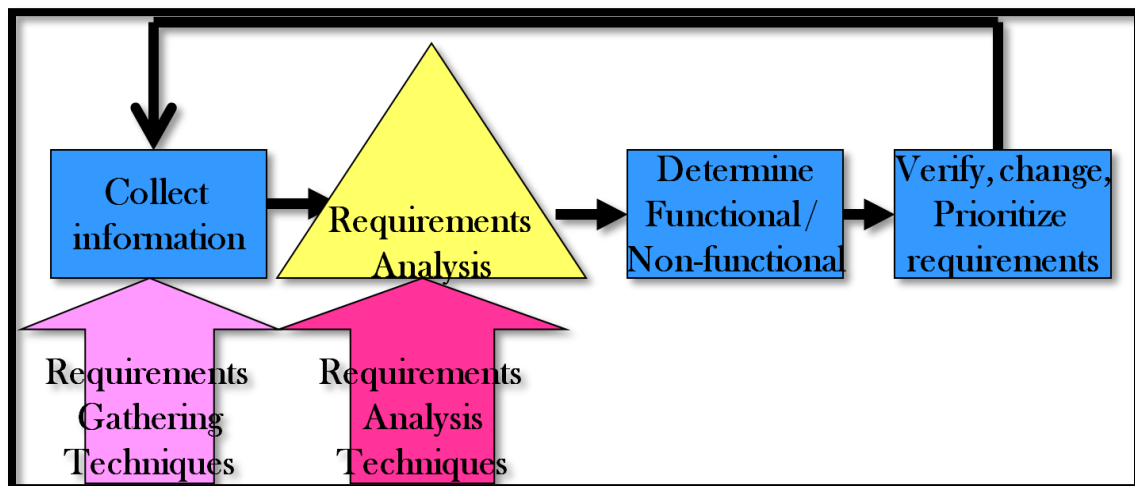


Figure 13: Process of Creating Requirements Definition

Based on the figure above, in order to collect the required information to be used during the development process of the application, the author has decided to carry out three different requirements gathering techniques which are distribution of online survey, face-to-face interviews as well as conducting researches on available resources. To be more specific, as every individual can own at least a cat, the author has made her target in distributing the online surveys through social networking sites like Facebook and Twitter. In deep, the author tried to reach every communities and groups of cat lovers

found through the Google site and Facebook as she was totally sure that every of the members should be a cat owner. The online survey form can be found in the section of Appendices as Appendix 1.

Apart of that, since Interactive Android Application as an Assistant to care for Cat's Health is considered as an Expert System, this means that the knowledge of the experts on cats' care need to be captured and stored in the application to be used by the users. Therefore, face-to-face interviews will then be conducted between the author and the veterinarians in ensuring the accuracy of the information on cats' health. In addition, as the veterinarians have been received lots of patients with varieties of health issues and problems, the information that will be given by the veterinarians might based on their experience which cannot be found in any resources.

Besides distributing online surveys through the social networking sites like Facebook and Twitter as well as face-to-face interviews with the veterinarians, another requirements gathering technique chose by the author would be researches on available resources like books, articles, research papers, journals, and websites which are related to the background and scope of the projects. Through this technique, lots of comparisons can be done between the current and existing applications either typical web-based systems, mobile web applications or mobile native applications and this to-be application. The section below illustrates all of the results gathered from the distribution of online survey as well as face-to-face interview with a veterinarian in Ipoh, Perak.

3.1.2.1 Results of Online Survey

As being expected by the author, every individual can become a cat owner regardless of gender, age, and profession. Even as early as the age of 5 years old, a kid can demand with the parents to have a cat too as long as he or she has been taught on how to love and appreciate the animals. Nevertheless, due to one of the purposes of the survey which is to identify the frequency of a cat owner to bring its cats to the veterinary clinics, this online survey is limited to respondents with

the age of as young as 16 only. With total number of 75 respondents in which 23 are males and 52 are females, the pie charts below show the percentage of the respondents with different genders, age, and profession that have cats.

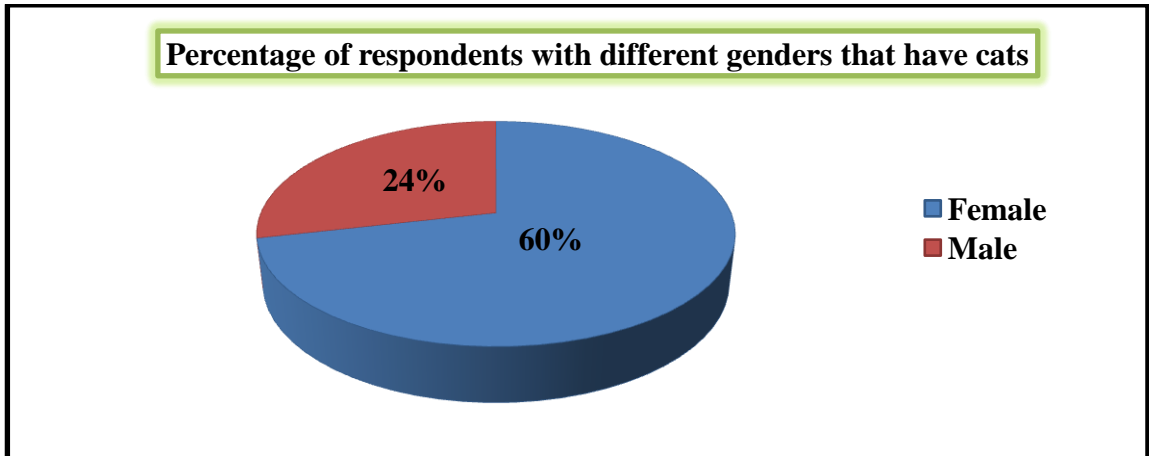


Figure 14: Percentage of Respondents with different genders that have cats

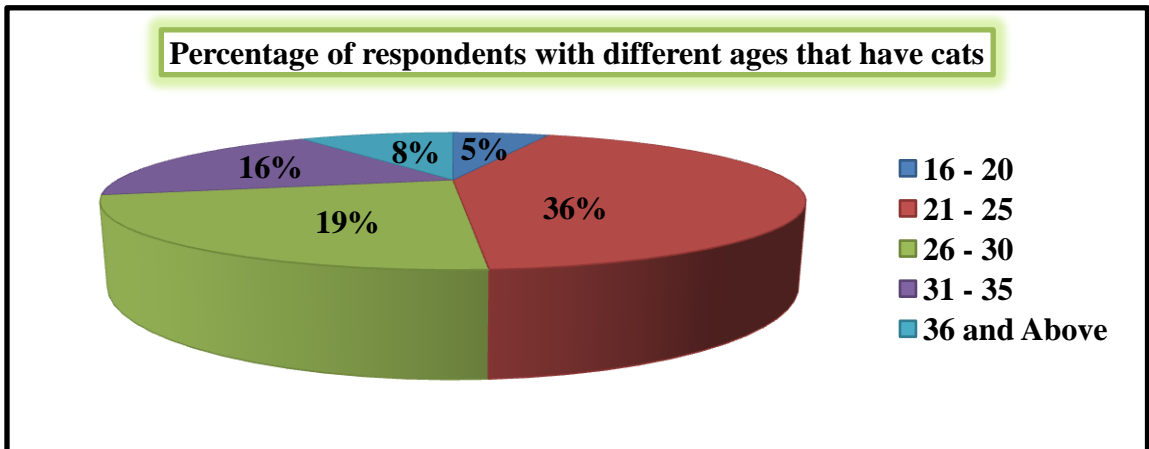


Figure 15: Percentage of Respondents with different ages that have cats

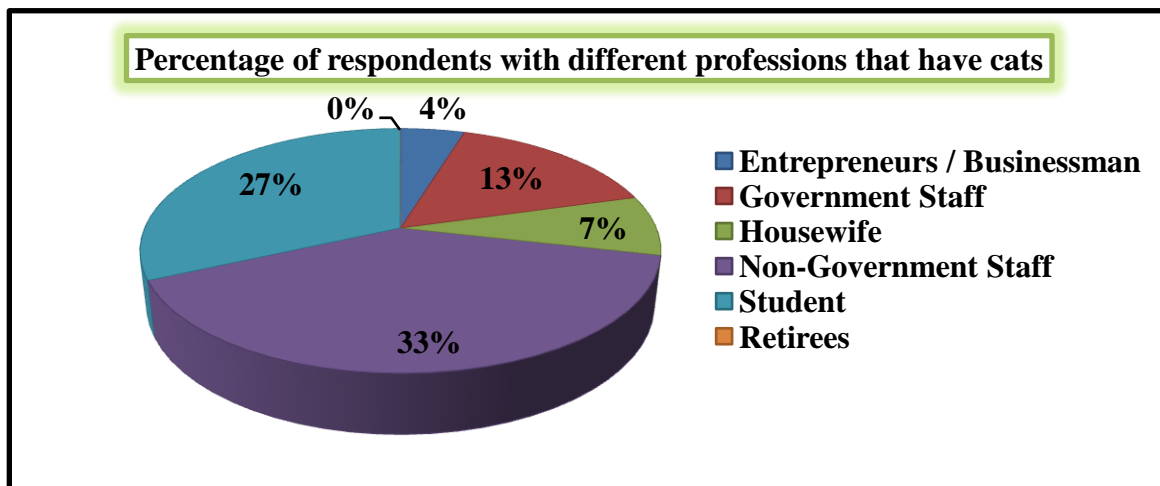


Figure 16: Percentage of Respondents with different professions that have cats

Based on the results of the pie charts shown above, out of the 75 respondents, about 24% of male respondents and 60% of female respondents did have and own cats. These have made total of 84% of the respondents are the cat owners. In addition, from 84% of the respondents, 36% are among the ages of 21 – 25 followed by 19% within the ages of 26 – 30, 16% from the ages of 31 – 35, 8% from the ages of 36 and above while 5% from the ages of 16 – 20. Based on the professions, Non-Government Staffs are having the highest percentage that has cats which is 33%. As Interactive Android Application as an Assistant to care for Cat's Health will be developed in Android Market, the author will then have to identify the number of Android users among the cat owners. The bar chart below shows the percentage of Android users among the cat owners.

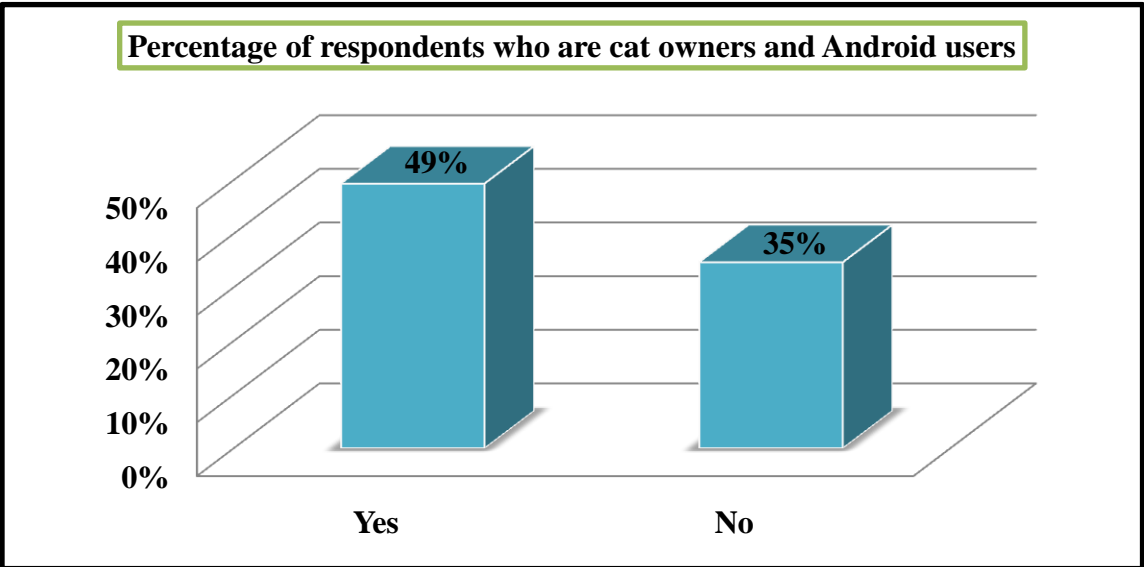


Figure 17: Percentage of Respondents who are Cat Owners and Android Users

According to the bar chart above, among 84% of the respondents who are eventually the cat owners, 49% out of it are the Android users. With a difference of 14%, this has approved that Android are the leading OS for Smartphone. In addition, based on the figure below, among the 49% of the Android users, 41% out of it are aware with the behavioral changes shown by the cats. With all of the calculated percentages, these can in turn become the strong points and reasons for the author to proceed with the development of the application.

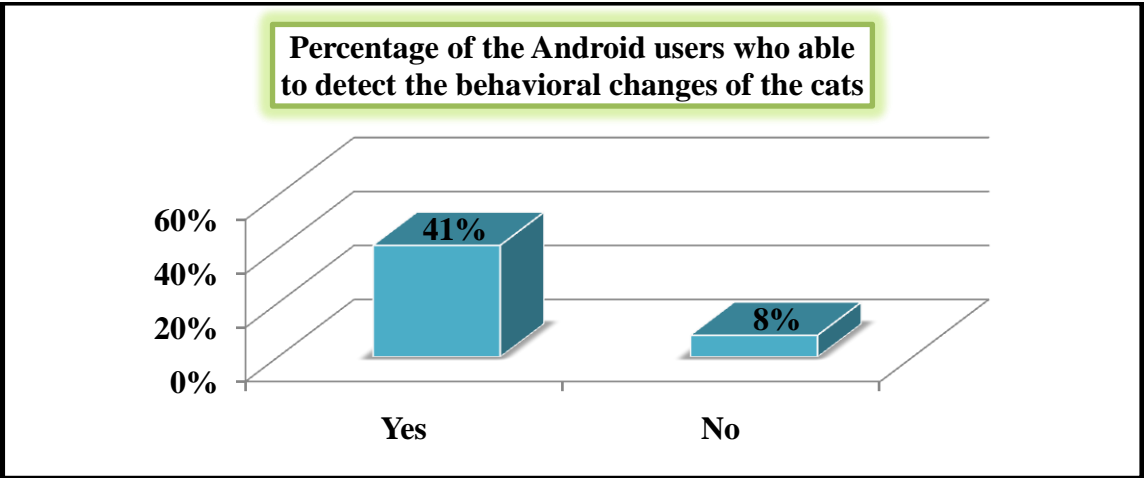


Figure 18: Percentage of the Android Users who are able to detect the Behavioral Changes of the Cats

Based on the results of the surveys above, first and foremost, as Interactive Android Application as an Assistant to care for Cat's Health is targeted to be used by every individual especially the cat owners, out of 84% of the cat owners, 79% did agree that this application will be able to help them in growing up a healthy cat. In deep, out of 49% of the Android users who are also the cat owners, 47% did agree with the same statement too. As there are 41% out of 49% of the Android users able to detect the behavioral changes shown by their cats, this show that Interactive Android Application as an Assistant to care for Cat's Health will be able to help the users to examine the health conditions of their cats based on the changes shown. In addition, since 40% out of the 49% of the respondents are willing to send their cats to the veterinary clinics, with the integration of GPS onto the application as shown in the figure below, this will become an extra feature that will attract the Android users to download this application in the future.

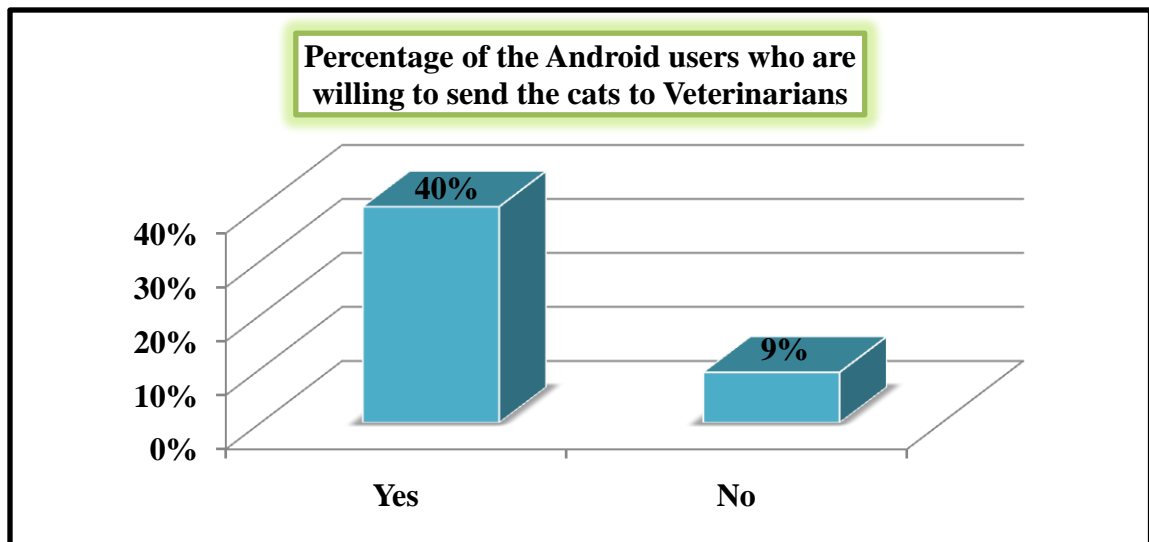


Figure 19: Percentage of the Android Users who are willing to send the cats to Veterinarians

3.1.2.2 Results of Face-to-Face Interview

Initially, the author's target is to develop an application that will help every individual especially the cat owners in diagnosing the diseases that might be suffered by the cats based on the symptoms shown. Nevertheless, after consulting with a veterinarian in Ipoh, Perak, he was actually suggesting the author to change the context of the application into how to care for a cat as from the perspective of the veterinarian, an application will never be able to replace the role of a veterinarian especially in terms of diagnosing a disease.

In addition, the main concern of the veterinarian would be how about if the cat owners are giving the wrong treatment to the cats as they are detecting a wrong disease based on the wrong symptoms. Rather than healing and curing the ill cats, the cat owners will make them sicker and even can lead to their death. As a result, based on the advice from the veterinarian, the author had decided to change the main context of the to-be application from diagnosing a disease that might be suffered by the cats into ways and steps to care for a cat.

As being described in the previous chapters, this to-be application will cover every aspects of a cat's health. With the listed symptoms of diseases that can be shown by a sick cat, the users will be able to identify related diseases that might be suffered by the cat based on the symptoms. Apart of that, this to-be application will teach the users on the right ways in applying the first-aids onto a cat based on the different cases. Rather than developing an application with main focus to detect the diseases affecting a cat, this to-be application will provide all sorts of information related to cat's health including the right procedures to supply medicine to a cat which can help the users in growing up a healthy cat. Below are the details of the veterinarian:

Table 7: Details of interviewed Veterinarian

Name:	Dr. Martin Balachandran
Veterinary Clinic:	My Pets Veterinary Clinic & Surgery
Address:	382, Jalan Pasir Puteh, 31659 Ipoh, Perak Darul Ridzuan
Contact Numbers:	05-241 8391

3.1.2.3 Requirements Definition

From the responses received from the online survey about the necessity of the development of Interactive Android Application as an Assistant to care for Cat's Health as well as perspectives received from the face-to-face interviews with the veterinarians about the rationale of the development of the application, the author has successfully come out with an outline that describes the functional and non-functional requirements of the to-be application as shown below.

Table 8: Requirements Definition for the development of Interactive Android Application as an Assistant to care for Cat's Health

Functional Requirements
<p>1. Cats' Diseases Diagnosis</p> <p>1.1 Before begin the diseases diagnosis onto the cat, the users are required to enter the necessary information about the cat.</p> <p>1.2 Based on the selected areas of the body, the users can select the symptoms shown by the cat.</p> <p>1.3 A list of possible diseases will be appeared according to the selected symptoms by the users.</p> <p>1.5 The users can identify the locations of veterinary clinics should the cat require treatments for the suspected diseases.</p>
<p>2. Cats' Diseases Information</p> <p>2.1 The users are given a list of diseases that can be suffered by the cat.</p> <p>2.2 The users can select any of the diseases to learn more about it especially on its description.</p>
<p>3. Changes in Cats' Behavior</p> <p>3.1 The users can select any of the changes in behaviors shown by the cat to identify related diseases that might be suffered by it.</p>
<p>4. Cats' Emergency Cases</p> <p>4.1 The users are given a list of emergency cases that can be faced by their cats.</p>

4.2 The users can select any of the emergency cases which is affecting their cats to learn more about it especially about the steps of first-aids that can be carried out.

4.3 The users can identify the nearest locations of veterinary clinics or hospitals should the cats require treatments for the emergency cases.

5. Procedures to supply Medicine

5.1 The users are given a list of different types of medicine to be supplied to their cats.

5.2 The users can select any types of the medicine and a step-by-step information will be appeared which teach the users on the right ways to supply the medicine to the cats.

6. Location of Veterinary Clinics

6.1 The users can identify the location of the veterinary clinics should their cats require any treatments from the experts or veterinarians.

Non-Functional Requirements

1. Operational Requirements

1.1 The application is developed for Smartphone and Tablet users.

1.2 The application will operate in the operating system of Android.

2. Performance Requirements

2.1 The information in the application will be updated based on necessity.

2.2 The application should be available for the users 24 hours per day and 365 days per year.

3. Security Requirements

3.1 As the application has been considered as an Expert System which provide information on how to care for cat's health for the users, there will be no authority assess to use it.

3.2 Personal information is not required in using the application and therefore, the users should feel no worriers in using it.

3.3 In other words, every user who download this application from the Play Store are allowed to use every of the features.

4. Cultural and Political Requirements

4.1 The application has no relationship with any culture issue as it provides information on how to care for cat's health.

4.2 There will be no political parties that are directly or indirectly involve in the development of the application as well as having any relationship with it.

3.1.2.4 Functional Decomposition Diagram for Interactive Android Application as an Assistant to care for Cat's Health

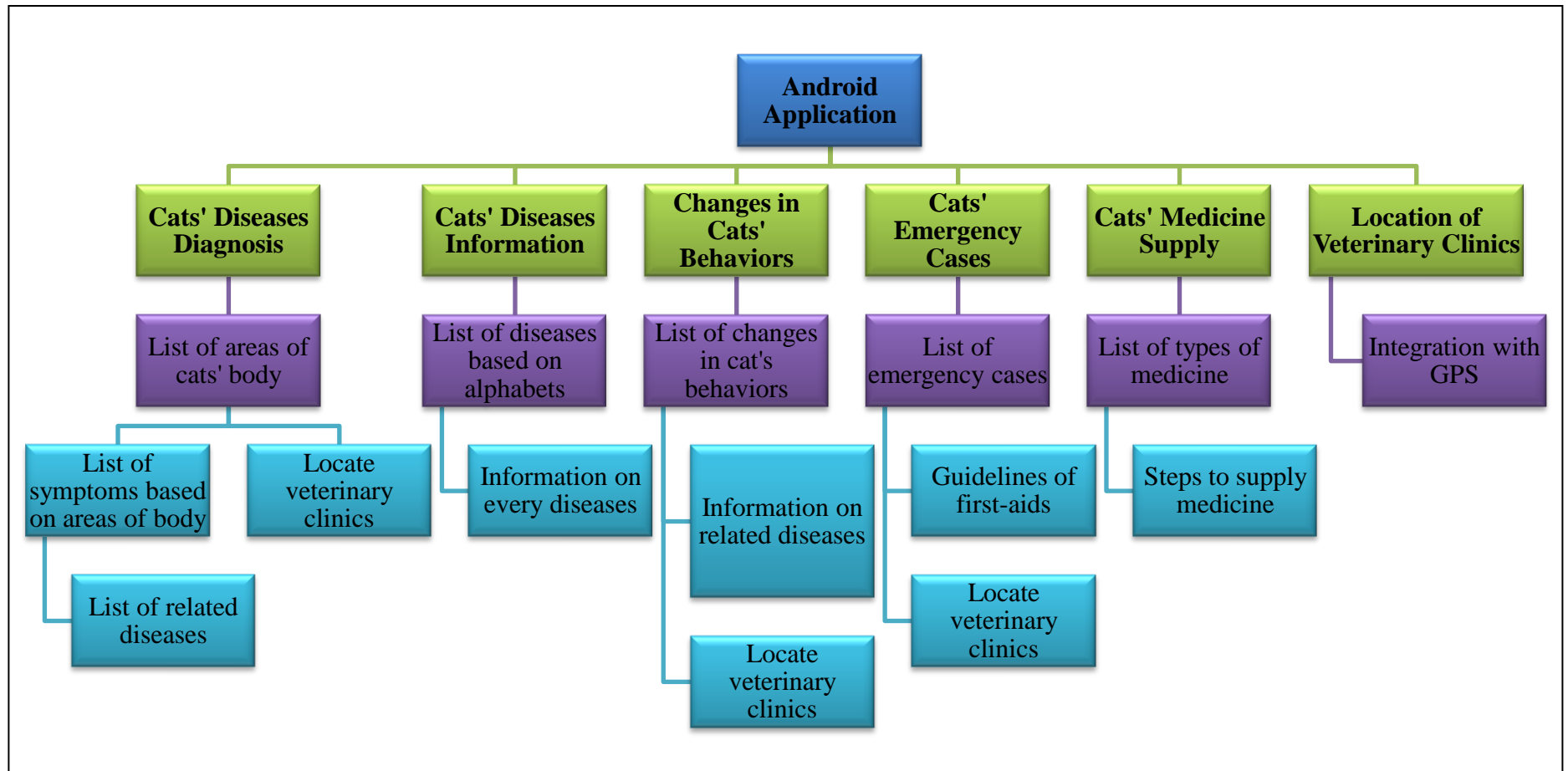


Figure 20: Functional Decomposition Diagram for Interactive Android Application as an Assistant to care for Cat's Health

3.1.2.5 Activity Diagram for Interactive Android Application as an Assistant to care for Cat's Health

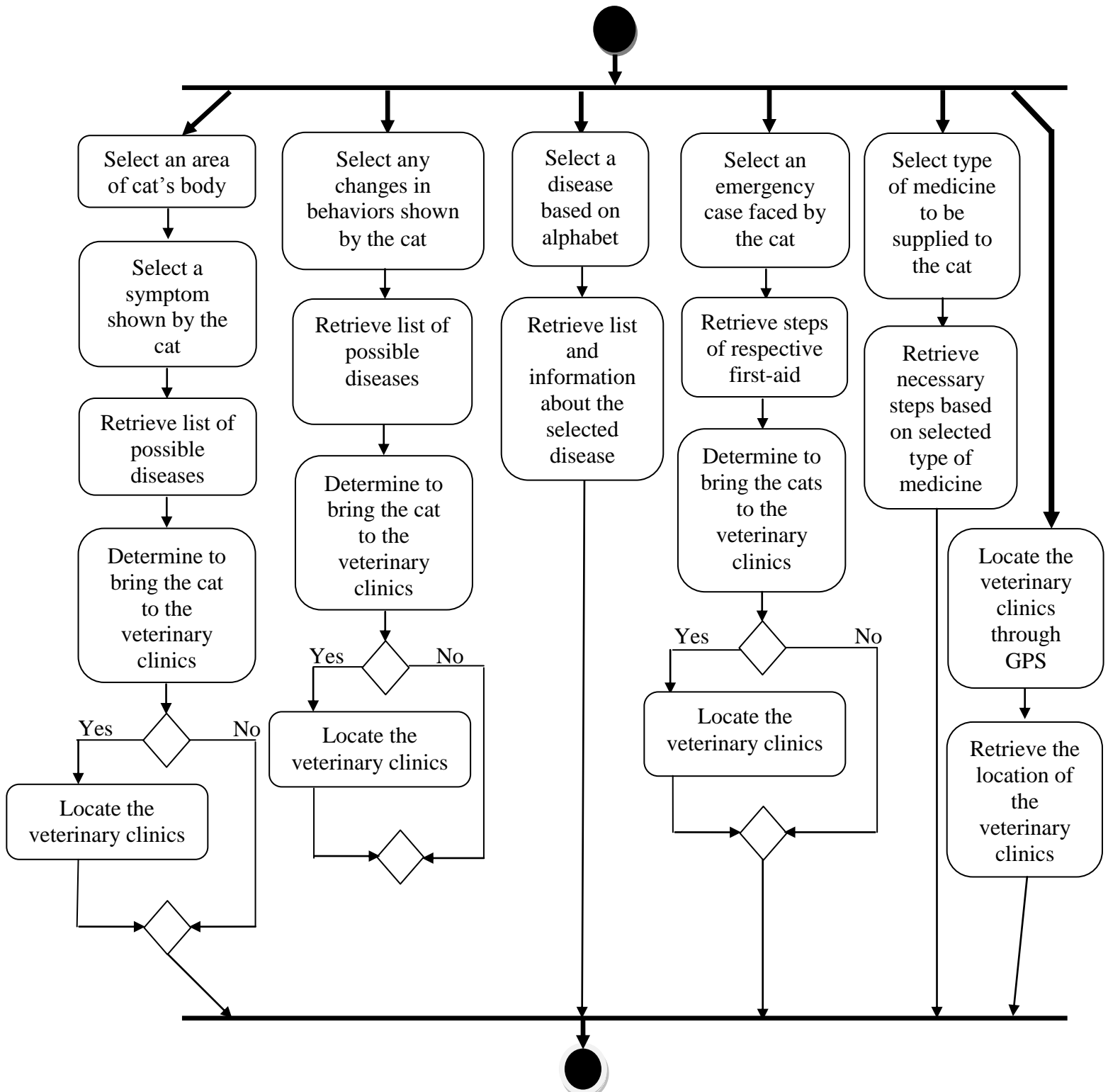


Figure: 21: Activity Diagram for Interactive Android Application as an Assistant to care for Cat's Health

3.1.2.6 Use Case Diagram for Interactive Android Application as an Assistant to care for Cat's Health

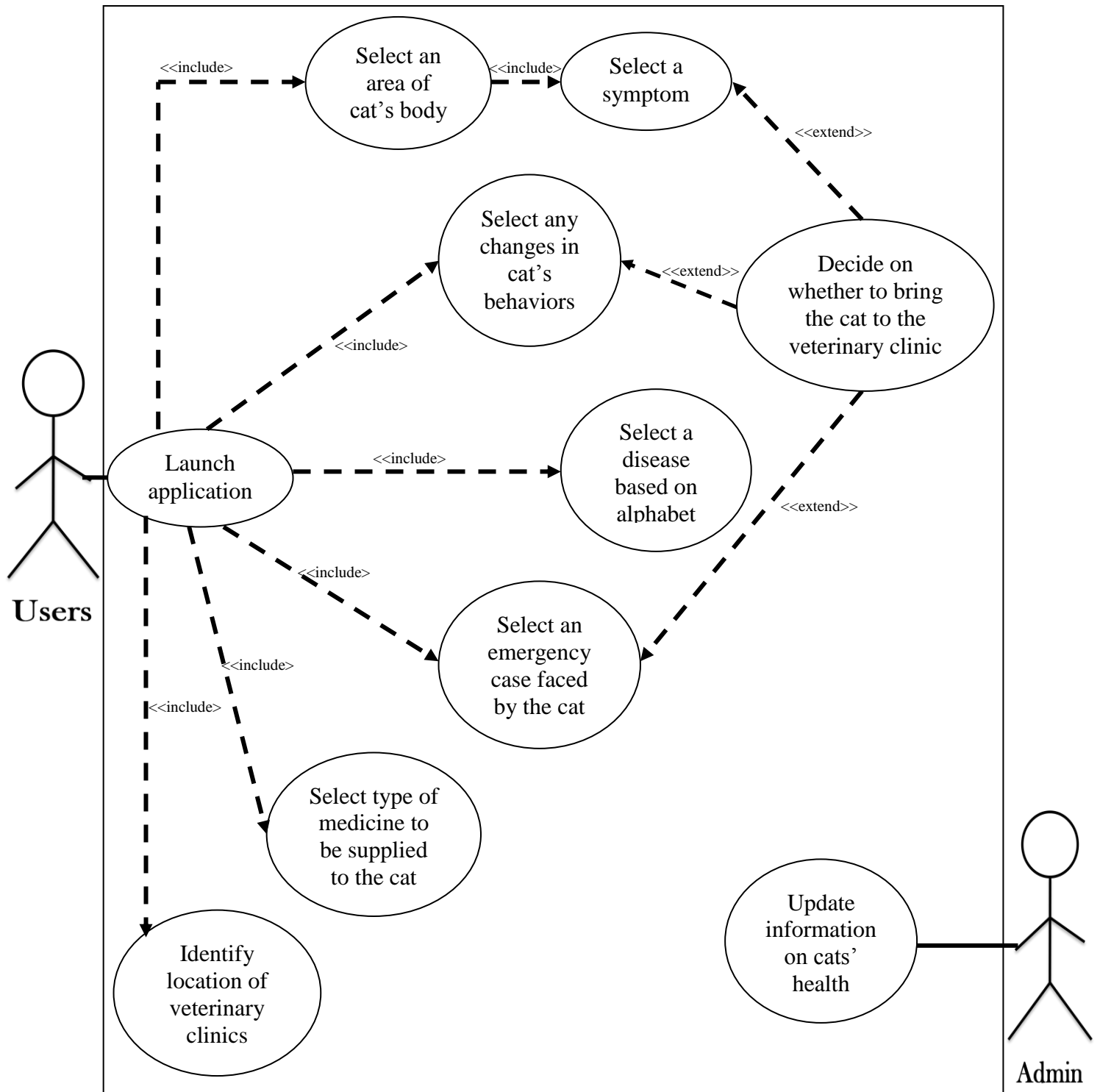


Figure 22: Use Case Diagram for Interactive Android Application as an Assistant to care for Cat's Health

3.1.3 Design Phase

After the author has successfully gather all of the requirements and come out with designs of functional models, she will now able to move on to the Design Phase and come out with the physical and conceptual designs as well as interfaces of Interactive Android Application as an Assistant to care for Cat's Health. In addition, in order to develop this application successfully, she has decided to use the software of App Inventor as the platform for the development and of course, an Android Smartphone will be required as well. The figures below show the system architecture of this project.

3.1.3.1 System Architecture

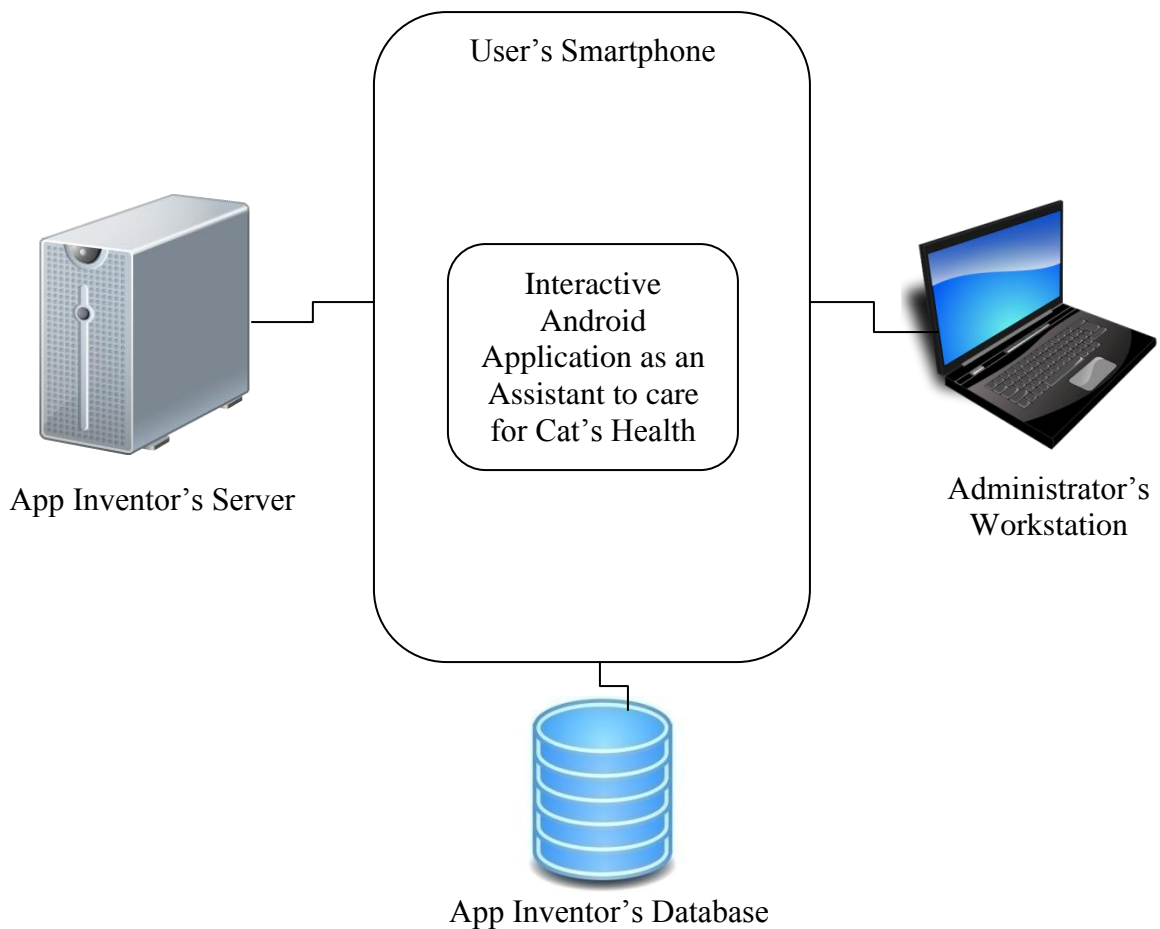


Figure 23: System Architecture of Interactive Android Application as an Assistant to care for Cat's Health

3.1.3.2 Physical Design

Interactive Android Application as an Assistant to care for Cat's Health will be developed by using a personal laptop as an official workstation for the author. Therefore, App Inventor would have to be installed in it. With this software, the author will be able to see the results of the development piece by piece through the Android Emulator. Nevertheless, by plug in USB driver between the Android Smartphone and the laptop, the author will be able to look for live results from the development. In addition, before begin the development, in order to develop an attractive Graphical User Interface (GUI) for this application, apart from using the features provided in App Inventor, the author has decided to use some elements offered in Adobe Photoshop. The table below shows the hardware and software specifications for this application.

Table 9: Hardware and Software Specifications for Interactive Android Application as an Assistant to grow Healthy Cats

Tools	Specifications
Hardware	Acer Personal Laptop and Android Smartphone
Software	App Inventor, Android Emulator, and Adobe Photoshop

3.1.3.3 Conceptual Design

Conceptual design can be described as a description of the proposed system in terms of a set of integrated ideas and concepts about what it should do, behave, and look like that will be understandable by the users in the manner intended. There are three different perspectives that will help the author to develop conceptual models which are interaction mode, interface metaphor, and interaction paradigm. Interaction mode describes how a user invokes actions when interacting with the system or application while interface metaphor help in combining familiar knowledge with new knowledge in a way that helps a user to understand the system. On the other hand, interaction paradigm assists in particular ways of thinking about interaction design. Below are the models.

3.1.3.3.1 Storyboard

An application storyboard is an illustration of the relationships between the functions that constitute the application of Interactive Android Application as an Assistant to care for Cat's Health. It is developed to assist in designing interfaces in the future as well as to ensure the flows are as intended. Basically, there are six different flows in the to-be application that can be depicted in a storyboard as shown below.

1. Diagnose your cat:

The user has to select an area of the cat's body to check for the possible symptoms of diseases.



The user will be given a list of possible diseases based on the selected symptoms shown by the cat.



The user can decide on whether to bring the cat to the veterinary clinics should the cat require treatment.

2. Changes in Cat's Behaviors

A user will be given a list of changes in behaviors that might be shown by the cat.



The user is allowed to select any of the behavior to identify related diseases based on the changes in behaviors.



The user can decide on whether to bring the cat to the veterinary clinics should the cat require treatment.

3. Diseases Information

A user can select any diseases to have a further understanding about it based on alphabets.



The user will be given a list of diseases with more information according to the selected alphabet.

4. First-Aids Guidelines

A user can select any emergency cases that might be faced by the cat.



The user will be given a step-by-step guideline on the first-aid that can be carried out based on the selected emergency cases.



The user can decide on whether to bring the cat to the veterinary clinics should the cat require treatment.

5. Medicine Supply

A user is required to select the type of medicine to be given to the cat.



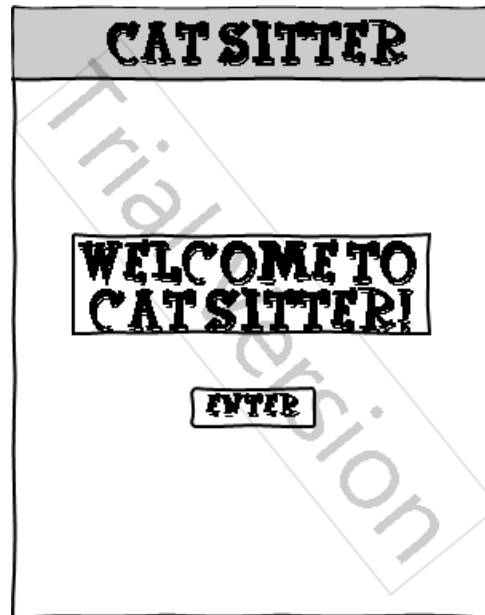
The user will be provided with a list of steps on the right ways to supply the selected type of medicine to the cat.

6. Locations of Veterinary Clinics or Hospitals

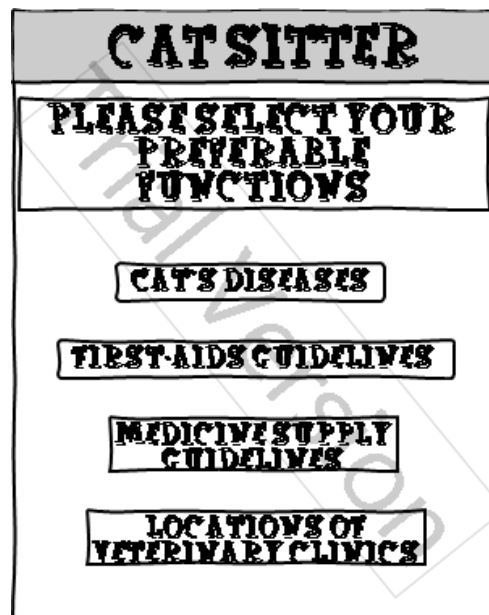
A user is allowed to trace the locations of veterinary clinics based on his or her current location.

3.1.3.3.2 Interface Designs

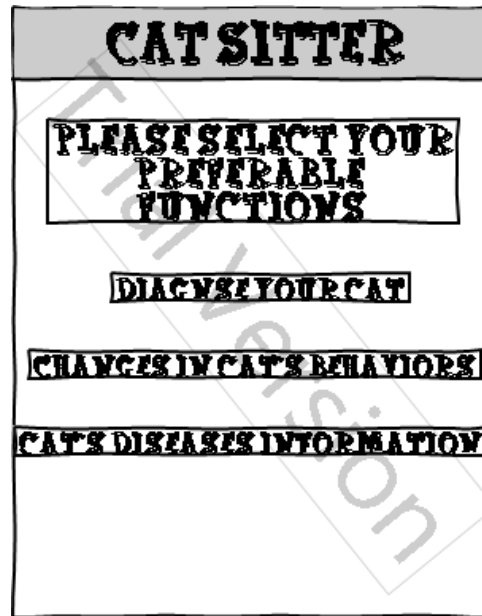
- Welcome Screen



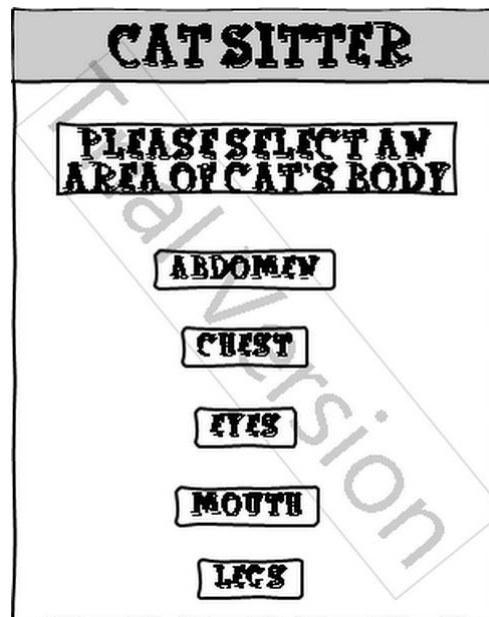
- Functions Screen



- **Situation 1:** The user selects Cat's Diseases



- **Situation 1.1:** The user selects Diagnose Your Cat



- Situation 1.1.1: The user selects Abdomen

CAT SITTER

PLEASE SELECT A SYMPTOM BELOW TO IDENTIFY DISEASES

ABDOMINAL PAIN

ABDOMINAL SWELLING

DIARRHEA

VOMITTING

- Situation 1.1.2: The user selects Abdominal Pain

CAT SITTER

BELOW ARE THE POSSIBLE DISEASES BASED ON THE SELECTED SYMPTOM

1. BLOAT

2. ASCITES

DO YOU WANT TO BRING THE CAT TO THE VETERINARY CLINICS?

OR

- Situation 1.1.3: The user selects OK

CAT SITTER

PLEASE SELECT YOUR CURRENT STATE

SELANGOR

JOHOR

SABAH

SARAWAK

PERAK

KUALA LUMPUR

This screenshot shows a mobile application interface for a cat sitter. At the top, there is a grey header with the text 'CAT SITTER'. Below the header is a white box containing the instruction 'PLEASE SELECT YOUR CURRENT STATE'. Underneath this instruction, there are six rectangular buttons, each containing the name of a state in Malaysia: SELANGOR, JOHOR, SABAH, SARAWAK, PERAK, and KUALA LUMPUR. The buttons are arranged vertically and are currently unselected.

- Situation 1.1.4: The user selects Perak

CAT SITTER

PLEASE SELECT THE VETERINARY CLINICS BELOW TO BRING THE CAT TO THE VETERINARIANS

JABATAN HAIWAN PERAK

KLINIK PAW PAW

KLINIK HAIWAN

MY VETS

This screenshot shows the same mobile application interface as the previous one, but after the user has selected 'PERAK'. The instruction now reads 'PLEASE SELECT THE VETERINARY CLINICS BELOW TO BRING THE CAT TO THE VETERINARIANS'. Below this instruction is a list box containing four entries: 'JABATAN HAIWAN PERAK', 'KLINIK PAW PAW', 'KLINIK HAIWAN', and 'MY VETS'. The list box has a vertical scrollbar on the right side, indicating that there are more options available than what is currently visible.

- Situation 1.2: The user selects Changes in Cat's Behaviors

CAT SITTER

PLEASE SELECT CHANGES IN BEHAVIORS BELOW TO IDENTIFY RELATED DISEASES

AGGRESSIVENESS WHEN TOUCHED

AVOIDS LIGHT

EXCESSIVE SLEEPING

HESITANT TO GO OUTSIDE AT NIGHT

- Situation 1.2.1: The user selects Aggressiveness when Touched

CAT SITTER

BELOW ARE THE POSSIBLE DISEASES BASED ON THE SELECTED CHANGES IN BEHAVIORS

MENINGITIS

DO YOU WANT TO BRING THE CAT TO THE VETERINARY CLINICS?

YES

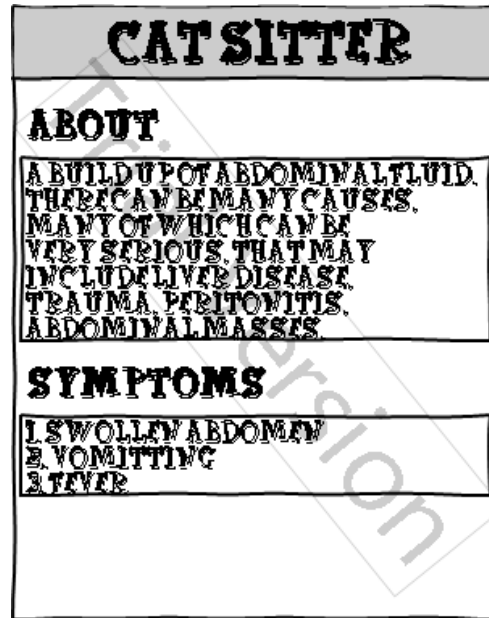
- Situation 1.3: The user selects Cat's Diseases Information

CAT SITTER						
PLEASE SELECT AN ALPHABET TO IDENTIFY ITS ASSOCIATED DISEASES						
A	B	C	D	E	F	G
H	I	J	K	L	M	N
O	P	Q	R	S	T	
U	V	W	X	Y	Z	

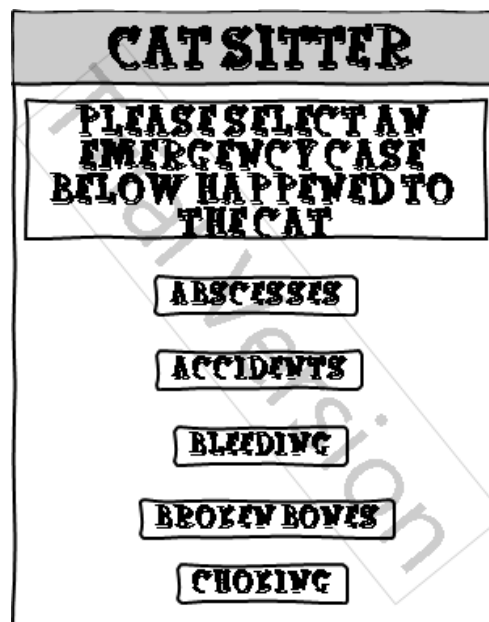
- Situation 1.3.1: The user selects A

CAT SITTER
BELOW ARE THE DISEASES ASSOCIATED WITH ALPHABET A
ACUTE KIDNEY DISEASE
ADDISON'S DISEASE
ADRENAL HYPERFUNCTION
ARTHRITIS
ASCITES

- Situation 1.3.2: The user selects Ascites



- Situation 2: The user selects First-Aids Guidelines



- Situation 2.1: The user selects Abscesses

CAT SITTER

ABOUT

AN ABSCESS IS A LOCALIZED COLLECTION OF PUS WHERE A WALL OF THICK FIBROUS TISSUE ENCOMPASSES IT.

WHAT TO DO

1. BRING THE ABSCESS TO A HEAD BY GENTLY BATHING WITH A MILD SOLUTION OF SALT OR BICARBONATE OF SODA.

2. IF IT HAS NOT RUPTURED WITHIN 24 HOURS, IT MIGHT HAVE TO BE LANCED.

DO YOU WANT TO BRING THE CAT TO THE VETERINARY CLINICS?

- Situation 2.1.1: The user selects OK

CAT SITTER

PLEASE SELECT YOUR CURRENT STATE

- Situation 2.1.2: The user selects Perak

The screenshot shows a mobile application interface with a grey header containing the text "CAT SITTER". Below the header is a white box with the instruction "PLEASE SELECT THE VETERINARY CLINICS BELOW TO BRING THE CAT TO THE VETERINARIANS". Underneath this instruction is a scrollable list of four options: "JABATAN HAIWAN PERAK", "KLINIK PAW PAW", "KLINIK HAIWAN", and "MY VETS". A vertical scrollbar is visible on the right side of the list.

- Situation 3: The user selects Medicine Supply Guidelines

The screenshot shows a mobile application interface with a grey header containing the text "CAT SITTER". Below the header is a white box with the instruction "PLEASE SELECT THE TYPE OF MEDICINE". Underneath this instruction are four buttons stacked vertically: "CAPSULE/PILL/TABLET", "LIQUID", "EAR DROP", and "EYEDROP".

- Situation 3.1: The user selects Capsule/Pill/Tablet

CAT SITTER

PROCEDURES

1. GENTLY HOLD THE CAT'S HEAD FROM ABOVE USING ONE OF YOUR HANDS. DO NOT RUFFLE ITS WHISKERS.

2. TILT THE HEAD BACK AND THE CAT WILL OFTEN DROP ITS LOWER JAW OPEN.

3. DROP THE PILL OR CAPSULE AS FAR BACK OVER THE TONGUE AS POSSIBLE. THEN IMMEDIATELY CLOSE THE MOUTH AND BLOW ON THE CAT'S NOSE WHICH WILL ENCOURAGE THEM TO SWALLOW.

- Situation 4: The user selects Locations of Veterinary Clinics

CAT SITTER

PLEASE SELECT YOUR CURRENT STATE

SELANGOR

JOHOR

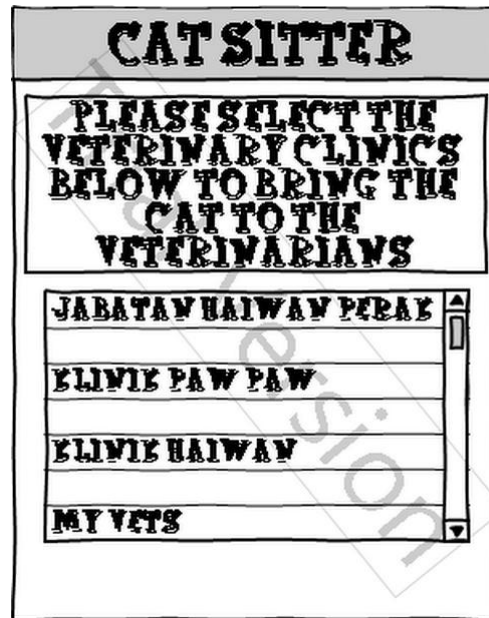
SABAH

SARAWAK

PERAK

KUALA LUMPUR

- **Situation 4.1:** The user selects Perak



3.1.4 Build Phase

Before a system or an application is able to be built, requirements gathering as well as creation of different models and designs will have to be done in order to avoid from any conflicts and issues throughout the development later. These will eventually assist a developer by providing a clear overview about the to-be application especially in ensuring its ability to meet the targeted objectives. As the author had successfully come out with the Requirements Definitions, Functional Decomposition Diagram, Activity Diagram, and Use Case Diagram as described in the previous chapters, the author can now move on to the next phase of the development of Interactive Android Application as an Assistant to care for Cat's Health which is Build Phase.

As been stated in Table 9 above, this application will be developed by using the author's personal workstation which is an Acer laptop together with an Android Smartphone to get the live results while developing. Instead of using Eclipse IDE, Adobe Flash Professional, and Basic4Android, the author decides to use App Inventor for the

development of Interactive Android Application as an Assistant to care for Cat's Health due to its drag-and-drop interface. It is a visual language that even non-technical people can program with it [18]. Below are the reasons of the decision made by the author.

1. **No syntax:** The blocks language eliminates the need to remember and type code.
2. **Everything is right in front of you:** The components and functions are organized into drawers. Just find, drag, and drop.
3. **Events at top level:** "When this happens, the app does this" is the correct conceptual model.
4. **High-level components:** A great library is provided with simplicity the main goal of an application.
5. **Only some blocks plug-in:** There are things that do not make sense.
6. **Concreteness:** Only program components, not abstractions.

Apart from using an Android Smartphone for live results, the author can also use the Android Emulator as provided by the App Inventor for the same purpose. The Build Phase starts with the development of the application's interfaces as per described in the previous chapter. In conjunction with the development of the interfaces, the author decides to use Adobe Photoshop for the enhancement of the images to be used. Since the author chose Prototyping Methodology for the development of this application, continuous refinement on the prototype will have to be conducted till it meets the users' expectation and satisfaction. Changes will be happened throughout the whole development process to ensure all of the targeted functions work as per required. Some of them are done prior to their functionalities while additional features will be added based on necessity. The prototype of Interactive Android Application as an Assistant to care for Cat's Health is to be discussed further in Chapter 4: Results and Discussion.

3.1.5 Testing Phase

Testing is a must before a system or an application is able to be implemented in the production environment. It uncovers as many errors as possible and therefore, it has to be done systematically and the results should be documented. There are generally four stages of tests which are Unit Test, Integration Test, System Test, and Acceptance Test. Each of the tests is having different objectives but with the same goal which is to uncover as many errors as feasible.

By the time the author has successfully developed a prototype with all the targeted functionalities, testing on it will have to be carried out. Hence, a test plan which defines a series of tests will be required throughout the process of testing. For Interactive Android Application as an Assistant to care for Cat's Health, the author had decided to carry out only three of the tests which are Unit Test, Integration Test as well as Acceptance Test. To be specific, Unit Test and Integration Test will be done by the author herself while Acceptance Test will be conducted by several selected testers, particularly those who own at least a cat. The results of the testing are to be discussed further in Chapter 4: Results and Discussion.

3.1.6 Implementation Phase

During this phase, Interactive Android Application as an Assistant to care for Cat's Health should be 100% complete through the prototype developed and has been undergone the different stages of tests in order to uncover as many errors as feasible. As a result, the author will be able to make improvements and enhancements on the prototype to become a complete application before it is able to be launched in the production environment, specifically to the targeted users.

3.1.7 Maintenance Phase

Maintenance Phase will be the last phase in SDLC and therefore, when Interactive Android Application as an Assistant to care for Cat's Health is successfully delivered to the users, the author should always be responsible towards maintaining it especially on the information provided. Up-to-date information is a must in meeting the objectives of this application. Apart of that, the author should be able to cater all of the feedbacks received from the users about the application either positive feedbacks or negative feedbacks. These can be used for improvements and enhancements in Interactive Android Application as an Assistant to care for Cat's Health which can also be considered as another step of maintaining it in the production environment.

CHAPTER 4

RESULT AND DISCUSSION

As a prove of development for the interface designs sketched in the previous chapter, the author will discuss about the prototype that has been successfully built in this chapter. In addition, the results of testing for the prototype of Interactive Android Application as an Assistant to care for Cat's Health will be included as well. Below are the results stated in the Build Phase and Testing Phase.

4.1 Prototype

A prototype is an early sample or model built to test a concept or process or to act as a thing to be replicated or learned from. It is a term used in a variety of contexts including semantics, design, electronics, and software programming. Moreover, a prototype is designed to test and trial a new design to enhance precision by the system analysts and the users. Prototyping serves to provide specifications for a real, working system rather than a theoretical one [19]. Therefore, below are the descriptions of the prototype for Interactive Android Application as an Assistant to care for Cat's Health which had been developed throughout the whole semester.

4.1.1 Welcome Screen

Interactive Android Application as an Assistant to care for Cat's Health starts with a Welcome Screen as shown in the figure below. When a user launches the application from a Smartphone or tablet, this Welcome Screen will be appeared which requires the user to press the Enter button in order to move on to the next screen which is the Functions Screen. In the case that the user chooses to exit the application from this screen, he or she is allowed to press the Back button of the Smartphone or tablet. A pop-up message will be appeared asking for a confirmation to exit the application as shown below.



Figure 24: Welcome Screen of Interactive Android Application as an Assistant to care for Cat's Health

Based on the pop-up message shown above, if the user presses the Cancel button rather than the OK button, he or she will be navigated to the Functions Screen. On the contrary, if the user presses the OK button, then the application will be closed or shut down.

4.1.2 Menu Screen

After the user presses the Enter button in the Welcome Screen or the Cancel button in the pop-up message above, the user will be navigated to the next screen which is the Menu Screen as shown below. There are four different functions offered by Interactive Android Application as an Assistant to care for Cat's Health that can be found in this screen which are Cat's Diseases, First-Aids Guidelines, Medicine Supply Guidelines, and Locations of Veterinary Clinics. Each of these functions is aimed to help every cat lovers especially the cat

owners in maintaining a good health level for their cats. By pressing these four buttons respectively, the user will be navigated to different screens based on the objectives of each button.



Figure 25: Menu Screen of Interactive Android Application as an Assistant to care for Cat's Health

In addition, after the user presses the Enter button in the Welcome Screen or the Cancel button in the pop-up message above, a pop-up message will be appeared first in the Functions Screen informing the user to select his or her preferable functions as shown above. Similarly as the Welcome Screen, in the case that the user chooses to exit the application from this screen, he or she is allowed to press the Back button of the Smartphone or tablet. A pop-up message will be appeared asking for a confirmation to exit the application as shown in Figure 24. If the user presses the Cancel button rather than the OK button, he or she will be remained in the Functions Screen. On the contrary, if the user presses the OK button, then the application will be closed or shut down.

4.1.3 Cat's Diseases Screen

Cat's Diseases Screen will show to the user another three functions or features offered by Interactive Android Application as an Assistant to care for Cat's Health which are Diagnose Your Cat, Changes in Cat's Behaviors, and Diseases Information. Each of these functions has different purposes but still interrelated to each other. Before the user is able to proceed with the three functions stated above, he or she will have to insert the cat's information specifically its name, age, weight, and breed on the first screen after pressing the Cat's Diseases button as shown in the figure below. In addition, a pop-up message will be appeared first informing the user to insert the cat's information before able to proceed to the next step. If the user presses the Cancel button in the pop-up message, he or she will be navigated back to the Functions Screen. All of these inputs will be appeared on the next screen as shown in the next figure.

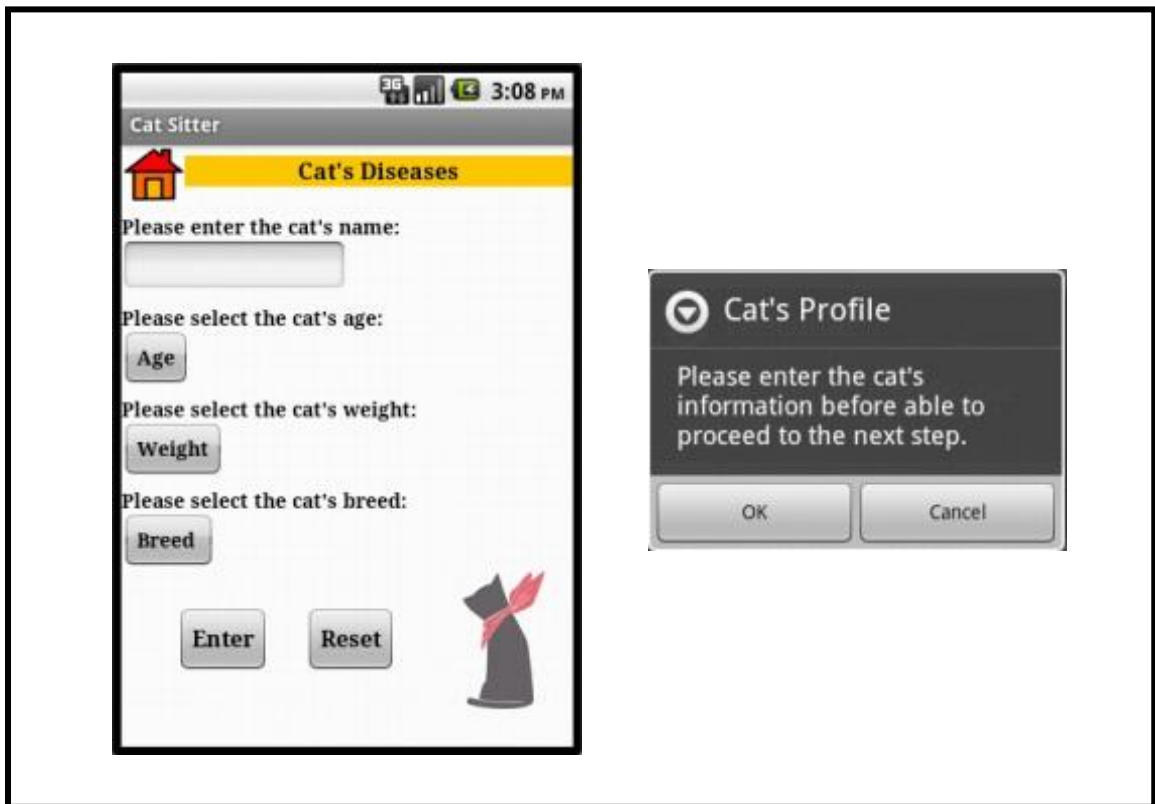


Figure 26: Cat's Diseases Screen 1 of Interactive Android Application as an Assistant to care for Cat's Health

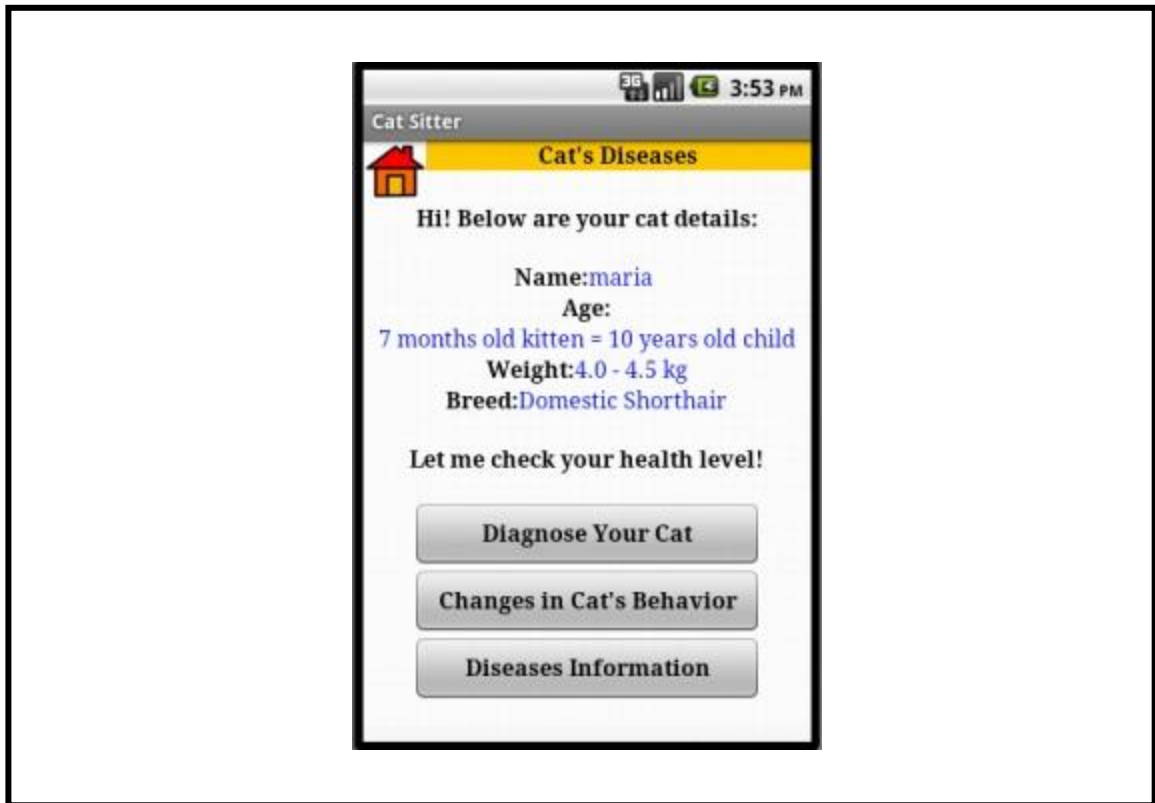


Figure 27: Cat's Diseases Screen 2 of Interactive Android Application as an Assistant to care for Cat's Health

For the purpose to educate the user, the developer had included a pop-up message with the information on how to calculate the cat's ages in human's years as shown in the figure below. To be more specific, when the user selects the cat's ages, the pop-up message will be appeared. If the user presses the Back button in the pop-up message, the selected cat's ages will not be appeared in the screen. The user is allowed to select again the cat's ages. As the user presses the Enter button found in the Cat's Diseases Screen, another pop-up message will be appeared telling more about the function of Cat's Diseases. The pop-up message can be found on the right-hand side of the figure below. If the user presses the Cancel button in the pop-up message, the user will be navigated back to the previous screen. On the other hand, if the user presses the Reset button, all of the inserted inputs about the cat's information will be removed from the screen.

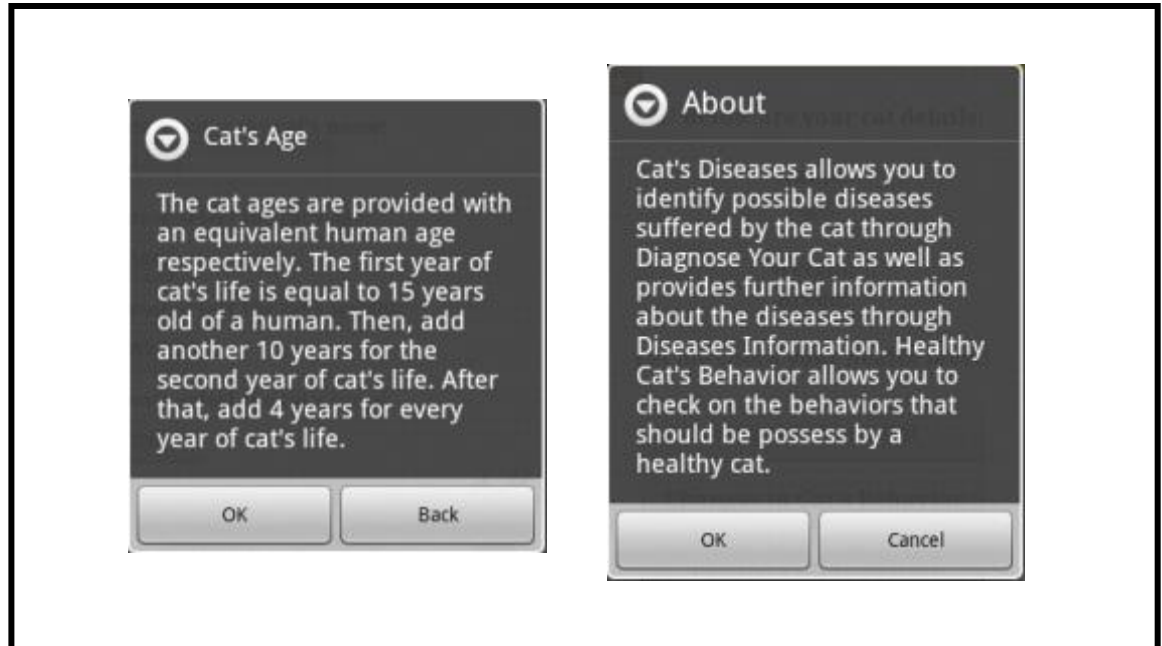


Figure 28: Pop-Up Message for Cat's Diseases Screen of Interactive Android Application as an Assistant to care for Cat's Health

By pressing the Diagnose Your Cat button, the user will be navigated to a screen contains of alphabets from A-Z as shown in the figure below. By pressing any of the alphabets button, a list of cat's body area which start with the particular alphabet will be appeared. The user is required to select the respective cat's body area in which he or she thinks that the cat is showing the unusual symptoms. On the contrary, based on the pop-up message as shown in the figure below, the user can press the B button found in the screen if he or she thinks that the symptoms shown by the cat are not directly on the cat's body. The user will be navigated to Behavior Screen which listed out all of the changes in cat's behaviors.

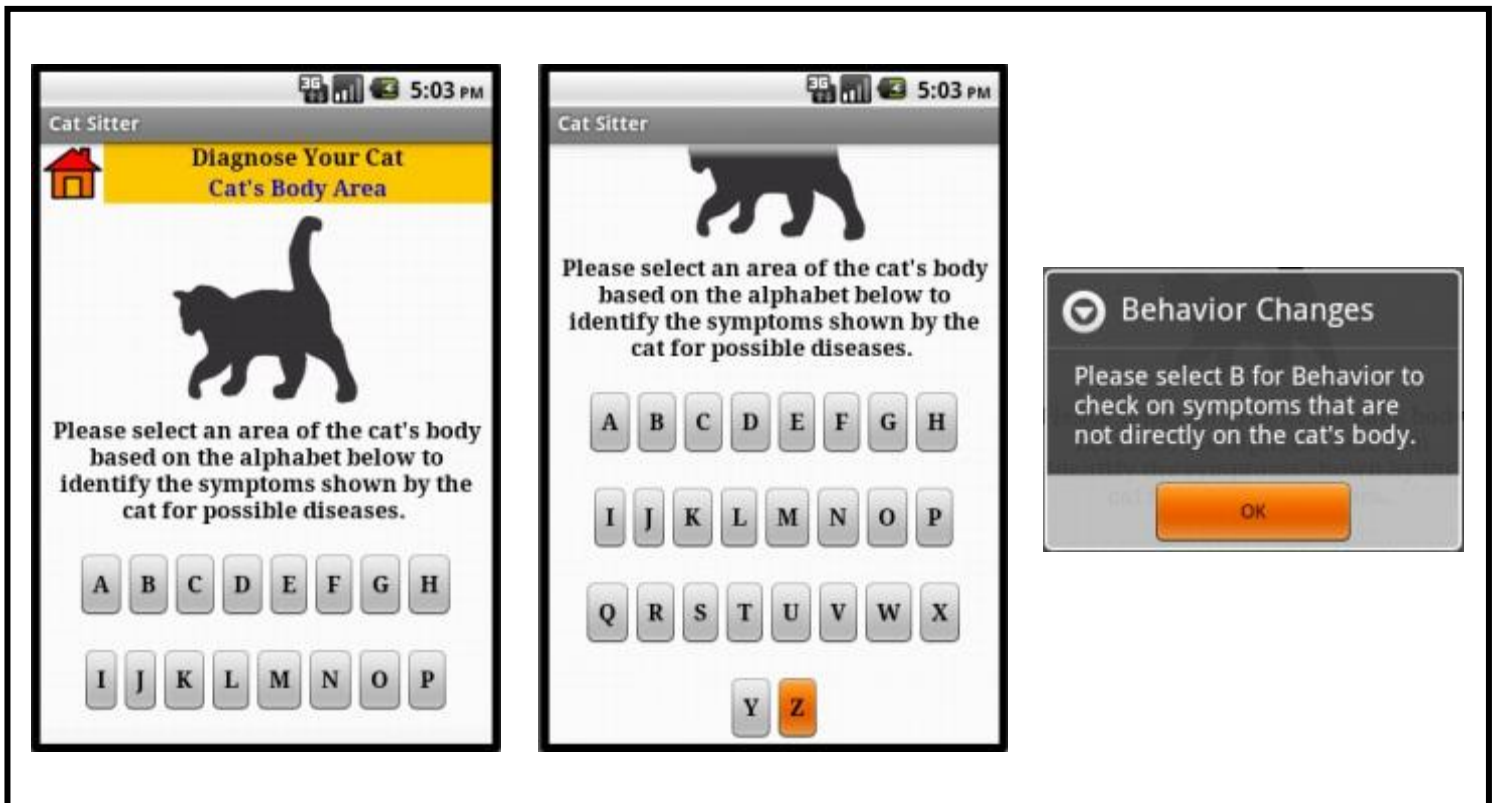


Figure 29: Diagnose Your Cat Screen 1 for Cat’s Diseases of Interactive Android Application as an Assistant to care for Cat’s Health

For an instance, if the user presses the A button, a list of cat’s body areas start with the alphabet A will be appeared as shown in the figure below. As abdomen is the only cat’s body area that starts with alphabet A, therefore, by selecting the Abdomen, the user will be navigated to the screen which requires he or she to select the symptoms associated with abdomen as shown on the next figure.

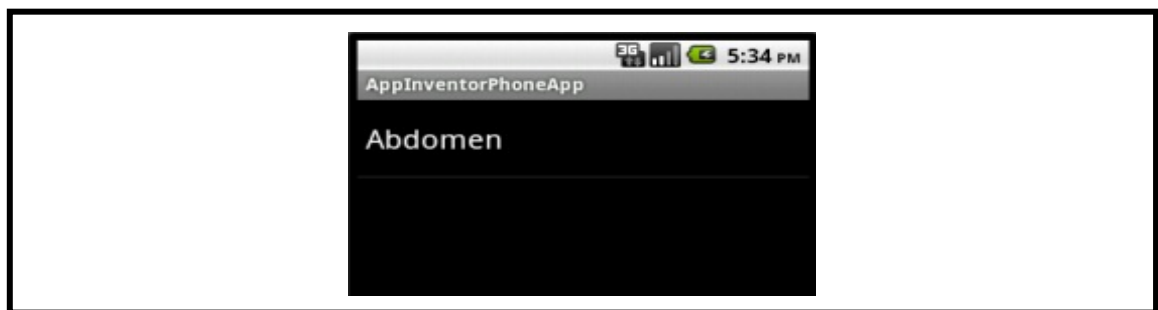


Figure 30: Diagnose Your Cat Screen 2 for Cat’s Diseases of Interactive Android Application as an Assistant to care for Cat’s Health

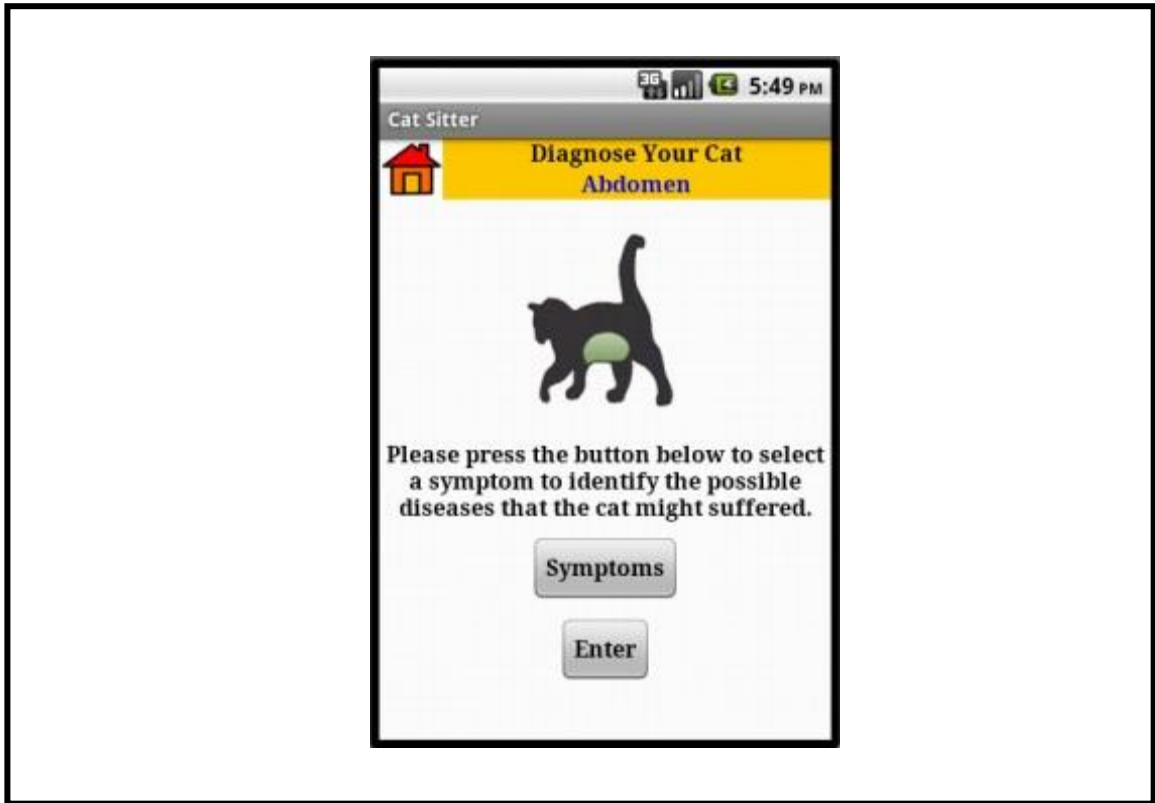


Figure 31: Abdomen Screen 1 for Diagnose Your Cat of Interactive Android Application as an Assistant to care for Cat's Health

Based on the figure above, by pressing the Symptoms button, the user will be given a list of symptoms that a cat might show at the body area of abdomen as shown in the figure below. If the user selects Abdominal Swelling in the list, he or she will be navigated to a screen which contains the information of the diseases related to the selected symptom as shown in the next figure. For the convenience of the user, he or she can have further information and understanding about the diseases through the function of Diseases Information. This will be notified through a pop-up message as shown in the next figure as well. If the user believes that the cat is suffering from a severe disease, by pressing on the Yes button found at the bottom of the screen, he or she will be navigated to Locations Screen as per described in the next section.

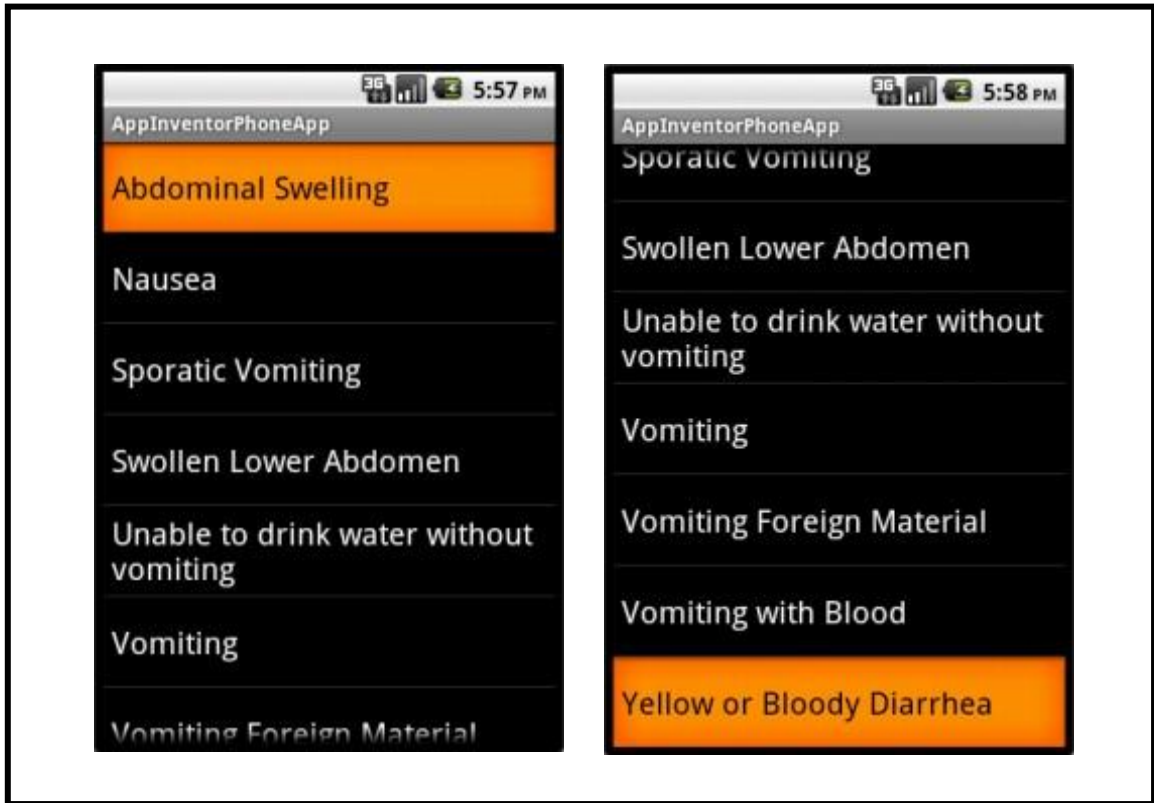


Figure 32: Abdomen Screen 2 for Diagnose Your Cat of Interactive Android Application as an Assistant to care for Cat’s Health

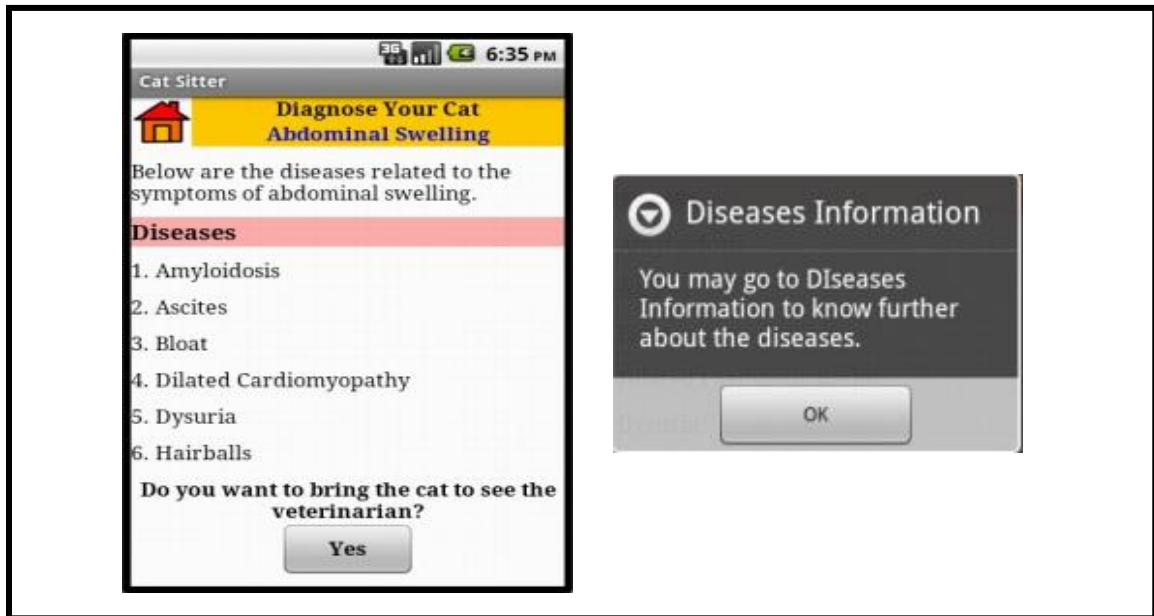


Figure 33: Abdominal Swelling Screen for Diagnose Your Cat of Interactive Android Application as an Assistant to care for Cat’s Health

On the contrary, if the user presses the B button, a list of cat's body areas start with the alphabet B will be appeared as shown in the figure below. As been stated in the pop-up message in Figure 29, if the user selects Behavior from the list, he or she will be navigated to Changes in Cat's Behaviors Screen that list out all of the possible changes in behaviors that a cat might show. This is shown in the next figure. However, the user is allowed to directly navigate to the Changes in Cat's Behaviors Screen from Menu Screen as shown in Figure 27.

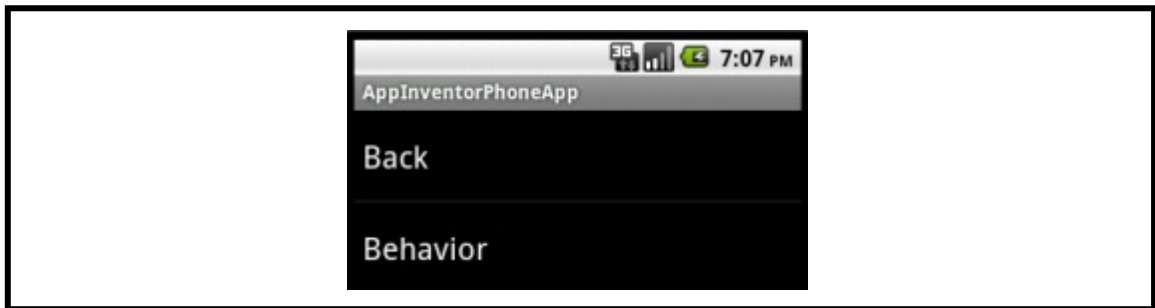


Figure 34: Diagnose Your Cat Screen 3 for Cat's Diseases of Interactive Android Application as an Assistant to care for Cat's Health



Figure 35: Changes in Cat's Behaviors Screen of Interactive Android Application as an Assistant to care for Cat's Health

If the user is able to detect the changes in the cat's behaviors in which it becomes aggressive when touched, he or she can press the Aggressiveness when touched button before being navigated to a screen consists of list of diseases associated with the changes as shown in the figure below. As being described previously, for the convenience of the user, he or she can have further information and understanding about the diseases through the function of Diseases Information. This will be notified through a pop-up message as shown in the figure as well. If the user believes that the cat is suffering from a severe disease, by pressing on the Yes button found at the bottom of the screen, he or she will be navigated to Locations Screen as per described in the next section.

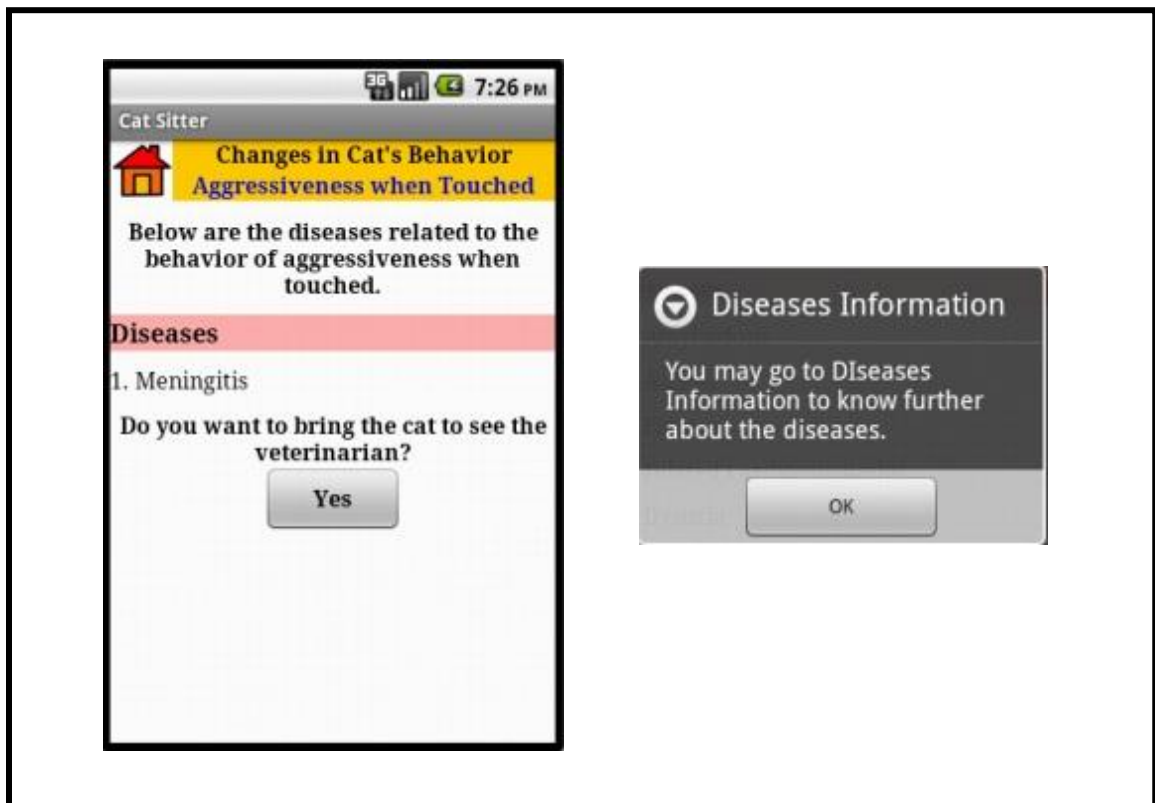


Figure 36: Aggressiveness when touched Screen for Changes in Cat's Behaviors of Interactive Android Application as an Assistant to care for Cat's Health

From Figure 33 and 36, if the user prefers to know further about the related diseases based on the symptom of Abdominal Swelling and changes in cat's behaviors of Aggressiveness when touched respectively, he or she can press the

Diseases Information button from the menu screen in Figure 27. By pressing the button, the user will be navigated to the Diseases Information Screen as shown below which contains alphabets from A-Z. Each of the alphabets is associated with a list of diseases that start with it respectively.

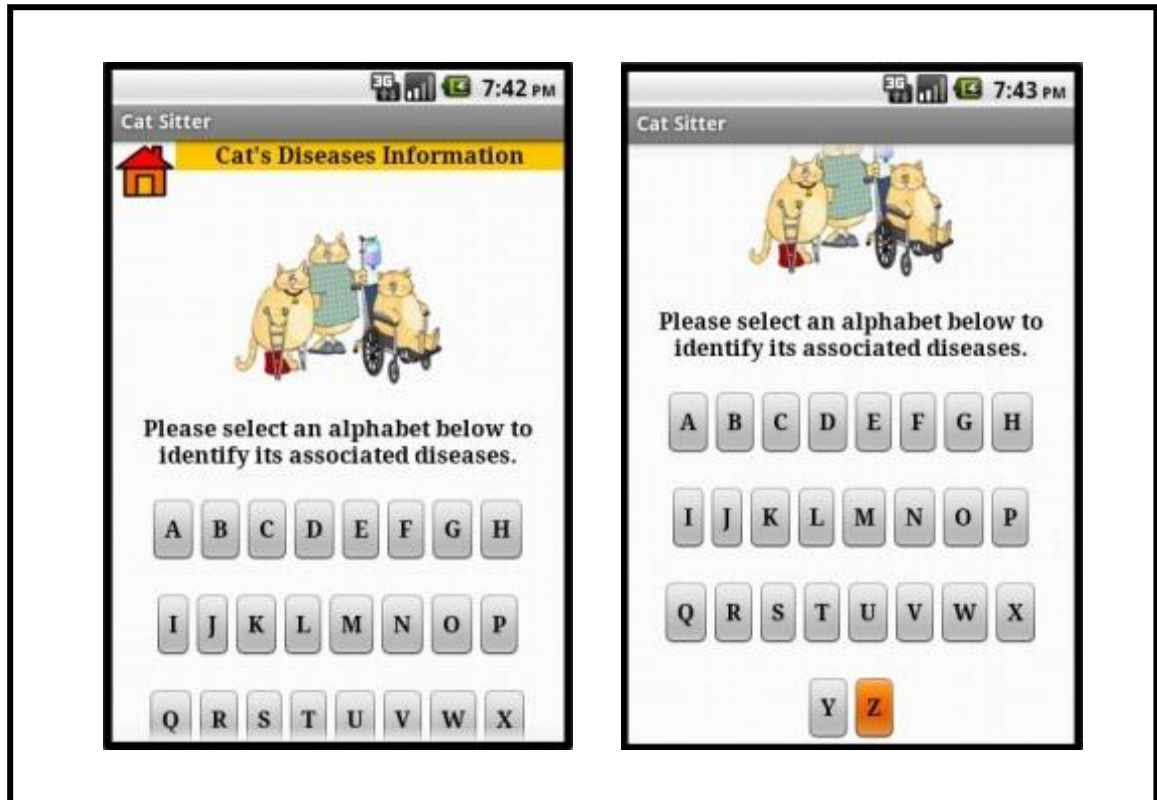


Figure 37: Diseases Information Screen 1 of Interactive Android Application as an Assistant to care for Cat's Health

As Ascites is one of the diseases related to the symptom of Abdominal Swelling, the user can press the A button in the Diseases Information Screen above. A list of diseases which start with the alphabet A will be appeared as shown in the figure below. By selecting Ascites from the list, the user will be navigated to a screen which contains information about Ascites as shown in the next figure. By referring to the advice provided by Dr. Martin Balachandran, the developer had decided not to include the information on disease's treatment as it might be danger to the cat.



Figure 38: Diseases Information Screen 2 of Interactive Android Application as an Assistant to care for Cat's Health

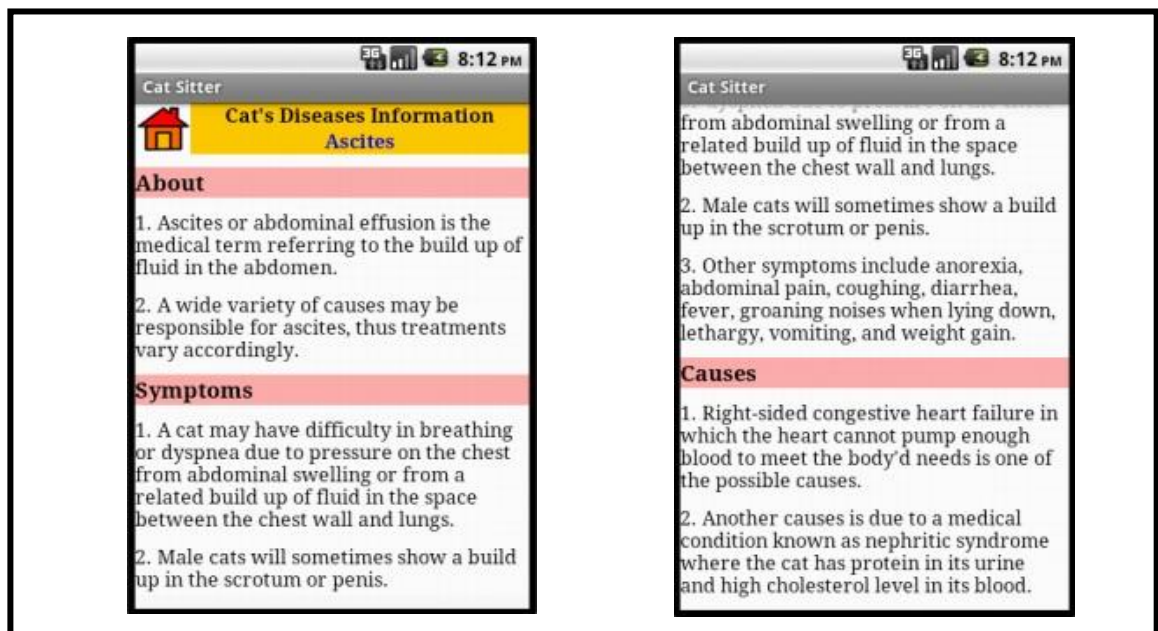


Figure 39: Ascites Screen for Diseases Information of Interactive Android Application as an Assistant to care for Cat's Health

4.1.4 First-Aids Guidelines Screens

Based on the Functions Screen shown above, if the user presses the First-Aids Guidelines button, he or she will be navigated to the first screen of First-Aids Guidelines which provides crucial information about the important things to handle an emergency case. As shown in the diagram below, the user will be given a list of equipments and medicines that should be available in a complete first-aid kit before an emergency case can be treated. The user has to press on the Continue button found at the bottom of the Screen in order to move on to the second Screen of First-Aids Guidelines.

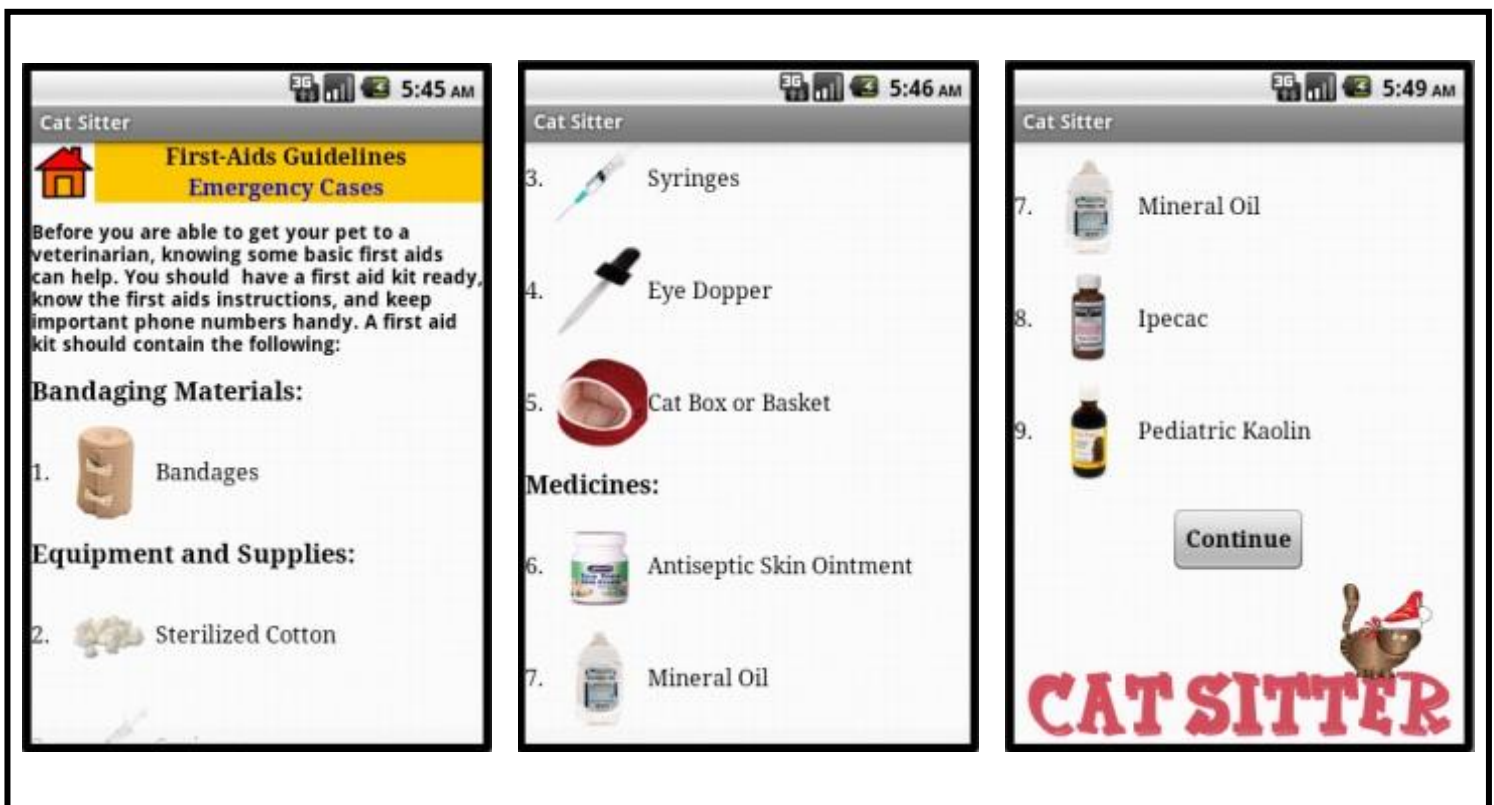


Figure 40: First-Aids Guidelines Screen 1 of Interactive Android Application as an Assistant to care for Cat's Health

When the user presses the Continue button, he or she will be navigated to the second screen of First-Aids Guidelines which listed out all the possible common emergency cases that might be faced by a cat as shown in the figure below.

There are Abscesses, Accidents, Bites/Stings, Bleeding, Broken Bones, Burns, Choking, Drowning, Fall from Height, Fever, Poisoning, Shock, and Wounds. Whenever the user presses any of the buttons of the common emergency cases, he or she will be navigated to a screen which consists of the description of the selected emergency case as well as the first-aids guidelines to handle it.



Figure 41: First-Aids Guidelines Screen 2 of Interactive Android Application as an Assistant to care for Cat's Health

For an instance, when the user presses the Abscesses button, he or she will be navigated to Abscesses Screen consists of two buttons which are About button and What To Do button as shown in the figure below. If the user prefers to read a description about Abscesses before carry out any first-aids onto the suffered cat, he or she can then press the About button. A description about Abscesses will then be appeared as shown in the figure below. This can be considered as a confirmation step that the cat is suffering from Abscesses before the user can simply carrying out the first-aids.

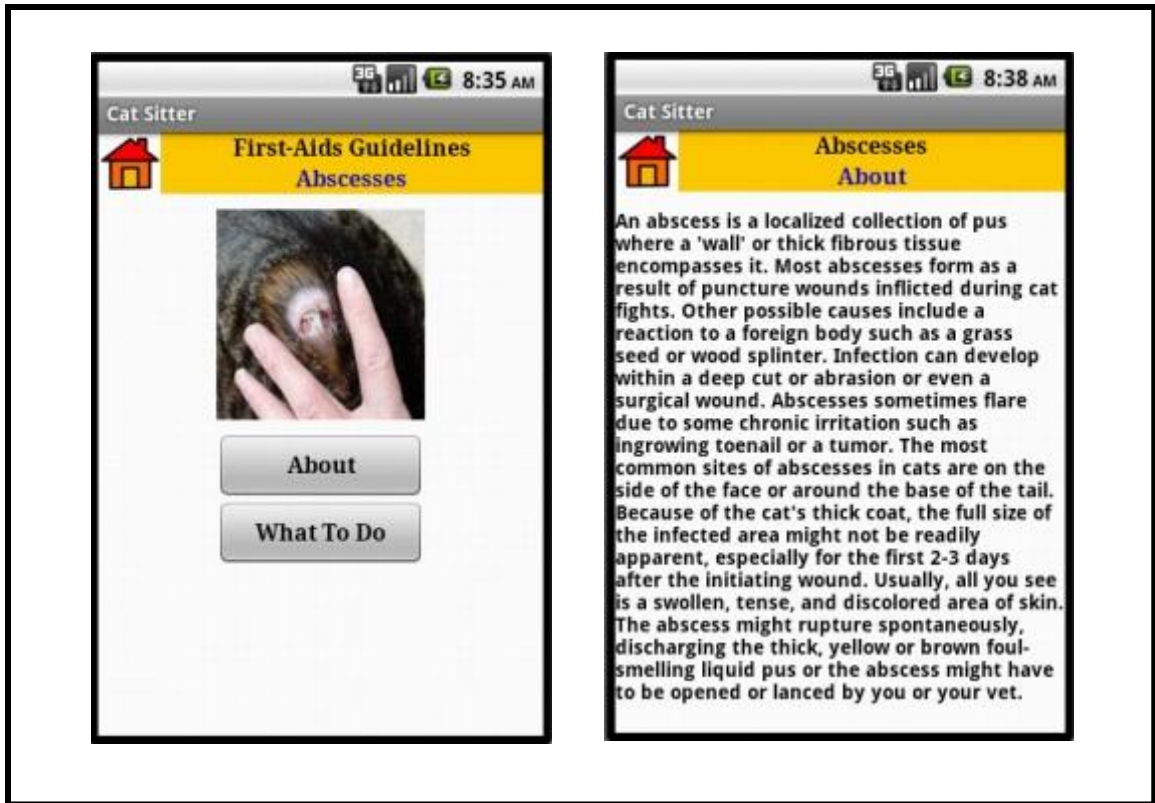


Figure 42: First-Aids Guidelines for Abscesses Screen 1 of Interactive Android Application as an Assistant to care for Cat's Health

On the other hand, when the user prefers to directly check on the right procedures to carry out the first-aids onto the cat, from the description screen about Abscesses, he or she can press the Back button of the Smartphone or tablet to return back to the Abscesses Screen as shown on the left figure above. From there, the user can press the What To Do button to be navigated to a screen consists of steps that teach a user on the first-aids that can be conducted on a cat with abscesses as shown in the figure below.

On the contrary, in the situation that the user does not press the About button when navigated to the Abscesses Screen, he or she can directly press the What To Do button to be navigated to the screen consists of steps of first-aids related to Abscesses. Throughout the navigation, apart from using the Back button in the Smartphone or tablet to return to the Functions Screen, the user can press the

Home button found on the upper left corner in every screen. By pressing the button, the user will be navigated back to the Functions Screen.

The user can only exit from the application when he or she returns back to the Functions Screen as when the user press the Back button of the Smartphone or tablet, a pop-up message will be appeared asking for a confirmation to exit the application as shown in Figure 24. Or else, the user needs to press the Back button of the Smartphone or tablet until the Functions Screen appears back to exit from the application.

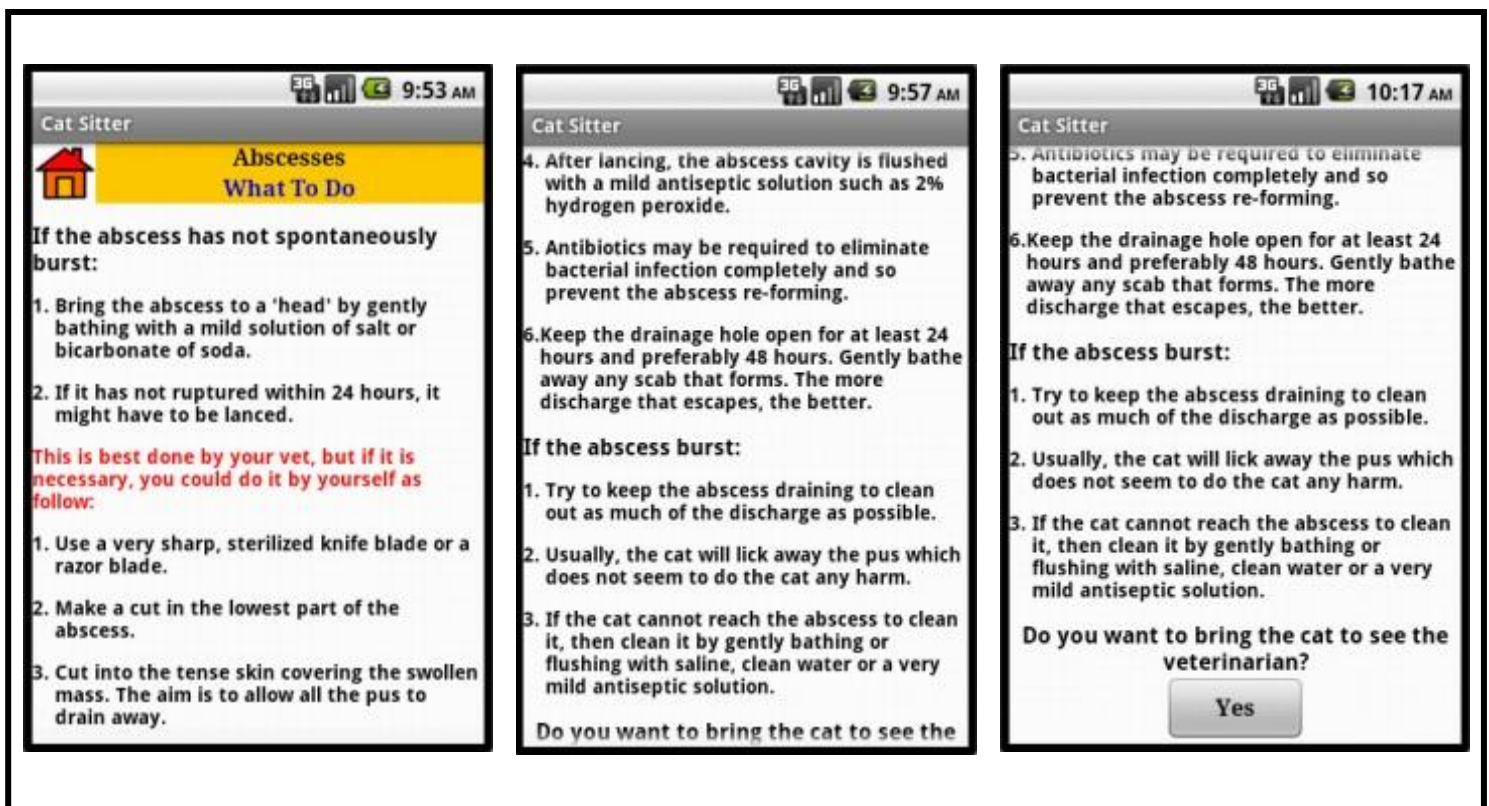


Figure 43: First-Aids Guidelines for Abscesses Screen 2 of Interactive Android Application as an Assistant to care for Cat's Health

If the user decides to bring the cat to the veterinary clinics to meet the veterinarians and receive appropriate treatments, he or she can press the Yes button to be navigated to Locations Screen. This will be described further in the next section.

4.1.5 Medicine Supply Guidelines Screens

Apart from checking on the right procedures to carry out the first-aids onto a cat based on selected emergency case, Interactive Android Application as an Assistant to care for Cat's Health also provides a user with information on the right ways to supply medicine to a cat. Therefore, from the Functions Screen, if the user prefers to identify the steps to supply different types of medicine to a cat, he or she can press the Medicine Supply Guidelines button to be navigated to the first screen of Medicine Supply Guidelines as shown below. There will be a pop-up message informing the user to select the types of medicine in order to get to the procedures to supply it to a cat as shown in the figure below.



Figure 44: Medicine Supply Guidelines Screen 1 of Interactive Android Application as an Assistant to care for Cat's Health

For an example, when a user wants to check on the right ways to supply a pill form of medicine to a cat, he or she can press the Capsule/Pill/Tablet button and

get navigate to the Capsule/Pill/Tablet Screen as shown below. As there are different ways to supply a pill form of medicine to a cat, it can be seen that there are three buttons in the Capsule/Pill/Tablet Screen which are Fingers, Pilling Devices, and Foods. Each of the buttons will show to the user about the different ways to supply a pill form of medicine to a cat. In addition, when the user enters the Capsule/Pill/Tablet Screen, there will be a pop-up message informing the user to select the different kinds of methods to give a capsule/pill/tablet form of medicine to a cat as shown in the figure below.

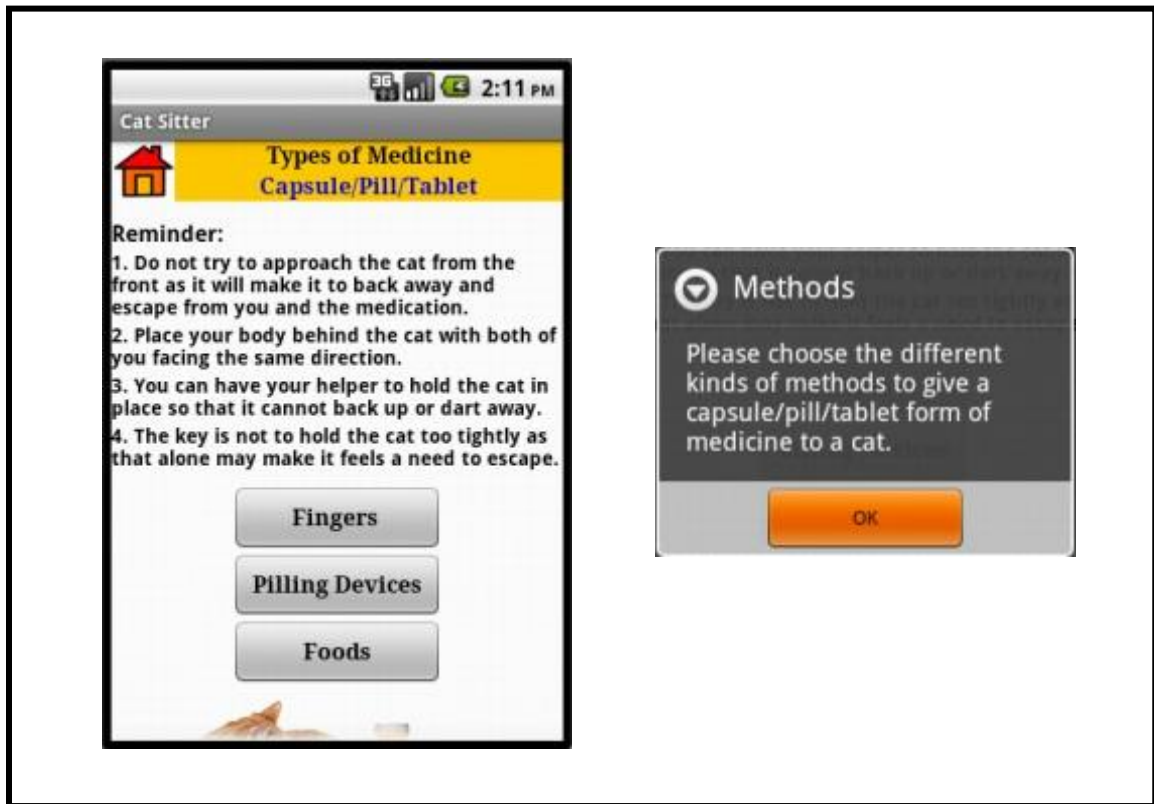


Figure 45: Medicine Supply Guidelines for Capsule/Pill/Tablet Screen 1 of Interactive Android Application as an Assistant to care for Cat's Health

To be more specific, if the user prefers to supply a pill form of medicine to a cat by using his or her bare fingers, the user can press on the Fingers button in the Capsule/Pill/Tablet Screen. The user will then be navigated to a screen consists of the step-by-step procedures on how to give a pill to a cat as shown in the figure below. Moreover, for the convenience of the user, the developer had

included a video extension that demos the procedures. This will require an internet connection before the user is able to watch it.

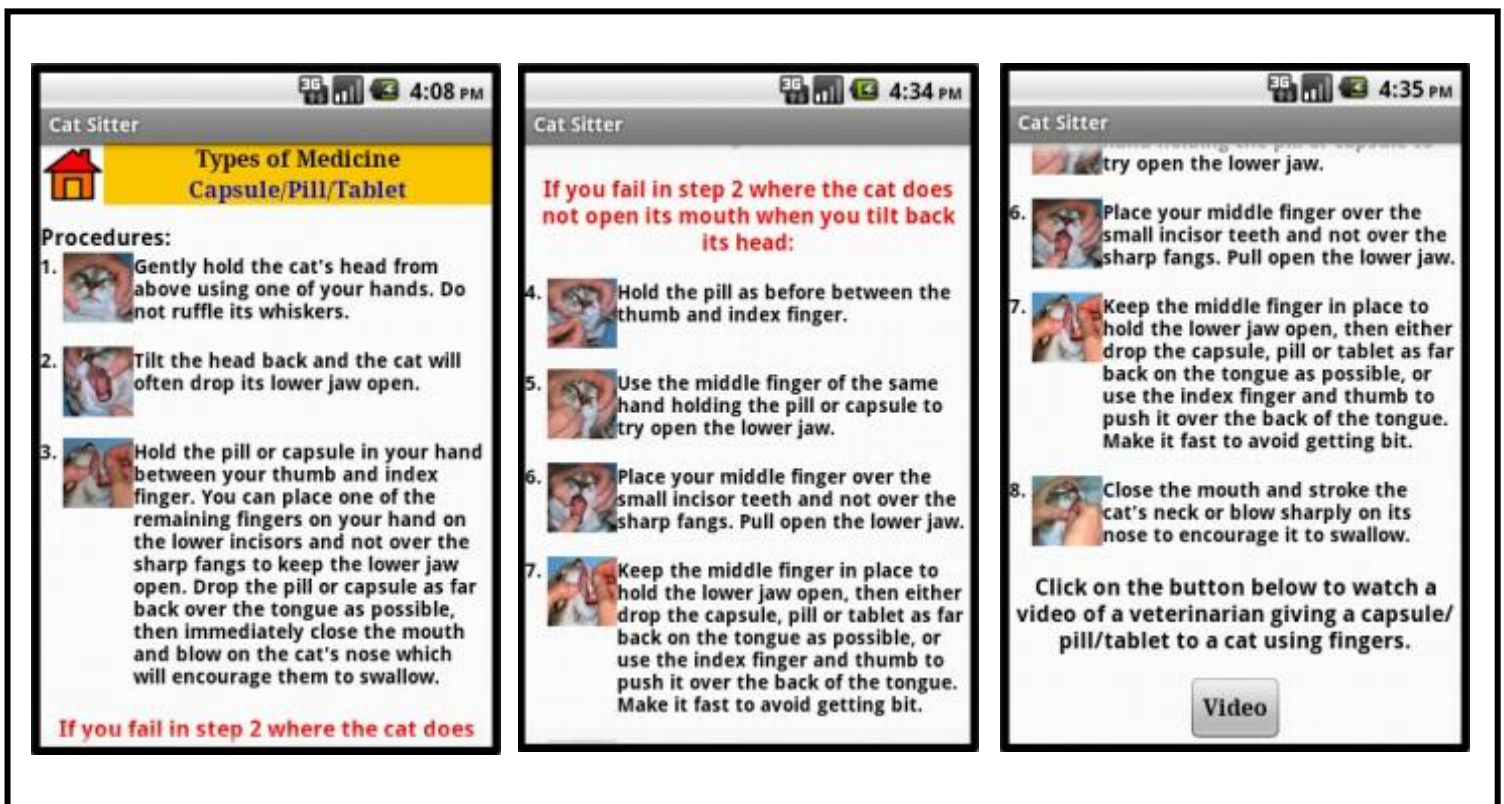


Figure 46: Medicine Supply Guidelines for Capsule/Pill/Tablet Screen 2 of Interactive Android Application as an Assistant to care for Cat's Health

4.1.6 Locations of Veterinary Clinics

As the most unique feature offered by Interactive Android Application as an Assistant to care for Cat's Health in comparison with the existing web-based systems, mobile web applications, and mobile native applications, by pressing the Locations of Veterinary Clinics button, a user will be navigated to a screen which requires he or she to select their current state as shown in the figure below. Since this application is developed for the Malaysians' users for the mean time, only states in Malaysia are listed in this application.



Figure 47: Locations of Veterinary Clinics Screen 1 of Interactive Android Application as an Assistant to care for Cat's Health

For an instance, if the user is currently staying in Perak, he or she can press the Perak button found in the States Screen before being navigated to a new screen which listed out all the veterinary clinics in Perak. To be more specific, the clinics are divided based on their districts as shown in the figure below. If the user chooses to send the cat to Hartamas Animal Medical Centre in Ipoh, by pressing the Hartamas Animal Medical Centre button, he or she will be shown a screen with the important information about the clinic which includes address, hours of operation, and contact details as shown in the next figure.

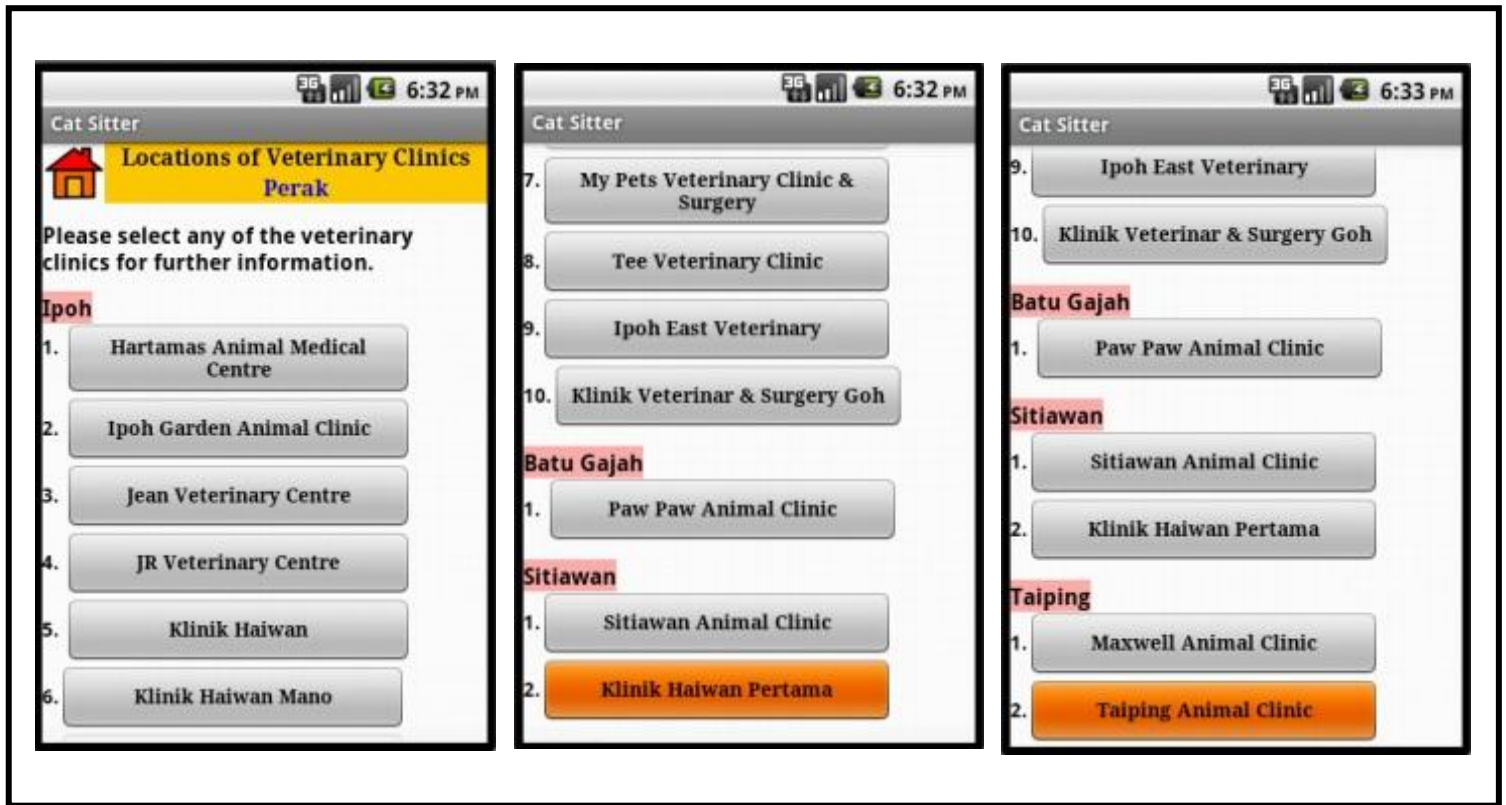


Figure 48: Locations of Veterinary Clinics for Perak Screen 1 of Interactive Android Application as an Assistant to care for Cat's Health

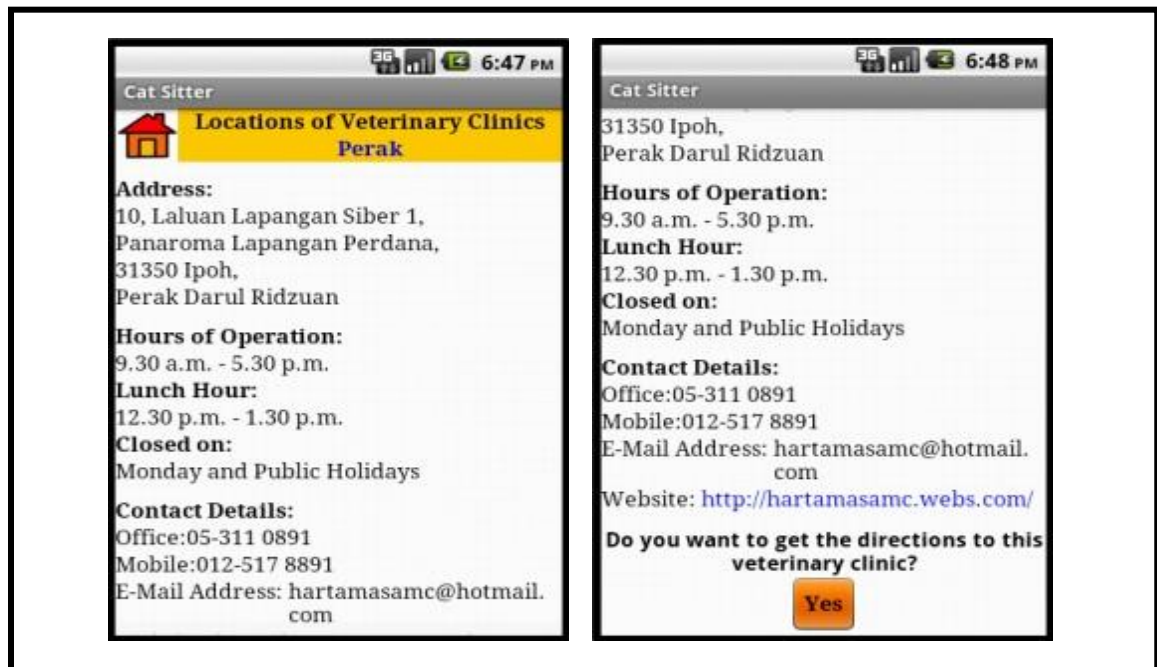


Figure 49: Locations of Veterinary Clinics for Hartamas Animal Medical Centre

Based on the figure above, if the user wants to get the directions to Hartamas Animal Medical Centre, he or she can press the Yes button before being navigated to the Maps. From there, the user will be able to identify the route or path that can be taken in order to reach the veterinary clinic as shown in the figure below. This will eventually conclude the whole functionalities offered by Interactive Android Application as an Assistant to care for Cat's Health.

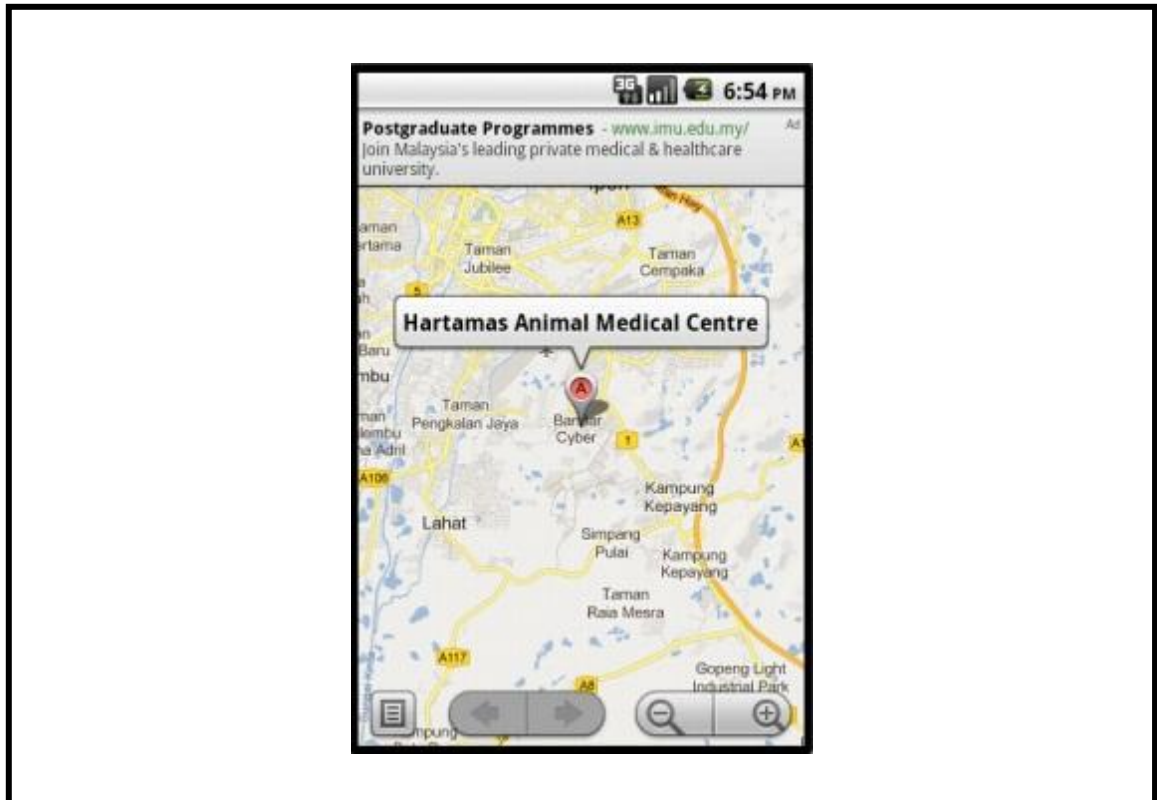


Figure 50: Maps for Hartamas Animal Medical Centre

4.2 Testing

Testing should not be confused with debugging in which the former is a process of finding “unknown” errors while the latter is a process of removing “known” errors. Generally, the objective of testing is to find errors in a system or an application and to see not only if the system or application does not do what it is supposed to do (a deficiency) but if it does what it is not supposed to do (a malfunction). In contrast, the

objective of debugging is to identify the type and location of the “found” errors and subsequently remove it by a re-definition, re-design or re-code, depending on the level of testing through which the errors were found. Therefore, testing and debugging should go hand-in-hand and be performed one right after another [20].

For Interactive Android Application as an Assistant to care for Cat’s Health, three different testing had been conducted by the developer which are Unit Test, Integration Test, and Acceptance Test. Unit Test is a process of testing the individual subunits, subroutines or procedures of a system or an application. Its purpose is to ensure that the unit does not contradict with the system or application’s internal specifications. It is performed during the development phase where different units can be tested in isolation simultaneously. It makes the debugging tasks much easier as it only involves a single unit and when an error is found, the error should be located within that particular unit.

On the other hand, Integration Test is conducted to explore the incompatibility of the interfaces between the system or application’s components. They must work together without any errors. Integration Test will ensure that the interfaces and linkages between different parts of the system or application work properly. At this point, the interfaces have passed their Unit Test. Therefore, the table below shows the results of Integration Test conducted on the prototype of Interactive Android Application as an Assistant to care for Cat’s Health.

Table 10: Results of Integration Test for the prototype Interactive Android Application as an Assistant to care for Cat's Health

No.	Test Case Names	Test Procedures	Pre-Conditions	Expected Results	Results
Welcome Screen					
1	Enter Button	Click on Enter button	None	Direct the user to Menu Screen with a pop-up message appears to welcome the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	A pop-up message will be appeared asking for a confirmation to quit the application	Pass
3	Pop-Up Message Cancel Button	Click on the Cancel button	None	Direct the user to Menu Screen with a pop-up message appears to welcome back the user	Pass
4	Pop-Up Message Yes Button	Click on the Yes button	None	The application will be closed.	Pass
Menu Screen					
1	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	A pop-up message will be appeared asking for a confirmation to quit the application	Pass
2	Pop-Up Message Cancel Button	Click on the Cancel button	None	Direct the user to Menu Screen	Pass
3	Pop-Up Message Yes Button	Click on the Yes button	None	The application will be closed.	Pass
4	Cat's Diseases Button	Click on the Cat's Diseases Button	None	Direct the user to the Cat's Diseases Screen 1 with a pop-up message appears to inform the user to enter the cat's information	Pass
5	First-Aids Guidelines Button	Click on the First-Aids Guidelines Button	None	Direct the user to the First-Aids Guidelines Screen 1	Pass
6	Medicine Supply Guidelines Button	Click on the Medicine Supply Guidelines Button	None	Direct the user to the Medicine Supply Guidelines Screen 1	Pass
7	Locations of Veterinary Clinics Button	Click on the Locations of Veterinary Clinics button	None	Direct the user to the Locations of Veterinary Clinics Screen 1	Pass
Cat's Diseases Screen 1					
1	Pop-Up Message OK Button	Click on the OK button	None	Direct the user to the Cat's Diseases Screen 1	Pass

2	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
3	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
4	Name Text Box	Enter the cat's name in the text box	None	The user should be able to enter the cat's name in his or her preferable format	Pass
5	Age List Picker	Click on the Age list picker	None	The user will be directed to a screen consists of a list of the cat's ages which requires he or she to select the respective age of the cat. A pop-up message will be appeared after the selection is made informing the user on how to convert a cat's age into a human's age.	Pass
6	Pop-Up Message OK Button	Click on the OK button	None	The user will be directed to the Cat's Diseases Screen 1 with the selected age appears in the screen	Pass
7	Pop-Up Message Cancel Button	Click on the Cancel button	None	The selected cat's age will not be appeared in the screen as the user is allowed to select again the cat's age	Pass
8	Weight List Picker	Click on the Weight list picker	None	The user will be directed to a screen consists of a list of the cat's weights which requires he or she to select the respective weight of the cat. After the selection is made, the user will be directed back to the Cat's Diseases Screen 1.	Pass
9	Breed List Picker	Click on the Breed list picker	None	The user will be directed to a screen consists of a list of the cat's breeds which requires he or she to select the respective	Pass

				breed of the cat. After the selection is made, the user will be directed back to the Cat's Diseases Screen 1.	
10	Enter Button	Click on the Enter button	The cat's name must be entered by the user.	If the user does not enter the cat's name, a pop-up message will be appeared requires he or she to enter the cats' name. Otherwise, the user will be directed to Cat's Diseases Screen 2 with all of the information inserted in Cat's Diseases Screen 1. A pop-up message will be appeared informing the user about the functions in Cat's Diseases Screen 2	Pass
11	Pop-Up Message OK Button	Click on the OK button	None	The user will be directed back to Cat's Diseases Screen 1 and have to enter the cat's name before able to proceed to the next screen.	Pass
12	Reset Button	Click on the Reset button	None	All of the inserted information will be removed from the screen	Pass
Cat's Diseases Screen 2					
1	Pop-Up Message OK Button	Click on the OK button	None	Direct the user to the Cat's Diseases Screen 2	Pass
2	Pop-Up Message Cancel Button	Click on the Cancel button	None	The user will be directed back to Cat's Diseases Screen 1	Pass
3	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
4	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Cat's Diseases Screen 1 with a pop-up message appears to inform the user to enter the cat's information	Pass
5	Diagnose Your Cat Button	Click on the Diagnose Your Cat button	None	The user will be directed to the Diagnose Your Cat	Pass

				Screen 1 with a pop-up message appears to inform the user to press B button if the symptom is not directly on the cat's body area	
6	Changes in Cat's Behaviors Button	Click on the Changes in Cat's Behaviors button	None	The user will be directed to Changes in Cat's Behaviors Screen 1	Pass
7	Diseases Information Button	Click on the Diseases Information button	None	The user will be directed to Diseases Information Screen 1	Pass
Diagnose Your Cat Screen 1					
1	Pop-Up Message OK button	Click on the OK button	None	Direct the user to the Diagnose Your Cat Screen 1	Pass
2	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
3	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Cat's Diseases Screen 2 with a pop-up message appears to inform the user about the functions in Cat's Diseases Screen 2	Pass
4	Alphabets A-Z Buttons	Click on any of the Alphabets buttons. For an instance, the user clicks on the A button	None	The user will be directed to a screen consists of a list of the cat's body areas start with the alphabet A. He or she is required to select the cat's body area in which the symptom appears. As Abdomen is the only body area that starts with the alphabet A, after the selection is made, the user will be directed to Abdomen Screen 1	Pass
Abdomen Screen 1					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the	None	Direct the user back to the Diagnose Your Cat Screen	Pass

		Smartphone or tablet		1 with a pop-up message appears to inform the user to press B button if the symptom is not directly on the cat's body area	
3	Symptoms Button	Click on the Symptoms button. For an instance, the user selects Abdominal Swelling from the list	None	The user will be directed to a screen consists of a list of the symptoms associated with the cat's body area of Abdomen and selects Abdominal Swelling	Pass
4	Enter Button	Click on the Enter button	None	The user will be directed to Abdominal Swelling Screen which contains list of its related diseases. A pop-up message will be appeared informing the user to check for further information about the diseases in Diseases Information Screen 1	Pass
Abdominal Swelling Screen					
1	Pop-Up Message OK Button	Click on the OK button	None	The user will be directed to Abdominal Swelling Screen	Pass
2	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
3	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Abdomen Screen 1	Pass
4	Yes Button	Click on the Yes button	None	The user will be directed to the Locations of Veterinary Clinics Screen 1	Pass
Changes in Cat's Behaviors Screen					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass

3	Changes in Cat's Behaviors Buttons	Click on any of the Changes in Cat's Behaviors buttons. For an instance, the user clicks on the Aggressiveness when touched button	None	The user will be directed to Aggressiveness when touched Screen which contains list of its related diseases. A pop-up message will be appeared informing the user to check for further information about the diseases in Diseases Information Screen 1	Pass
Aggressiveness when touched Screen					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Changes in Cat's Behaviors Screen	Pass
3	Yes Button	Click on the Yes button	None	The user will be directed to the Locations of Veterinary Clinics Screen 1	Pass
Diseases Information Screen 1					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
3	Alphabets A-Z Buttons	Click on any of the Alphabets buttons. For an instance, the user clicks on the A button	None	The user will be directed to a screen consists of a list of diseases start with the alphabet A. He or she is then required to select the diseases. For an instance, as Ascites is one of the diseases related to the symptom of Abdominal Swelling, the user can select Ascites from the list and thus, being navigated to Ascites Screen.	Pass

Ascites Screen					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Diseases Information Screen 1	Pass
First-Aids Guidelines Screen 1					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
3	Continue Button	Click on the Continue Button	None	The user will be directed to First-Aids Guidelines Screen 2 which contains list of common emergency cases faced by cats	Pass
First-Aids Guidelines Screen 2					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the First-Aids Guidelines Screen 1	Pass
3	Emergency Cases Buttons	Click on any of the Emergency Cases buttons. For an instance, the user clicks on the Abscesses button	None	The user will be directed to the Abscesses Screen 1	Pass
Abscesses Screen					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the First-Aids Guidelines Screen 2	Pass
3	About Button	Click on the About button	None	Direct the user to Abscesses Screen 1	Pass

4	What To Do Button	Click on the What To Do button	None	The user will be directed to Abscesses Screen 2 which contains first-aids procedures for Abscesses	Pass
Abscesses Screen 1					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Abscesses Screen	Pass
Abscesses Screen 2					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Abscesses Screen	Pass
3	Continue Button	Click on the Continue Button	None	The user will be directed to Abdomen Screen 3 which contains more information about the first-aids procedures for Abscesses	Pass
Abscesses Screen 3					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Abscesses Screen 2	Pass
3	Video Button	Click on the Video button	The user must have an internet connection to watch the video	The user will be directed to a YouTube video describing about the first-aids procedures for Abscesses	Pass
4	Yes Button	Click on the Yes button	None	The user will be directed to the Locations of Veterinary Clinics Screen 1	Pass
Medicine Supply Guidelines Screen 1					
1	Pop-Up Message OK Button	Click on the OK button	None	A pop-up message will be appeared first informing	Pass

				the user to select the type of medicine to be supplied to the cat in order to get to its procedures. After clicking the OK button, the user will be directed to Medicine Supply Guidelines Screen 1	
2	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
3	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
4	Types of Medicines Buttons	Click on any of the Types of Medicines buttons. For an instance, the user clicks on the Capsule/Pill/Tablet button	None	The user will be directed to Capsule/Pill/Tablet Screen 1 with a pop-up message appears informing the user to select the kind of methods to supply the medicine to the cat	Pass
Capsule/Pill/Tablet Screen 1					
1	Pop-Up Message OK Button	Click on the OK button	None	The user will be directed to Capsule/Pill/Tablet Screen 1	Pass
2	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
3	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Medicine Supply Guidelines Screen 1 with a pop-up message informing the user to select the type of medicine to be supplied to the cat in order to get to its procedures	Pass
4	Methods to supply Capsule/Pill/Tablet form of medicine to cat Buttons	Click on any of the Methods to supply Capsule/Pill/Tablet form of medicine to cat buttons. For an	None	The user will be directed to a screen consists of procedures to supply a capsule/pill/tablet form of medicine to a cat by using	Pass

		instance, the user clicks on the Fingers button		fingers	
Capsule/Pill/Tablet Screen 2					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Capsule/Pill/Tablet Screen 1 with a pop-up message informing the user to select the kind of methods to supply the medicine to the cat	Pass
3	Video Button	Click on the Video button	The user must have an internet connection to watch the video	The user will be directed to a YouTube video describing about the procedures to supply capsule/pill/tablet form of medicine to a cat by using fingers	Pass
Locations of Veterinary Clinics Screen 1					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
3	States Buttons	Click on any of the States buttons. For an instance, the user clicks on the Perak button	None	The user will be directed to the Perak Screen 1 which consist a list of all of the veterinary clinics in Perak	Pass
Perak Screen 1					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Locations of Veterinary Clinics Screen 1	Pass
3	Veterinary Clinics in Perak Buttons	Click on any of the Veterinary Clinics in	None	The user will be directed to Hartamas Screen which	Pass

		Perak buttons. For an instance, the user clicks on the Hartamas Animal Medical Centre button		contains information about the address, hours of operations, and contact details of the veterinary clinic	
Hartamas Screen					
1	Home Button	Click on the Home button	None	Direct the user back to the Menu Screen with a pop-up message to welcome back the user	Pass
2	Back Pressed	Click on the Back Pressed button of the Smartphone or tablet	None	Direct the user back to the Perak Screen 1	Pass
3	Yes Button	Click on the Yes button	The user must have an internet connection to get the directions to the veterinary clinics	The user will be directed to Google Maps in order to get the directions to Hartamas Animal Medical Centre	Pass

Apart from conducting Unit Test and Integration Test, the developer had conducted Acceptance Test as well as per described previously. Acceptance Test is done primarily by the users to confirm the system or application is totally complete, meets the users' requirements that prompted the system or application to be developed, and is acceptable by the users. Therefore, for Interactive Android Application as an Assistant to care for Cat's Health, the developer had selected four testers whom own at least a cat. Generally, there are three different phases carried out by the developer in order to have a complete Acceptance Test.

First and foremost, the developer had briefed the testers about the overview of the application. Then, the testers were given the application to be tested. While they were conducting the testing, the developer will take note or jot down their suggestions or attitudes towards the tested application. From this, the developer will be able to identify the usability of the application to them. Lastly, the developer gave a survey form as attached in the Appendix 2 to the testers which required them to fill in as a feedback about the application. All of the results will be used for the betterment and improvement

of Interactive Android Application as an Assistant to care for Cat's Health. Below are the results of the testing.

Table 11: Summary of Feedbacks from Acceptance Test for the prototype Interactive Android Application as an Assistant to care for Cat's Health

Respondent 1
<ul style="list-style-type: none"> • Reduced the number of the pop-up messages appeared in the application. • If possible, the pop-up messages should be appeared as an instruction throughout the application wherever necessary. • Otherwise, some of the pop-up messages can be replaced as a Help Button with the necessary information.
Respondent 2
<ul style="list-style-type: none"> • Reduced the words especially appeared in terms of instructions throughout the application. • Reduced the number of the pop-up messages appeared in the application. • The pictures provided throughout the application should be bigger for the convenience of the users.
Respondent 3
<ul style="list-style-type: none"> • Instead of providing a list of cat's ages in Cat's Diseases Screen 2, the users should insert it by themselves. • Reduced the number of the pop-up messages appeared in the application as pop-up messages should appear for important information only. • Removed some of the unnecessary buttons throughout the application like the Enter Button in Abdomen Screen. • All the words appeared in the application should be simplified and make it into instruction sentences. It would be much better if the sentences are short and precise.
Respondent 4
<ul style="list-style-type: none"> • Reduced the number of the pop-up messages appeared in the application. • Transformed the sentences throughout the application to be shorter and more precise.

Table 12: Survey Form's Feedback for the prototype Interactive Android Application as an Assistant to care for Cat's Health

Questions	Respondent 1	Respondent 2	Respondent 3	Respondent 4
User-Friendliness				
1. The application has user-friendly Graphical User Interface (GUI).	4	3	3	5
2. It is easy to navigate from one screen to another screen through the application.	2	3	4	4

Informativeness				
1. The application will help the cat owners and cat lovers to care for their cat's health.	4	5	5	5
2. The pictures being used for different purposes are attractive and understandable.	3	4	5	5
3. The video extension provided will help the users to have better understanding about the information provided.	5	4	4	5
4. The application will help the users to easily locate the veterinary clinics especially during emergency period.	5	5	5	5
5. The information provided is simple and easy to understand.	3	4	4	4
User Feedbacks				
1. You are interested to use this application.	3	4	5	4
2. Do you know any web-based systems or mobile applications exist for cat's cares?	No	No	Yes	Yes
3. Please leave your comments about Interactive Android Application as an Assistant to care for Cat's Health for the betterment and improvement of this application.	-	Wordy	I prefer a short and precise instruction. It would be awesome!	-

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The development of Interactive Android Application as an Assistant to care for Cat's Health had been conducted in two different sessions which are January 2012 and September 2012. As the author decided to develop this application on the basis of SDLC, the phases were being completed separately in both of the sessions where Planning Phase, Analysis Phase, and Design Phase had been done in the first session, January 2012, while Build Phase, Testing Phase, Implementation Phase, and Maintenance Phase had been carried out in the second session, September 2012.

Although the author managed to come out with all the designs and models during the Design Phase in January 2012, lots of changes had been done on them later especially during the Build Phase in order to meet the users' satisfactions and fulfill the suggestions given by the experts. As a result, the author was able to meet the objective of this project which is to develop a mobile native application in Android with the information on cats' health as well as locations of veterinary clinics in order to help every individual especially the cat owners in growing up a healthy cat.

To be more specific, instead of developing an Android application which focuses in diagnosing a cat's diseases based on the symptoms shown at the first place, the author decided to change the focus of the application after having a consultation with Dr. Martin Balachandran, a veterinarian in Ipoh, Perak. As he stated that an application will never be able to replace the position and expertise of a veterinarian, therefore, apart from diagnosing a cat's diseases, the author chose to offer other functionalities like First-Aids Guidelines, Medicine Supply Guidelines, and Locations of Veterinary Clinics which is now focusing in providing information on cat' health as stated in the objective above.

5.2 Recommendations

5.2.1 From the Author

From the experience of the author after she had successfully developed this application, the first future work that comes into her mind is to build Interactive Android Application as an Assistant to care for Cat's Health in other languages. Although English language is a global language, it will be better if this application exists in Bahasa Melayu as well since not every user of Smartphone and tablet who download this application can easily understand English language. For the convenience of Malaysians, the author is targeting to develop this application in Bahasa Melayu soon.

Apart of that, besides providing the users with information on cat's health in order to help them to care for their cats, the author is targeting to provide functionality in the application which is to allow the users to have a connection with an online veterinarian. From this, any enquiries out of the scope offered in the application can be asked directly to the veterinarians. For the improvements of the application, the author can take an opportunity by analyzing the trend of the questions being asked by the users to the veterinarians. This will help the author to identify other demanded functionalities for the application.

As there are lots of other animals that have become a favorite to people nowadays, the author is planning to develop this kind of application to them. Nevertheless, an analysis on the ranking of the most favorite animals will need to be conducted as the author is targeting her application to be used by numbers of users. For the mean time, the author is targeting to develop this application for dogs as this kind of animal have becoming the most common pets besides cats. Moreover, she is planning to develop the same kind of application to rabbits and sugar glider as well since these kinds of mammals have been a favorite to people.

5.2.2 From the Examiners

As detecting locations of nearest veterinary clinics is one of the features offered by Interactive Android Application as an Assistant to care for Cat's Health, therefore, from the perception of Mr. Mohd. Asrul Bin Abdul Aziz as the external examiner for VIVA, this function shall be developed by a different unit or team in the real industry. It will be considered as a new module that needs to be developed by selected developers.

However, the implementation of GPS in a system or an application is no longer applicable in today's industry as Augmented Reality is slowly taking its place due to its capabilities. Based on the experience of Mr. Mohd. Asrul Bin Abdul Aziz, Augmented Reality had been developed in most of the systems and applications. As a to-be fresh graduate, he advised the students including the author to take an opportunity in the implementation of Augmented Reality before it drops its value in the future.

In addition, he suggested the author to add another functionality in the application which is to allow the users to capture a video on the conditions of the sick cat and directly upload and submit the video to the targeted veterinarian. From the video, the veterinarian will be able to determine the health level of the cat. In the situation where the cat requires an immediate treatment based on the conditions and symptoms shown in the video, the users can quickly bring it to the veterinary clinic and meet the veterinarian.

From this feature, the author can eventually replace the treatment function that should be offered at the first place of the development of Interactive Android Application as an Assistant to care for Cat's Health. As been described previously, since Dr. Martin Balachandran was afraid that the users might give the wrong treatment to the cats, thus the author decided not to provide treatment

information to the users. Nevertheless, with the function described previously, the author can use it as an alternative of the treatment function.

Apart from the features and functionalities of Interactive Android Application as an Assistant to care for Cat's Health, Mr. Mohd. Asrul Bin Abdul Aziz had also stressed on the information presented in the dissertation as well as in the slides of presentation. First and foremost, he suggested to the students and the author to replace tables with more than five lines into charts as well as using more figures and keynotes for the convenience of the readers and audience. However, it is the responsibility of the students to set a suitable scale for the figures.

Furthermore, Mr. Mohd. Asrul Bin Abdul Aziz advised the students and the author to explain the system architecture of a system or an application in terms of figures. He wanted us to avoid explaining it in thousands of words as a reader can easily understand it from a figure. For a good impression from the reader especially an external examiner likes Mr. Mohd. Asrul bin Abdul Aziz, he wanted the author not to use any trial version software for the development of the dissertation and slides of presentation especially when there is watermark of "Trial Version" appears throughout them.

On the other hand, to be more specific on the part of presentation. Mr. Mohd. Asrul Bin Abdul Aziz suggested to the students and the author to prepare the slides using the software of Prezi especially when it is now offering more features for slides preparation. This might help a presenter to present a new way of presentation to the audience. In addition, throughout the presentation, he wanted us to avoid from looking at the laptop and the screen simultaneously as it might interrupt the focus of the audience to our presentation.

Although the audience especially an examiner might asked tones of questions about the presentation, Mr. Mohd. Asrul Bin Abdul Aziz wanted us to keep calm and answered each of the questions confidently as the examiner wants to actually

see our thinking process about the overall project. Moreover, he wanted us to conduct the demonstration of a prototype especially for Android's application through the Android Emulator or video. Please avoid demonstrate a product through a Smartphone or a tablet as it is not convenience if the audience is in huge numbers like 100 or 1000.

Last but not least, from the perception of Mr. Mohd. Asrul Bin Abdul Aziz as the applications' developer for iOS, he wanted the author to stay update and alert with the latest information on the comparison between Android and iOS as both are closed rival. The same opinion had been given by Professor Dr. Alan Oxley where he also suggested the author to be alert with the latest information especially when he noticed that one of the figures in the Literature Review was actually out dated.

Apart of that, Professor Dr. Alan Oxley wanted the author to prepare a complete and detailed result of survey as he noticed that there were some missing values in one of the pie charts shown in the Analyze Phase of Chapter 3: Methodology. He wanted the author to show another 16% of the respondents in the pie chart as those who are not having or own any cats. As a conclusion, all of the recommendations, suggestions, and feedbacks from the examiners were being taken for the betterment and improvement of the project in the future.

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APPENDICES

Appendix 1: Online Survey Form

Cats Diseases Diagnosing Application for Android

The purpose of this questionnaire is to identify the importance of a mobile application in helping every individual towards maintaining and sustaining the cats' health.



Profile Details

1) What is your gender? *

- Male
- Female

2) What is your age? *

- 16-20
- 21-25
- 26-30
- 31-35
- 36 and above

3) What is your profession? *

- Student
- Government Staff
- Non-Government Staff
- Entrepreneurs / Businessman
- Housewife
- Retirees

Familiarity with Technology

1) Do you use Android-based device? *

- Yes
- No (If no, please answer Question 2)

2) What kind of Operating System do you use for your device?

- iOS
- Blackberry OS
- Symbian OS
- Windows
- None
- Other:

3) Are you aware with the availability of mobile applications for pets? *

- Yes
- No

Importance of Cats Diseases Diagnosing Application

1) Do you have cats? *

- Yes
- No

2) Do you always aware with diseases' symptoms or behavioural changes show by your cats? *

- Yes (If Yes, please answer Question 3)
- No

3) Will you bring your cats to any Veterinary Clinics or Hospitals?

- Yes
- No

4) How frequent do you bring your cats to see the Veterinar? *

1 2 3 4 5

Never Always

5) In your opinion, why do you think there are people who resist to bring their cats to the Veterinary Clinics or Hospitals? *

6) In your opinion, will Cats Diseases Diagnosing Application on Android will help you to diagnose your cats' diseases? *

- Yes
- No

7) Do you prefer to treat your cats by yourself with natural remedies? *

Yes

No

8) If there is an Android application which can help you to identify your cats' diseases and suggest the appropriate treatments to be given, would you like to give it a try? *

Yes

No

Appendix 2: Survey Form for Acceptance Test

Interactive Android Application as an Assistant to care for Cat's Health

Interactive Android Application as an Assistant to care for Cat's Health is developed to assist today's cat owners about their cats' cares. Please fill in the survey form below to evaluate the effectiveness of the prototype.



User-Friendliness

1. The application has user-friendly Graphical User Interface (GUI). *

1 2 3 4 5

Strongly Disagree Strongly Agree

2. It is easy to navigate from one screen to another screen through the application. *

1 2 3 4 5

Strongly Disagree Strongly Agree

Informativeness

1. The application will help the cat owners and cat lovers to care for their cat's health. *

1 2 3 4 5

Strongly Disagree Strongly Agree

2. The pictures being used for different purposes are attractive and understandable. *

1 2 3 4 5

Strongly Disagree Strongly Agree

3. The video extension provided will help the users to have better understanding about the information provided. *

1 2 3 4 5

Strongly Disagree Strongly Agree

4. The application will help the users to easily locate the veterinary clinics especially during emergency period. *

1 2 3 4 5

Strongly Disagree Strongly Agree

5. The information provided is simple and easy to understand. *

1 2 3 4 5

Strongly Disagree Strongly Agree

User Feedbacks

1. You are interested to use this application. *

1 2 3 4 5

Strongly Disagree Strongly Agree

2. Do you know any web-based systems or mobile applications exist for cat's cares? *

Yes

No

3. Please leave your comments about Interactive Android Application as an Assistant to care for Cat's Health for the betterment and improvement of this application.