Cooperative Education Report

Pet Identity and Medical Records Storage System in Web Application Development

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ABSTRACT

The purpose of this research is to create a "Pet Identity and Medical Records Storage System in Web Application Platform Development". This system transforms all pet and owner information into digital format records instead of paper records. The web application named "PAWTY" is developed based on the needs of pet owners or even pet services, such as, pet grooming, pet sitting or veterinary. "PAWTY" is an intermediary between pet owners and pet services. This platform offers pet owner verification, through the use of pet ID, and medical records management in order to solve system management problems and to keep information by accession.

ACKNOWLEDGEMENT

It is a good opportunity to develop the "Pet Identity and Medical Record Storage System in a Web Application". I focus on these topics because it is essential for me to quickly understand this topic.

I acknowledge, with gratitude, Asst. Prof. Dr.Panarat Cherntanomwong, my advisor, for always helping in the cooperative education. Additionally, I am grateful to Mr. Kris Konkaew, my mentor from AIS, for supporting me and looking after me during the last four months of the participatory education program.

I have tried to gather all relevant documents regarding this research. Furthermore, I do not claim that all information in this work is included perfectly. There may be actual errors, all of which are mine. However, I will try to provide better accounts in the future.

Nattamon Sridam

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

CHAPTER 1

INTRODUCTION

1.1 Background

Presently, numerous people around the world, not only in Thailand, raise pets. Many pet owners pay attention to pets and look after them like family members. Additionally, the Pet Market's growth rate is growing rapidly every year, which means that pet owners do not ignore their pets and invest in them. At the same time, pet services are also expanding, resulting in higher competition.

The purpose of this project is to study and explore the problems of those who have pets, such as, pet identification, raising, caring, giving time to care for their pet, and the expenses associated with raising pets. The information collected is then used to determine the pain points and customer insights in order to solve problems and develop applications that meet the needs of pet owners or even pet services, such as, pet grooming, pet sitting or veterinary. In addition, this project considers the issues of storing pet's medicals records. Currently, most veterinarians record pets' medical records on their pet medical records organizer book, which means that pet owners need to bring this document to the veterinary each time they visit.

1.2 Objectives

1) To study and explore the problems of pet owners, whether it be pet identification, raising, caring, giving time to care for their pet or even the expenses associated with raising a pet.

2) To use the information and survey results to correctly solve current problems and provide useful solutions in the future, based on the theory that has been studied.

3) To use design thinking techniques in order to create a real product by determining customer's insight and pain point, which will lead to practicality and efficiency in the real world.

4) To develop a web application onto a platform that provides a service to pets, that eventually becomes an ecosystem.

1.3 Scope

1) Design a product and services in the form of a web application platform that consist of two main systems, which are, Digital Pet Identity (Pet ID) and Pet's Medical Records Storage System.

2) Use design method techniques to design a product and services, which consist of a business plan using business model canvas (BMC) and study customer insights, customer journey and customer pain point through the use of a survey.

3) Develop frontend and backend for the web application, including authentication (Login), database for data storage and APIs Generating.

4) Create RESTful API web server to handle and manage data from MySQL Database on VM instance.

5) Design software using cloud computing technique. Use microservice from Google cloud platform to build and deploy RESTful API web service for server management, configuration deployment and automatically scales.

1.4 Method

1) Find valuable proposition based on survey results and analysis of the benefits, costs, and values so that our product and services can solve customer's pain points.

2) Design a system architecture and data structure that analyze the results of value proposition (Gain creators & Pain Relievers).

3) Create Google Cloud Platform Project to run and deploy web server on VM instance.

4) Create database on Google Cloud SQL for storing data of pet owner information, pet information, veterinarian information and pet's medical records.

5) Create RESTful API web server that uses HTTP requests to GET, PUT, POST and DELETE data from database.

6) Use Postman to test send and receive requests, POST and GET data to the server to make sure the server is working and responds back the correct data.

7) Design and develop a responsive web that makes web pages render well on a variety of devices and window or screen sizes.

8) Combine all parts of frontend and backend from the above steps and test all functionality to make sure it will work without errors.

1.5 Expected Outcomes

1) Ability to transfer pet information onto a digital pet ID card, which pet owners can easily use by scanning the QR code.

2) Ability to identify pets and their owners through a digital identity, which will help reduce the problem of abandoned pets who eventually become stray animals.

3) Ability to apply this technology to the business at the maximum level through a design thinking process.

1.6 Table of Operation

Operating time is demonstrated in Table 1.1

Table 1.1 Operating time

Topic	Month			
	August	September	October	November
1. Find valuable proposition based on survey results and analysis of the benefits, costs, and values.				
2. Design a system architecture and data structure that analyze the results of value proposition.				
3. Create Google Cloud Platform Project to run and deploy web server on VM instance.				
4. Create database on Google Cloud SQL for storing data of all users.				
5. Create RESTful API web server that uses HTTP requests to GET, PUT, POST and DELETE data from database.				

Topic	Month			
	August	September	October	November
6. Use Postman to test send and receive requests, POST and GET data to the server to make sure the server is working and responds back the correct data.				
7. Design and develop a responsive web.				
8. Testing all functionality to make sure that it will work without errors.				

CHAPTER 2

LITERATURE REVIEW

2.1 Theoretical Background for Business Part

2.1.1 Lean Startup and Design Method

Lean Startup is a startup that focuses on the value that consumers or users will receive and focuses on reducing unnecessary steps or wasting resources. Creating a Lean Startup product begins by understanding the consumer insight in order to reduce the time and money in designing unnecessary features. This method of design will help reduce the problems that many startups tend to find, which is, investing a lot of time on the product but in the end there are no users and so the business is abandoned. This method will help develop some new products methodically according to the diagram in Fig. 2.1.

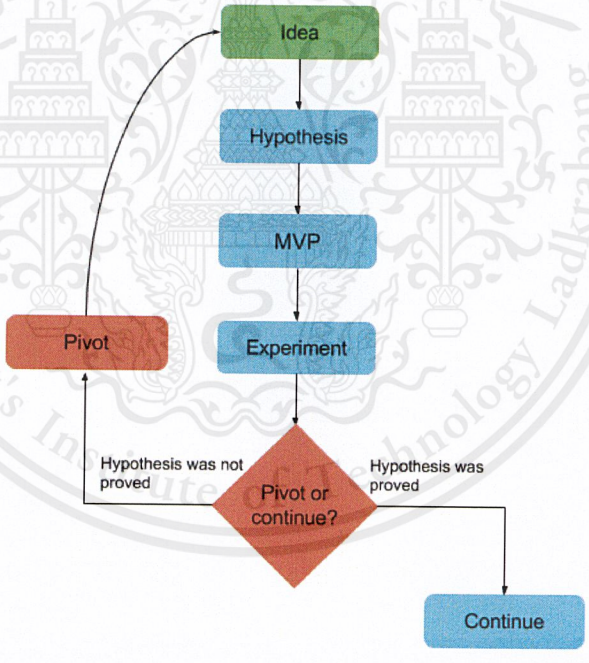

Figure 2.1 Lean startup methodology process diagram [1]

2.2 Theoretical Background for System Architecture Design

2.2.1 Microservices

Microservices, also known as a microservice architecture, is an architecture model, as shown in Fig. 2.2, and creates applications as a set of services and products for this project:

- Individually deployable
- Consists of one or more processes
- Owns its own data store
- Replaceable
- A small team can maintain a handful of microservices

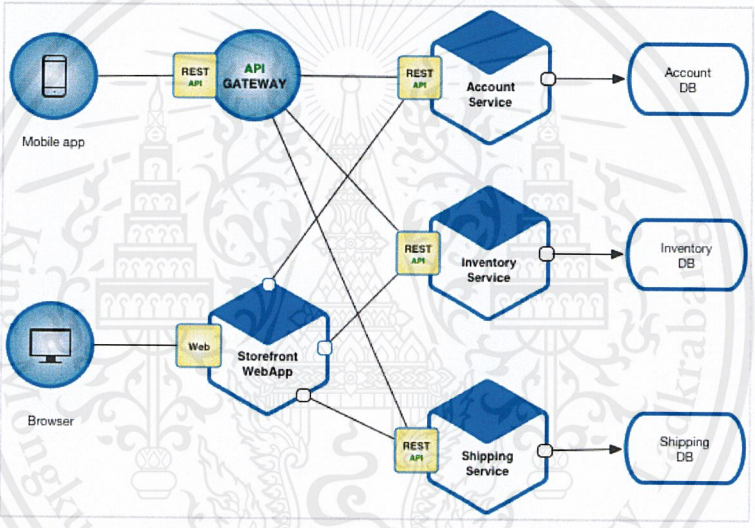

Figure 2.2 Microservices Architecture [2]

2.2.2 RESTful API (REST API)

REST or Representational State Transfer is a way to create a Web Service that uses the HTTP Method (GET, POST, PUT, DELETE) to work and returns it in the form of JSON or XML. Information is very convenient across platforms since it calls through the HTTP protocol that is already used to call the website. Another thing that makes REST accessible is due to the use of traffic because when REST returns it will be in the form of JSON or XML, which is small and extracted easily. Figure 2.3 shows the process of REST API that is computed via the internet.

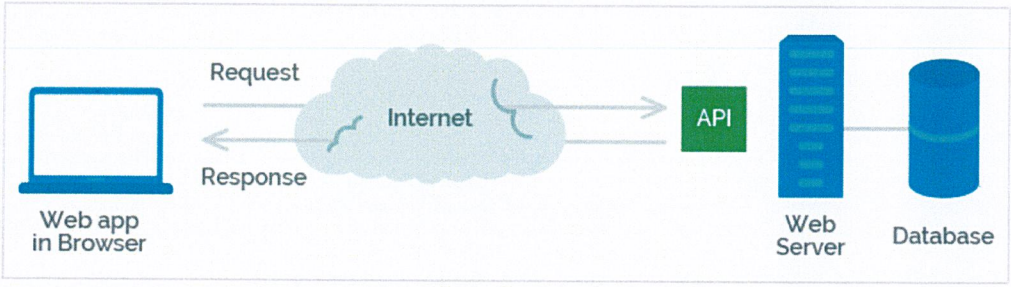

Figure 2.3 REST API Process [3]

2.2.3 MySQL (Database)

MySQL is an open source that has a relation database management system (RDBMS) function that uses Structured Query Language (SQL) as the communication language. MySQL can run on Linux, UNIX, and Windows and people still use it for most web-based jobs.

2.3 Theoretical Background for Web Application Development

2.3.1 Responsive Web Design

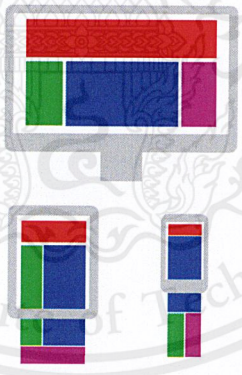

Figure 2.4 An example of RWD in different device [4]

Responsive Web Design is a web design that supports various types of devices, such as, computer screens, mobile phones, smart phones, and tablets, as shown in Fig. 2.4. These devices have different screen sizes, therefore, the website rendering requires flexibility and adjustability to suit the device in question.

Web design consists of three main components, which are:

1. Fluid Grid, layout design by using a flexible grid without a fixed size to PX but using % sizing.

2. Flexible images and media, for instance, the width of the image is determined by using the % of the screen size, in order to display properly, instead of specifying the width as PX.

3. CSS3 Media Queries by using the code to define a basic style sheet and coding the style sheet for various screen sizes.

2.3.2 Web App Building Blocks

There are three components used to build web apps in this project, which are:

1. HTML (Hypertext Markup Language)

The HTML language is responsible for managing the structure and shape of the website, comparable to a human body with a head, body, and legs. Additionally, it consists of many different tags.

2. CSS (Cascading Style Sheets)

The CSS language will beautify the website, similar to how humans wear clothes and shoes, put on make-up, or do their hair, resulting in each website having unique and different elements and aesthetics.

3. Javascript

The Javascript language will add features or add unique features to the website. It makes the website more interactive for users.

2.3.3 Vue.js

Vue is a progressive design framework used for building user interfaces in this web application. This is a JavaScript framework for the development of UI (User Interface) and some frameworks, such as Laravel, uses Vue as a template for the frontend.

2.3.4 Single-page Application (SPA)

Single Page Applications (SPA) is a web application that loads only one HTML but can meet the needs of users. It can run on another HTML dynamically. The noticeable difference between conventional websites and SPA is the reduction in the number of page

refreshes. SPA uses AJAX and HTML5 to connect to backend servers to retrieve the information on the website without having to refresh the entire website. Figure 2.5 shows the process of rendering the webpage, which will occur on the client side.

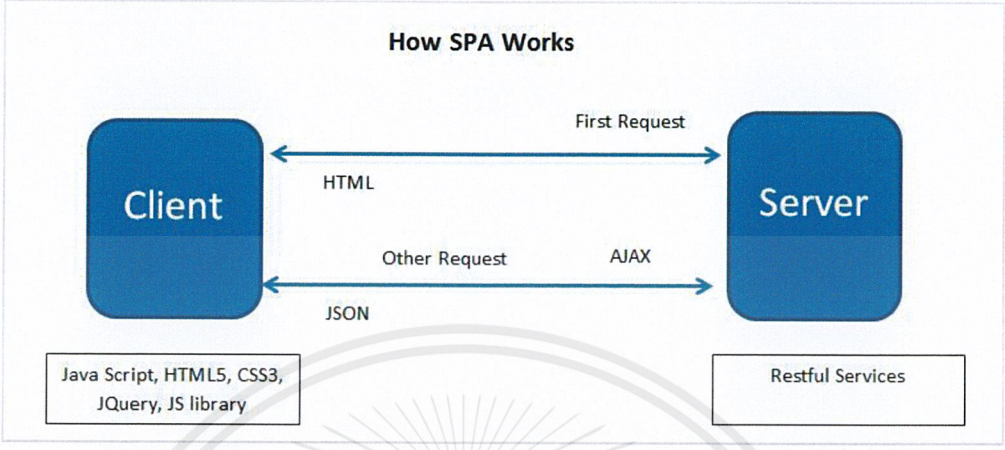

Figure 2.5 Single-page Application Lifecycle [6]

2.3.5 Postman

Postman is a tool used for API Developers. Usually, when we write an API Service, we typically use Postman, an API Testing tool, to send requests and see the responses. As a result, the test API is more suitable and more convenient for this web app development. Figure 2.6 shows the example code used for making POST request on Postman.

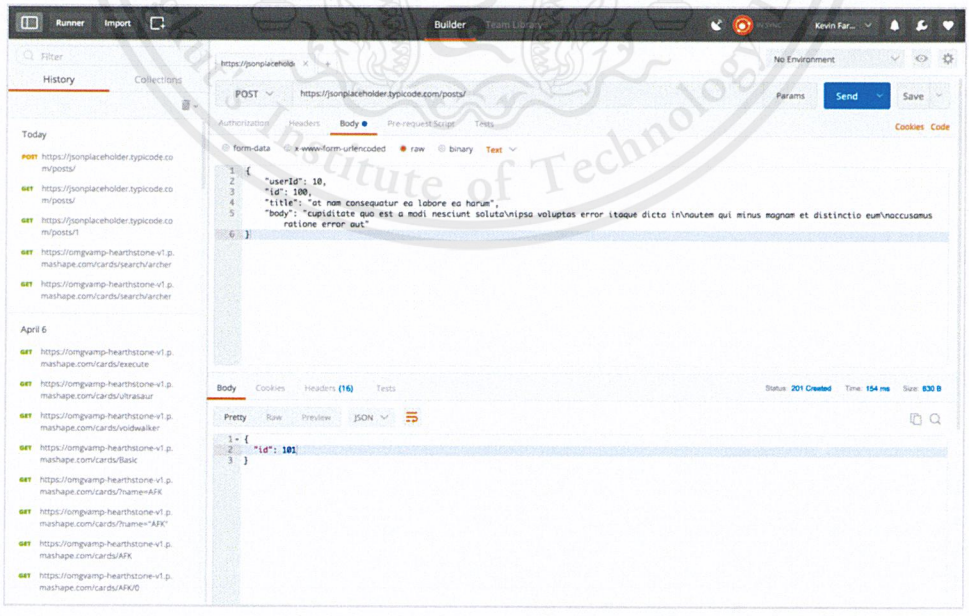

Figure 2.6 Example code for making POST request [8]

2.3.6 Firebase

Firebase is a platform designed to be an API and Cloud Storage for developing Realtime Application that supports many platforms, as shown in Fig. 2.7. The latest basic is also available to develop with three Platforms, which are IOS App, Android App and Web App. In this project, Firebase is used to develop with a web application written in HTML, Javascript, and CSS.

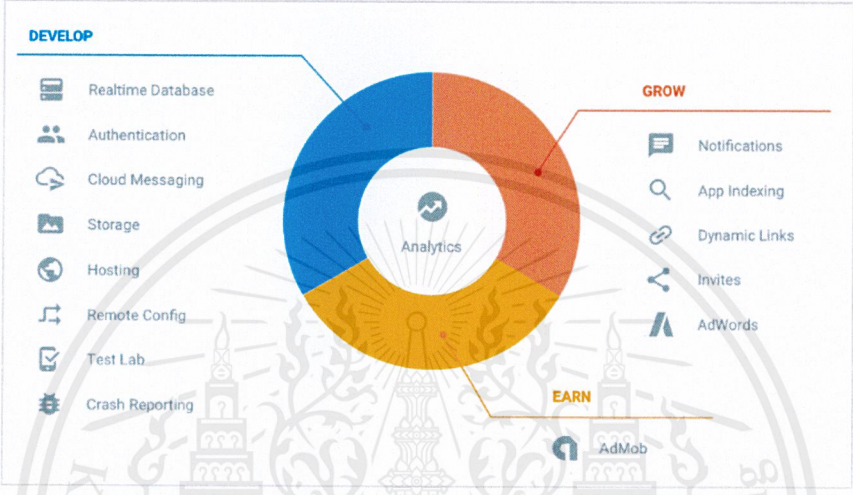

Figure 2.7 Tools and services of firebase [9]

Two services, from all of services that Firebase provides, are used for this project, which are, Firebase Authentication and Firebase Hosting.

2.3.7 Google Cloud Platform (GCP)

Google Cloud Platform or GCP, is a web-based service platform that was developed by Google. It has been successfully used for data analysis and server management in this project. The advantage of using Google Cloud Platform is that one does not need to buy hardware because there is a 24-hour system administrator, therefore, the cost is calculated according to the actual usage. Moreover, there are many more separate services to choose from, including Compute Engine, Storage & Databases, Big Data, API Platform and Ecosystems, Machine Learning, Identity & Security, and others. Figure 2.8 demonstrates the Google cloud platform console Interface.

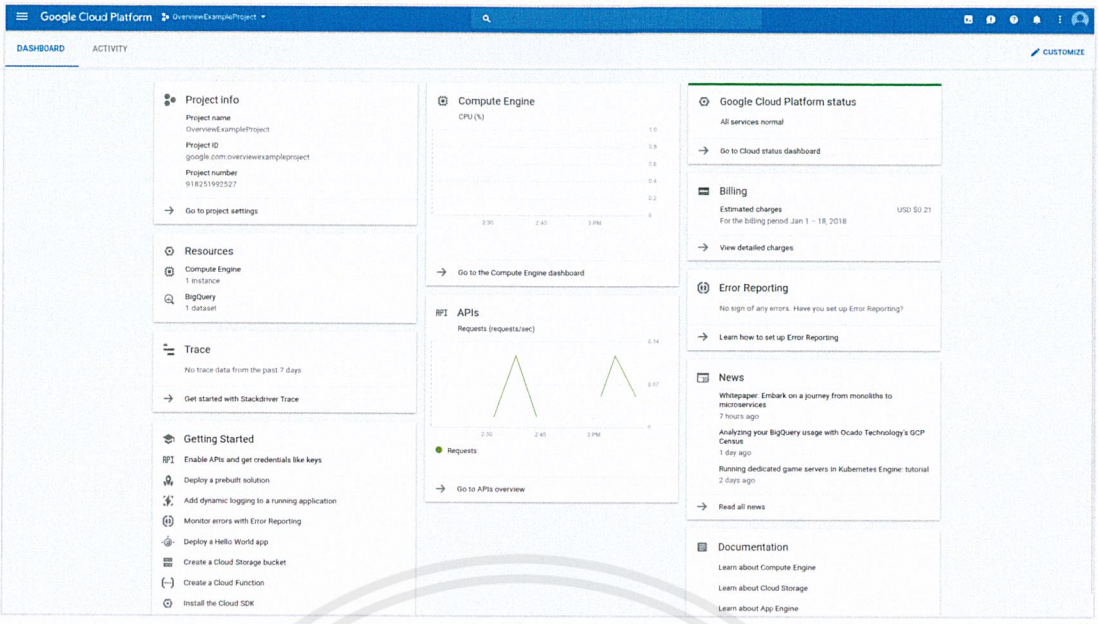

Figure 2.8 Google Cloud Platform Console Interface [10]

2.4 Related Work

The purpose of this project is to study and explore the problems of those who have pets, such as, raising, caring, giving time to care for them or even the cost associated with raising a pet, and then using the information gathered in order to determine the pain points and customer insights in order to solve problems and develop applications that meet the needs of pet owners and pet services, such as, pet grooming, pet sitting and veterinary. In addition, this project considers the issues of storing pets' medicals records. Presently, most veterinarians record pets' medical records on their pet medical records organizer book, which means that pet owners must bring the pet medical records organizer book every time they have an appointment with the veterinarian.

2.4.1 Pet Owners' Views of Pet Behavior Problems Research

One research has been conducted regarding the Pet Owners' Views of Pet Behavior Problems and Willingness to Consult Experts for Assistance [11]. They surveyed pet owners and asked them to rate 13 problematic behaviors. Participants were asked to assess each response in terms of the severity of the problem ("Would you consider this a problem?"), and the opportunity for that person to ask for advice ("How likely would you be to ask for advice or from an expert?").

TABLE 5
Ratings of Ways to Get Help With Pet Behaviors by Dog and Cat Owners

Item	Dog Owners		Cat Owners	
	M	*SD*	*M*	*SD*
Visit a free animal behavior Web site.	8.85	2.3	8.91	2.1
Call a veterinarian for free advice.	8.68	2.5	8.82	2.2
Buy a book on how to solve animal behavior problems.	7.76	2.8	8.06	2.1
Call an animal behavior helpline for free advice.	7.45	3.0	7.22	3.5
Call an animal behaviorist for free advice.	7.41	3.0	7.28	3.4
Call an animal shelter for free advice.	7.12	3.3	7.60	3.2
Pay for a class on solving animal behavior problems at the Humane Society.	6.85	3.0	6.25	3.2
Pay for a visit to the vet to discuss the problem.	6.75	3.3	7.47	2.6
Pay an animal behaviorist to work with you and your pet.	5.44	3.0	5.14	3.3
Pay for a class on solving animal behavior problems at a pet store like PetSmart.	5.26	3.3	5.48	3.3
Call an animal behavior helpline that charges for its services.	4.29	3.0	4.86	3.3
Visit an animal behavior website that charges for its services.	3.47	2.6	3.98	3.0

Note. 1 = *Never would;* 10 = *Definitely would.*

Figure 2.9 Ratings of Ways to Get Help with Pet Behaviors by Dog and Cat Owners [12]

The table in Fig. 2.9 presents the ranking of the probability that participants will use different methods to request assistance for pet behavior problems. All options are related to fees or payments, and free services receive a higher score, for instance, a visit to the animal behavior website is ranked highest when the visit is free. The addition of fees to the service results in the final credit rating decreasing.

2.4.2 Pet Market in Thailand

Since the purpose of this project is to create a product or web application by using design thinking and lean startup method, it is necessary to gather information on pet markets. Based on the Pet Market in Thailand [13], consumers are raising pets as part of their family due to the ongoing humanitarian trend. Thai consumers have transformed from pet lovers to "pet parents" driven by young people who think that owning pets is like having children.

Thailand is home to many stray cats and dogs, which support the need and existence of many animal shelters in the country. While Thai consumers prefer domesticated animals, the most popular being cats and dogs, many cannot afford pet ownership because of its various limitations, such as, a small living space not approved by

their parents or neighbors for having pets, inability to find suitable pets and the lack of resources to help them with adequate care.

2.4.3 Retention of Pet ID Tags

Another research was carried out on Pet Identification or Retention of Pet ID Tags [14]. They explore questions such as, "How do pet owners use ID tags and how is their importance ranked?". Do pet owners keep the personal ID tags that were placed on their pets? Are the animals tagged in the study missing? Do the tags help them return home? Can many dogs and cats be tagged in the community? What is the impact on getting lost or controlling local animals? The findings are based on a survey from Oklahoma City. The result is that 80% of pet owners say that pet ID tags are "very important" but only 33% of pet owners reported that their pets wear ID tags all the time.

2.4.4 Lost pet problems and chances of finding lost pets

Another study explored search and identification methods that owners use to find lost cats[15]. One of the initial objectives of the study was to examine factors related to the recovery time of a lost cat. Since the data collected was for cats that were recovered by the owner using one of the methods of finding or because the cats have specific methods of identification, this analysis was not performed.

	Time cat was lost (d)			
Recovery method	**≤ 3**	**> 3 but ≤ 7**	**> 7**	**Total**
Came home on own	16 (59)	21 (78)	11 (58)	**48 (66)**
Rabies tag	0 (0)	0 (0)	1 (5)	**1 (1)**
Neighborhood signs	3 (11)	3 (11)	2 (11)	**8 (11)**
Newspaper advertisement	0 (0)	1 (4)	1 (5)	**2 (3)**
Call or visit to animal agency	4 (15)	1 (4)	0 (0)	**5 (7)**
Found in neighborhood*	2 (7)	1 (4)	2 (11)	**5 (7)**
Other	2 (7)	0 (0)	2 (11)	**4 (5)**
Total	**27 (100)**	**27 (100)**	**19 (100)**	**73 (100)**

Values are given as number of cats (%).
*Includes cats recovered as a result of being found in the woods, in a drain, in a neighbor's attic, and by driving in the neighborhood.

Figure 2.10 Recovery method results from survey [16]

The website lostpetresearch [17] mentions this research and summarizes the result, as displayed in Fig. 2.10:

- 53% recovery (73/138) concludes that traditional search and identification methods are largely ineffective
- 35% of all cats go home by themselves, 66% found cats go home by themselves
- Average recovery time = 5 days (interval 0.5 to 81 days)
- The percentage of cats recovered that were not neutered (25%) is significantly lower than neutered cats (57%) (P = 0.02)
- 41% of lost cats (56) are indoor cats
- Lost before: 78% of cats have never disappeared, 17% have disappeared 1-5 times before, and 5% have disappeared more than five times before
- Identity: 10% of cats have ID tags, 6% have rabies tags, and 7% have chips. Overall, 14% have some type of visible ID, and 19% have some other kind of ID

For Cat recovery, identification ID tags do not increase the chances of recovering cats (probably because many cats find their own way home).

CHAPTER 3

METHODOLOGY

3.1 Research the Market Trends in The Pet Industry

Before starting this project, I researched the market trends in the pet industry and discovered studies a discussion about the Market Trends in The Pet Industry [18]. They say that the pet industry is experiencing a rapid growth. According to the American Pet Products Association, 85 million households have pets, and in the last 30 years, pet owners have increased from 56% to 68%. While some changes in pet ownership are a result of technology and the advent of online purchases, the growth is mainly due to cultural changes.

Another article that discusses current pet market trends is from KBank [19], which argues that the pet market in Thailand is constantly growing. They are not merely raised for love or desire but are raised as a child and part of the family, which means that owners are willing to spend a lot of money to give them the best life. This is the main reason why the pet market has grown more than 3 billion baht. The pet food business, which has the highest value, represents 45%, at 1.46 billion baht. Pet health care is worth 1.02 billion baht, at 32%, and other businesses such as clothing, pets or toys accounts for 23% at 7,370 million baht. Figure 3.1 shows the chart of value of pet market in Thailand.

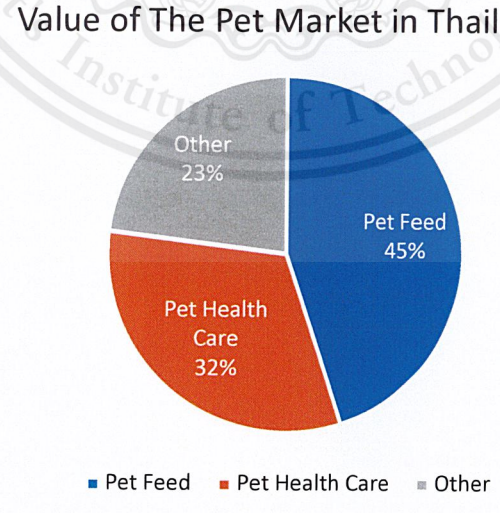

Figure 3.1 Chart of Value of the Pet Market in Thailand

The five main factors that cause the pet market to grow are:

1) Aging Population
2) Dual Income, No Kids (D.I.N.K)
3) Pet Humanization
4) Pet Health Care improved
5) Friendly Pet Community

According to the aforementioned studies, the pet market is likely to grow further in the future. Many different groups of people can become a target customer for a pet-related web application, since pet owners give great importance to their pets liking them to a member of their family.

3.2 Value Proposition Canvas

To accurately understand a customer's insight, we need to determine the customer's pain point and the customer's journey by conducting a questionnaire about pet care and the problems that pet owners often encounter and how they resolve those problems?

The questionnaire was created, in order to discover the problems of the pet owners, by using Google Form with the title "Pet Owner 's Problem." It was then shared on social media via Facebook, Twitter, Instagram, and Line. The questions are multiple-choice so that the analysis can be done with ease. This questionnaire allows for the collection of data from the general public, which can be used for analysis in this research.

3.2.1 Questionnaire results

The pie chart in Fig. 3.2 shows the percentages of those who have a pet and those who do not, 69.2% or 157 participants and 31% or 70 participants, respectively. It can be concluded that there is a higher ratio of people who have pets.

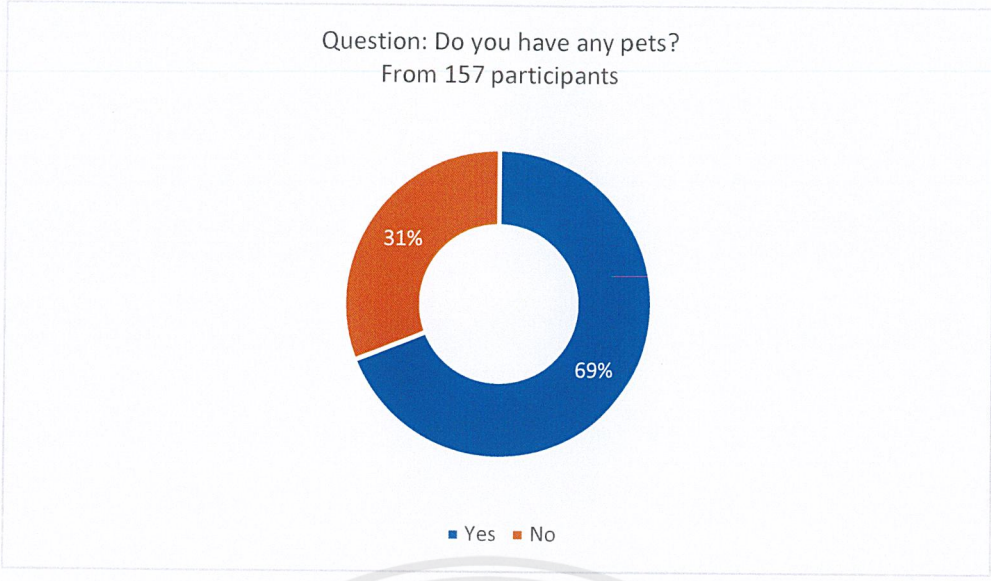

Figure 3.2 Question – Do you have any pets?
From Survey "Pet Owner 's Problem"

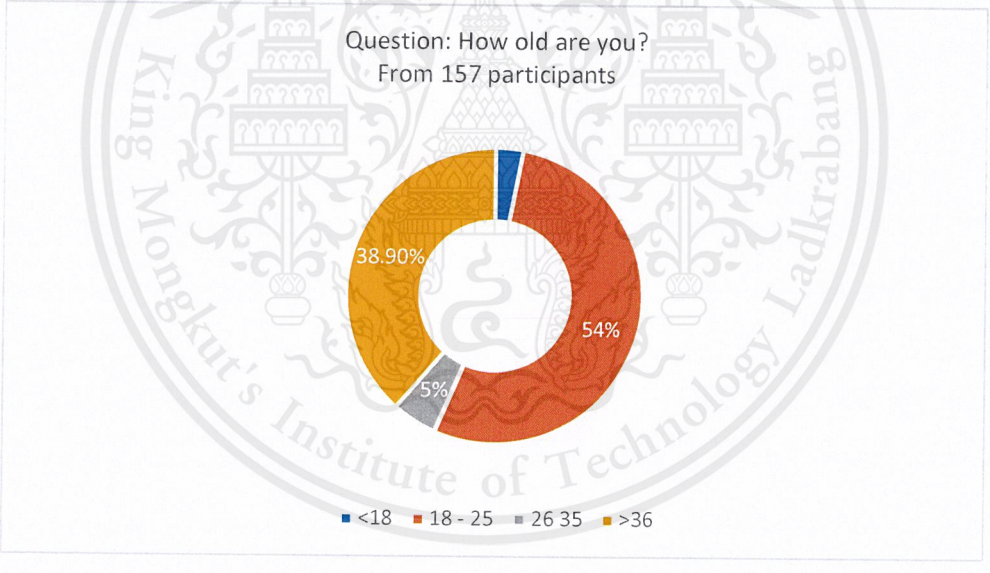

Figure 3.3 Question – How old are you?
From Survey "Pet Owner 's Problem"

The pie chart in Fig. 3.3 shows the age range of the 157 participants. It can be concluded that the majority of the participants (54%) are aged between 18 and 25, followed by being under 18 (39%), and then 26 to 35 (5%), and finally over 36 (2%).

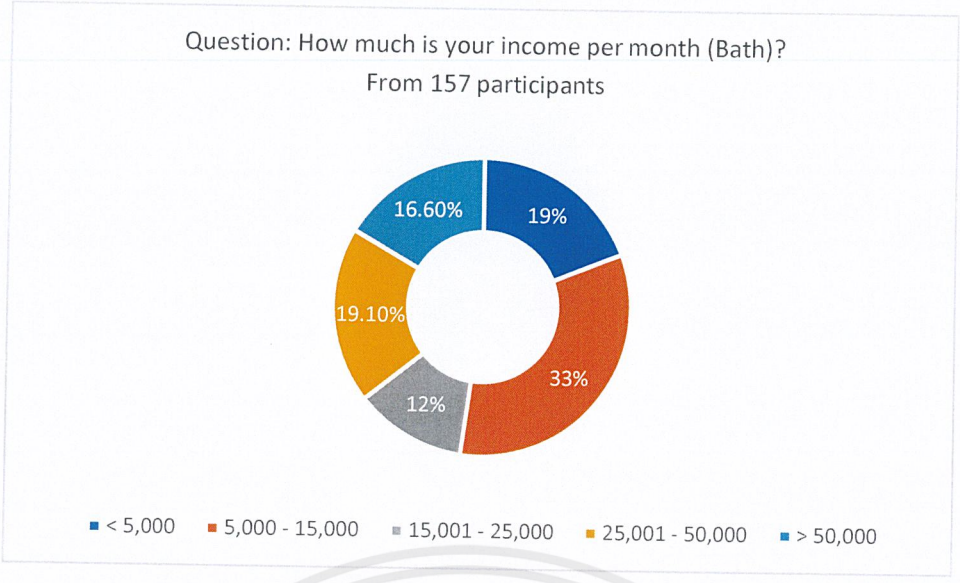

Figure 3.4 Question – How much is your income per month (Baht)?
From Survey "Pet Owner 's Problem"

The pie chart in Fig. 3.4 shows the income per month (baht) of the 157 participants. It can be concluded that 19% of participants earn less than 5,000 baht per month, 33% earn around 5,000–15,000, 12% earn 15,000 – 25,000, about 19% earn 25,000–50,000 baht and roughly 16% earn more than 50,000 baht.

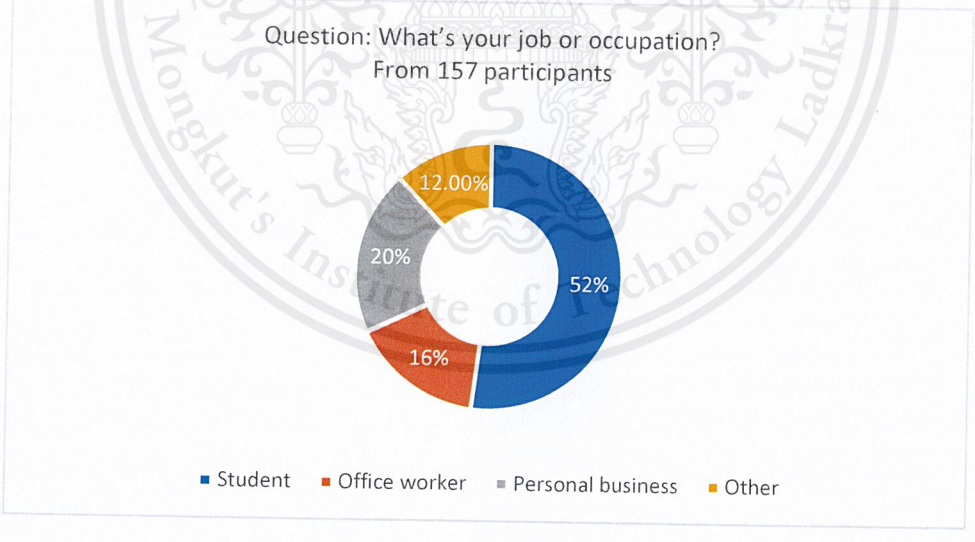

Figure 3.5 Question – What's your job or occupation?
From Survey "Pet Owner 's Problem"

The pie chart in Fig. 3.5 shows the job or occupation proportion of the 157 participants. It can be concluded that 52% or 81 participants are students, 20% or 31

participants have a personal business, 16% or 25 participants are office workers and 12% or 20 participants have other occupations.

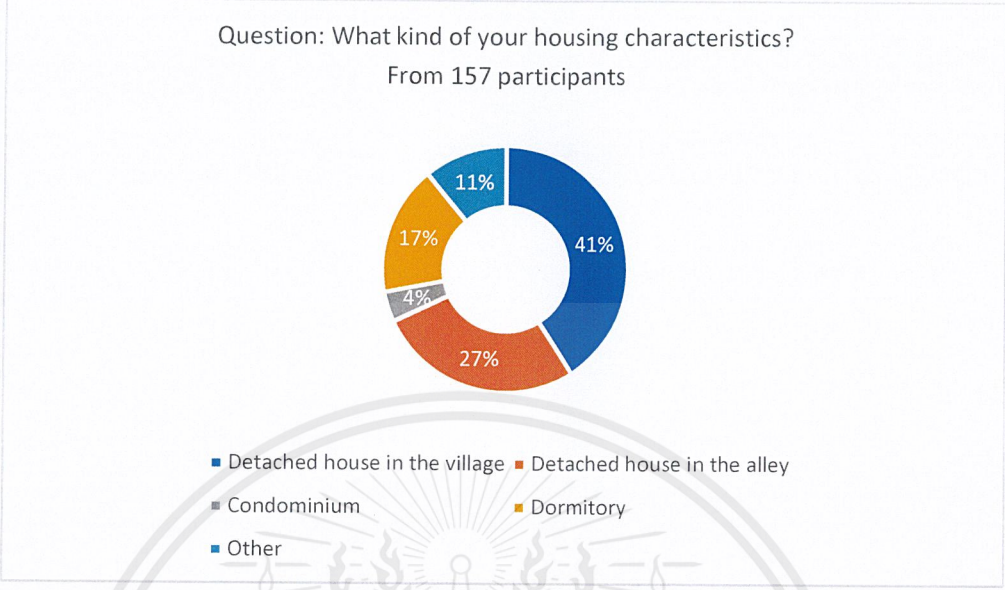

Figure 3.6 Question – What are the characteristics of your house?
From Survey "Pet Owner 's Problem"

The pie chart in Fig. 3.6 shows the housing characteristics proportion of the 157 participants. It can be concluded that 41% or 65 participants live in a detached house in a village, 27% or 43 participants live in a detached house in an alley, 17% or 26 participants live in a dormitory, 4% or 6 participants live in a condominium and 11% or 17 participants live in another type of housing.

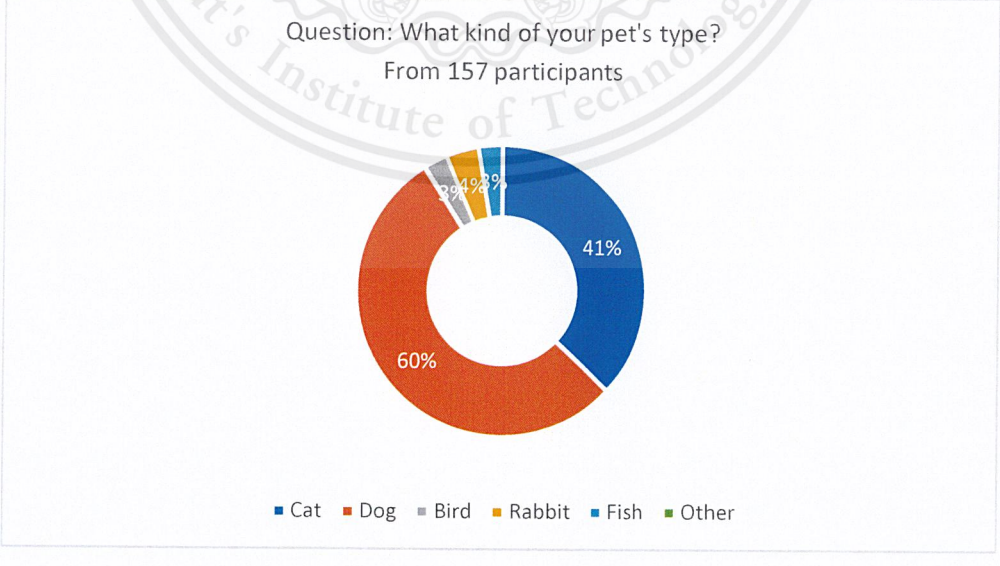

Figure 3.7 Question – What type is your pet?
From Survey "Pet Owner 's Problem"

The pie chart in Fig. 3.7 shows the proportion of the type of pet owned by the 157 participants. It can be concluded that 60% or 94 participants have a dog, 41% or 65 participants have a cat, 3% or 5 participants have a bird, 2% or 4 participants have a rabbit, 2% or 3 participants have a fish or other types of animals.

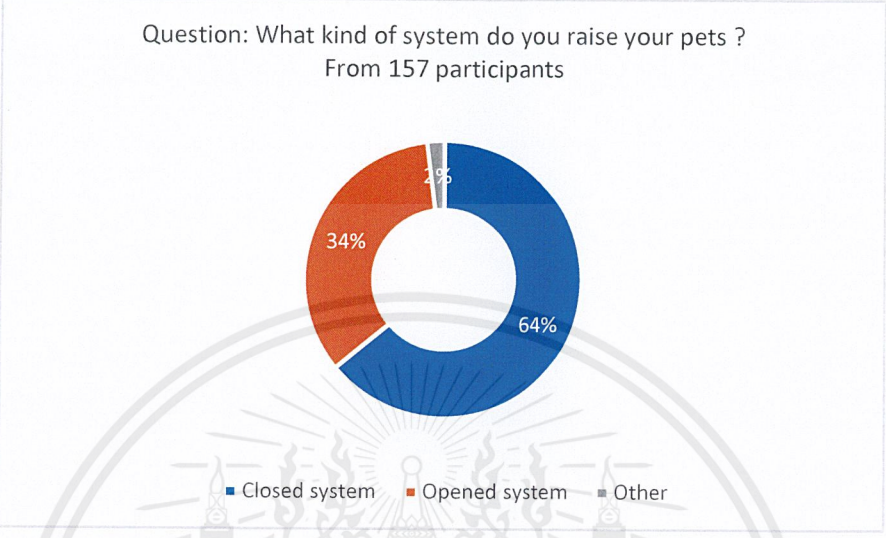

Figure 3.8 Question – What kind of system do you raise your pets in?
From Survey "Pet Owner 's Problem"

The pie chart in Fig. 3.8 shows the kind of system that the 157 participants raise their pets in. It can be concluded that 64% or 101 participants raise their pet in a closed system, 34% or 53 participants raise their pet in an opened system, and 2% or 3 participants raise their pet in a different kind of system.

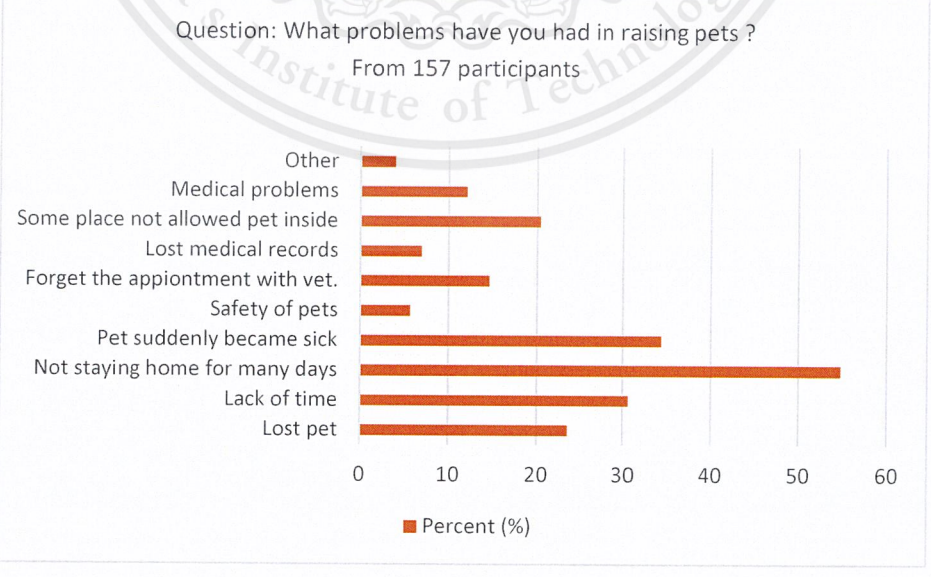

Figure 3.9 Question – What problems have you had in raising pets?
From Survey "Pet Owner 's Problem"

The chart in Fig. 3.9 breaks down the problems in raising pets of the 157 participants. Overall, it is clear that the main problem faced by pet owners is when they need to go somewhere or are unable to stay home for several days. This problem was reported by 55% of the participants who claim that sometimes there is no one who can take care of their pets and so they need to find a pet service while they travel. The second most prevalent problem is when pets suddenly become sick, which accounts for 34%, especially since some pet owners report that they lack time to care for their pets. Perhaps it is because the owners need to go to work or study since most of the participants are students, office workers or have a personal business. Furthermore, there are many other problems that pet owners encounter, such as, lost pets, some public places not allowing pets inside, forgetting an appointment with the veterinarian, losing their pet's medical records, or their pet's safety issues when taking them outside.

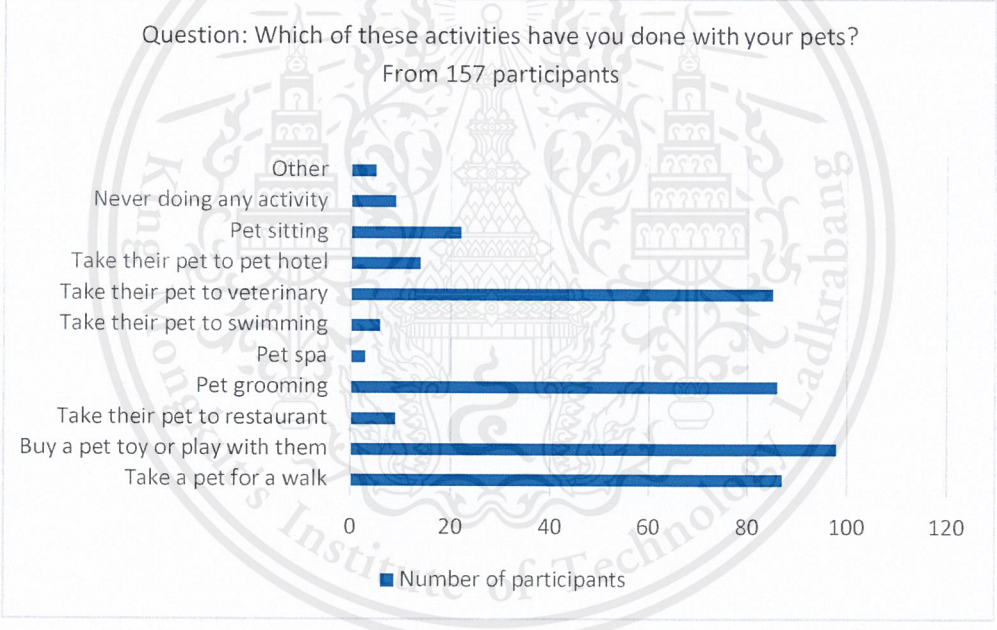

Figure 3.10 Question – Which of these activities have you done with your pets? From Survey "Pet Owner 's Problem"

The chart in Fig. 3.10 shows the activities that the 157 participants do with their pets. It can be summarized that the most frequent activity is the pet owners buying a pet toy or playing with their pet, which accounts for 98 participants. The following three activities have roughly equal proportions, which are, taking their pet to the veterinary, pet grooming and walking their pet. There are numerous other activities that pet owners do

with their pets, such as, taking their pet to a pet sitting service, pet hotel, swimming pool, pet spa or pet restaurant.

After we have summarized the results of each question, the next step is to summarize the value proposition for this service and product. A value proposition is concerned with the needs or problems of customers (or target group), which the business needs to find a connection point for. How a business' product responds involves "products/services" and "consumers", which have two core themes: Gains / Gain Creators and Pains / Pain Relievers. If the product can respond to the need of the consumers then the product or service will be of interest to them

3.2.2 Find the pain relievers and gain creators of customers

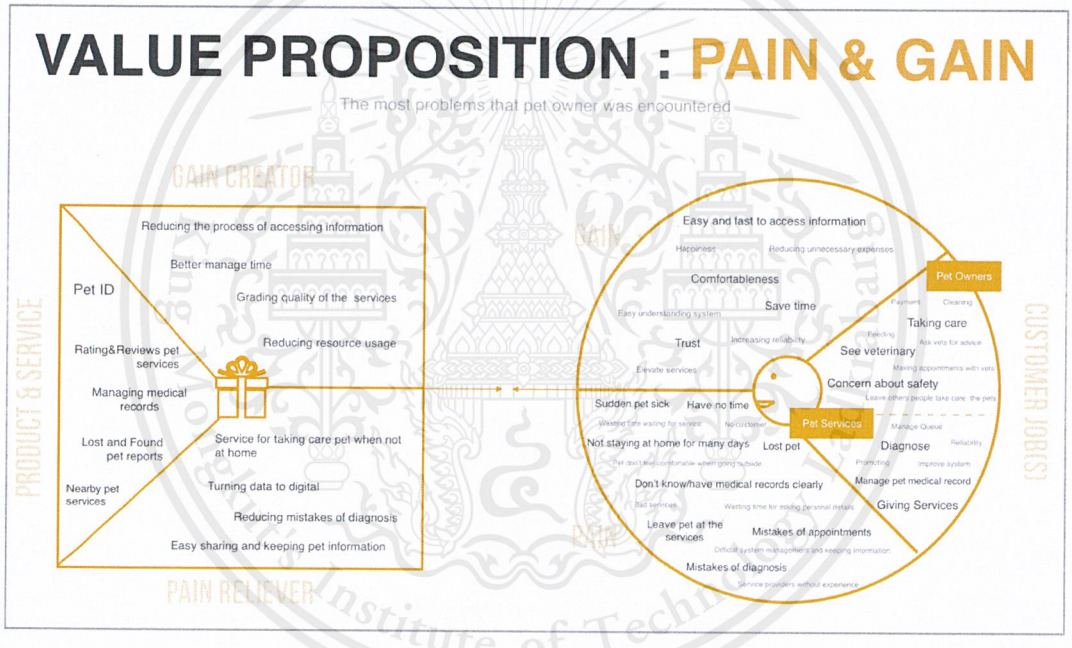

Figure 3.11 The value proposition canvas analyzed from questionnaire results

Figure 3.11 shows the value proposition canvas that was derived using the questionnaire results by dividing the data into two sides: the box on the left consists of the gain creators, pain relievers and products and services that might solve the problems. The right side consists of the pain, gain and customer jobs.

Customer jobs as analyzed from the questionnaire results

The customer job is the end-to-end process that they must do when they need good products or services.

- Pet owners
  - Taking care of their pets
  - Taking their pets to veterinary
  - Concern about safety
  - Expenses
  - Cleaning
  - Feeding
  - Asking for advice
  - Making appointments with veterinary
  - Leave others to care for their pets
- Pet services
  - Diagnosing
  - Managing pet medical records
  - Giving services
  - Managing queue
  - Building reliability
  - Promoting
  - System improvement

Gains

Gains are things that make customers excited to use the product or service. Gains make a customer happy, satisfied, or feel positive about the process

- Pet owners
  - Easy and fast access information
  - Comfortability
  - Saving time
  - Trust
  - Happiness
- Pet services
  - Easy and fast access information
  - Reducing unnecessary expenses
  - Saving time
  - Increasing customer

- Easy-to-understandsystem
- Increasing reliability
- Elevating services

Pains

Pain is everything that the customers hate about the job that needs doing. They make customers groan, such as, thinking about having to travel to get things done.

- Pet owners
  - Pet getting sick
  - Lack of time
  - Not staying at home for many days
  - Losing their pet
  - Do not have medical records
  - Wasting time
  - Pet does not feel comfortable when going outside
  - Appointment mistakes
  - Difficult system management and information keeping
  - Bad services
  - Service providers without experience
- Pet services
  - Mistakes of diagnosis
  - Do not have medical records
  - Difficult system management and information keeping
  - Leaving pet at the services
  - Wasting time asking for personal details
  - No customers
  - Appointment mistakes

Gain creators

Help the customer to satisfy their gain.

- Pet owners
  - Easy to ask for advice
  - Better time management

- Grading quality of the services
- Many channels to using the services
- Appointment and reservations system
- Reducing the process of accessing information

- Pet services
  - Service improvement
  - Popular service
  - Increasing channels to reach customers
  - Reducing the process of accessing information
  - Better time management
  - Feedbacks from customers
  - Reducing resource usage

Pain relievers

Help the customer to relieve their pain.

- Pet owners
  - Service for taking care of pet
  - Verify identity service provider
  - Transforming data to digital
  - Service reviews
  - Easy sharing and keeping pet information
  - Real time consultation
  - Reducing appointments mistakes
- Pet services
  - Know the customer needs
  - Reducing mistakes of diagnosis
  - Easy access to pet information
  - Verify identity pet owner
  - Reducing appointments mistakes
  - Increasing channels to find more customers

Products and services that will result in Gain creators & Pain relievers

- Pet ID
- Managing medical records
- Rating and reviews pet services
- Lost and Found pet reports

We summarized the ranking of the most pains of the **pet owners** in descending order, as follows:

1) Pet suddenly becomes sick
2) Difficult system management and information keeping
3) Lost Pet Problems
4) Leave home for many days
5) Do not have medical records
6) Poor quality services
7) Service providers without experience
8) Pet does not feel comfortable when going outside
9) Appointment mistakes

And the most pains of the **pet services** in descending order is as follows:

1) Mistakes of diagnosis
2) Not enough customers
3) Do not have medical records
4) Abandoned pets at the pet services
5) Difficult system management and information keeping
6) Wasting time asking for personal details
7) Appointment mistakes

The solution for analyzing the pain points of pet owner is the pet lover web application platform named "PAWTY", which is an intermediary between pet owners and pet services. This platform offers "Pet ID and Medical Records Management" to solve the problematic system management and information keeping, including pet owner verification and pet medical records accession. The purpose of "Pet Service Recommendation" is to address the lack of time of pet owners by recommending pet services that can take care

of their pets and also increase channels to reach customer. Finally, "Lost and Found Pet Report" will help pet owners find their lost pet.

This paper is responsible for the " Pet ID and Medical Records Management" which is a storage system for Pet & Owner Information and also Pet's Medical Records. This system will generate a Digital Pet ID Card for each pet, which includes a QR code to allow ease-of-use for pet owners.

3.3 Business Model Canvas Design

After establishing the problem statements and the value proposition, the next step is to design the business model canvas (BMC) in order to plan the business strategies and look at the overall business for expansion and generating revenue in the future. The target customers are pet owners and pet services, who shall be reached using mobile application, social media, web application, events and at pet services and pet-allowed venues. The pet owners can use this platform as freemium, however for pet services, if they want to reach more customers, they can pay for advertisement on this platform.

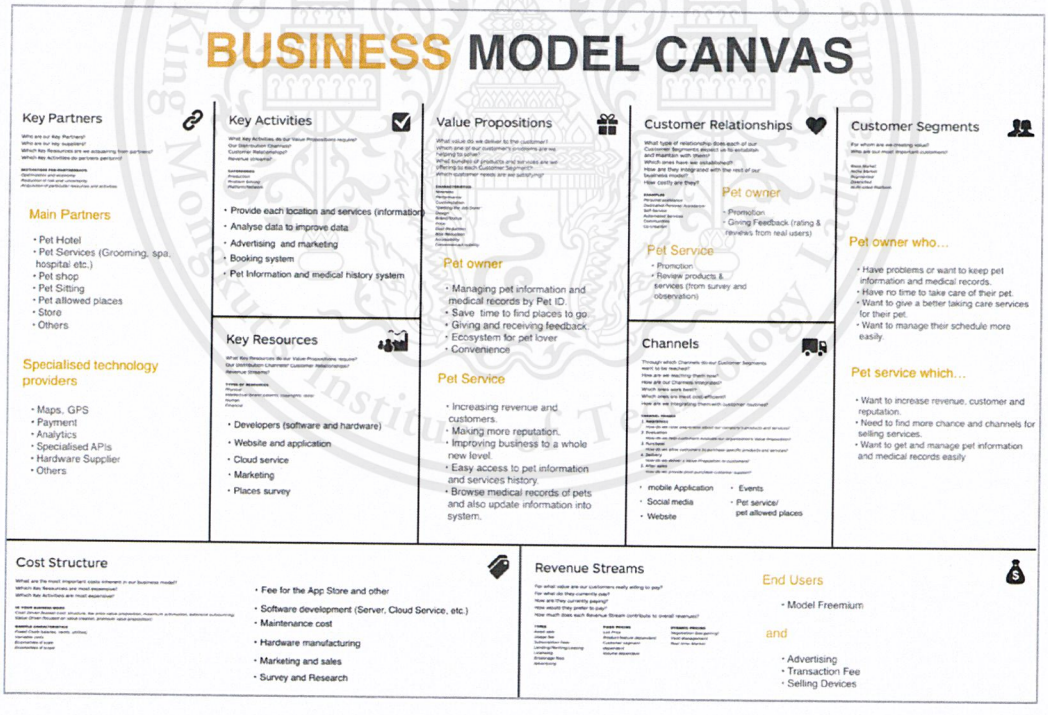

Figure 3.12 Business Model Canvas Design of this product

Figure 3.12 shows the final business model canvas design of this product, whereby, the results are analyzed from the customer pain points and the value proposition.

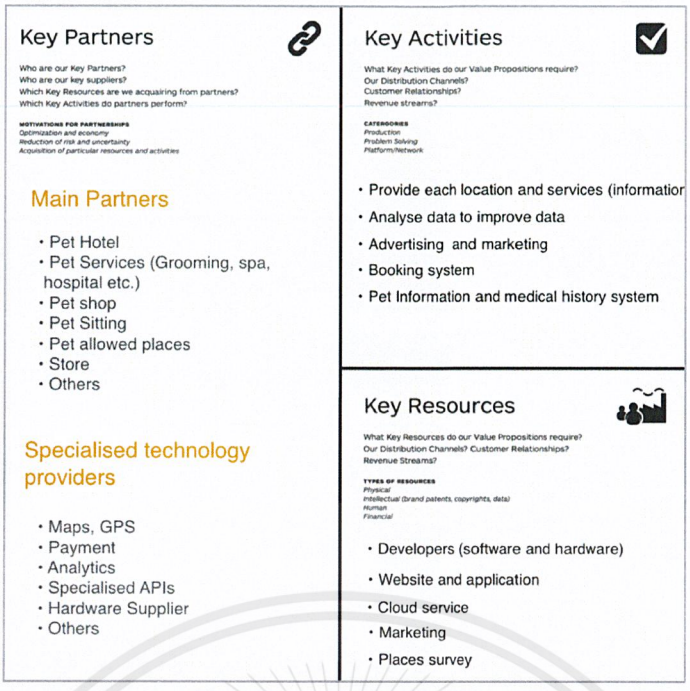

Figure 3.13 Business Model Canvas Design of this product

(Key Partners, Key Activities, Key Resources)

Figure 3.13 outlines the Key Partners, Key Activities and Key Resources of this product, which can be summarized as follows:

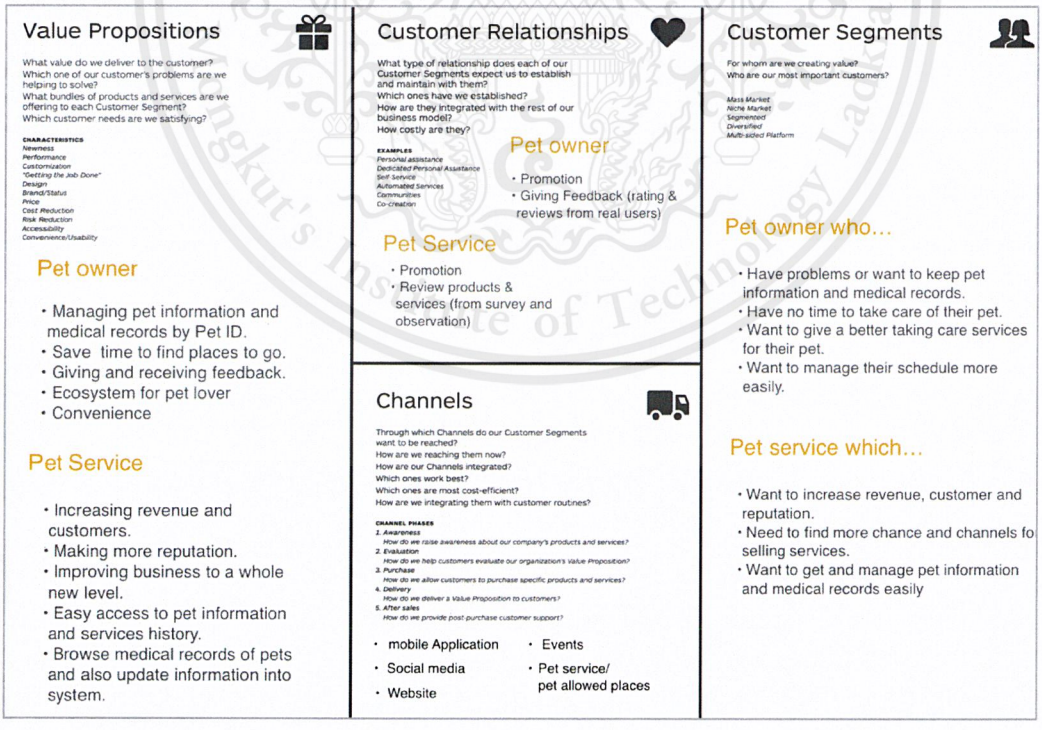

Figure 3.14 Business Model Canvas Design of this product

(Value Propositions, Customer Relationships, Channels, Customer Segments)

Figure 3.14 portrays the Value Propositions, Customer Relationships, Customer Segments and Channels of this product, which can be summarized as follows:

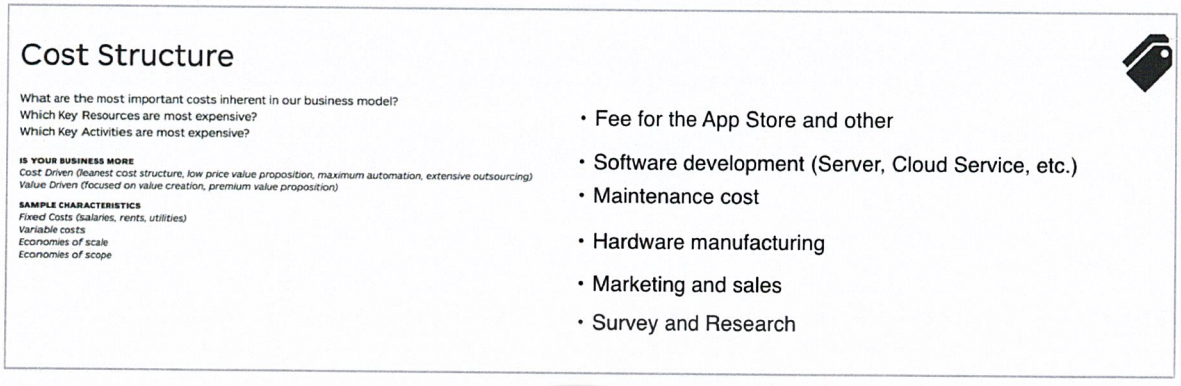

Figure 3.15 Business Model Canvas Design of this product (Cost Structure)

Figure 3.15 shows the Cost Structure of this product, which can be summarized as follows:

- Fee for the App Store and others
- Software development (Server, Cloud service, etc.)
- Maintenance cost
- Marketing and sales
- Survey and Research

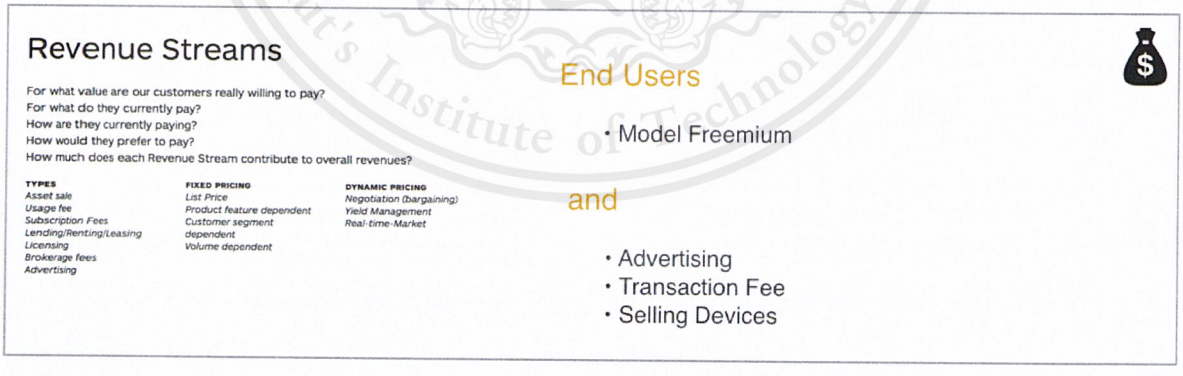

Figure 3.16 Business Model Canvas Design of this product (Revenue Streams)

Figure 3.16 outlines the Revenue Streams of this product, which can be summarized as follows:

- Model Freemium (End users)
- Advertising
- Transaction fee
- Selling devices

3.4 Building Product's Prototype

3.4.1 System Architecture Design

1) Firebase authentication

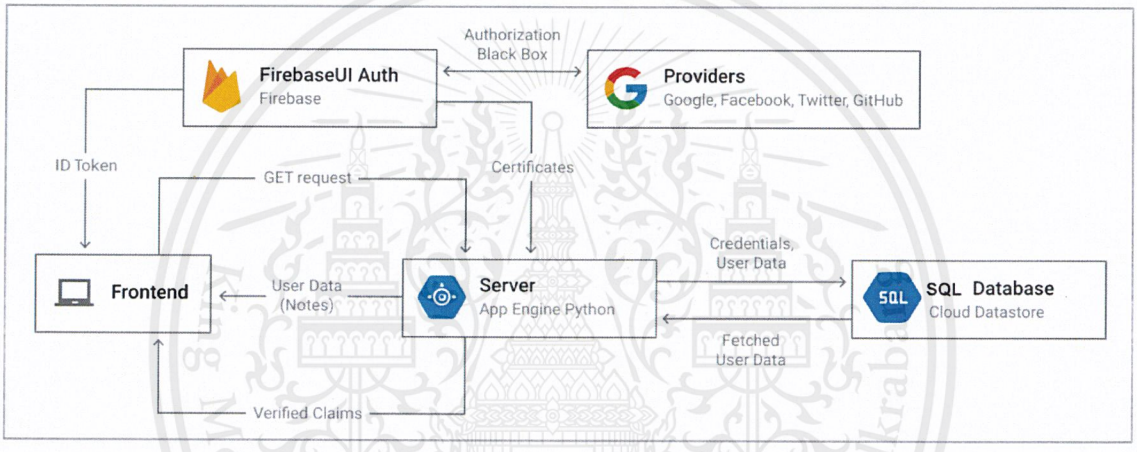

Figure 3.17 Frontend and backend communicate with each other and how user credentials travel from Firebase to the database diagram [20]

The following diagram (Fig. 3.17) shows how the frontend and backend communicate with each other and how user credentials travel from Firebase to the database.

2) RESTful API Web Service

Figure 3.18 shows the PAWTY RESTful Web Service System Architecture Design. This architecture includes a conceptual model that defines the structure, behavior, and more views of a PAWTY RESTful Web Service system. The status of the process is sorted by numbers in a yellow circle. First of all, before users make a GET request to the API Gateway, they are required to request an ID token from the firebase. This token is used to uniquely identify them and to grant them access to several resources. After users receive an ID token

and make a GET request with the ID token, the server will verify the integrity and authenticity of the ID token and retrieve the user ID (UID) from it. If the ID token is validated then the server will query data from the database (SELECT, INSERT, UPDATE) and then display the result. Subsequently, the server will send a response back to the clients in JSON format.

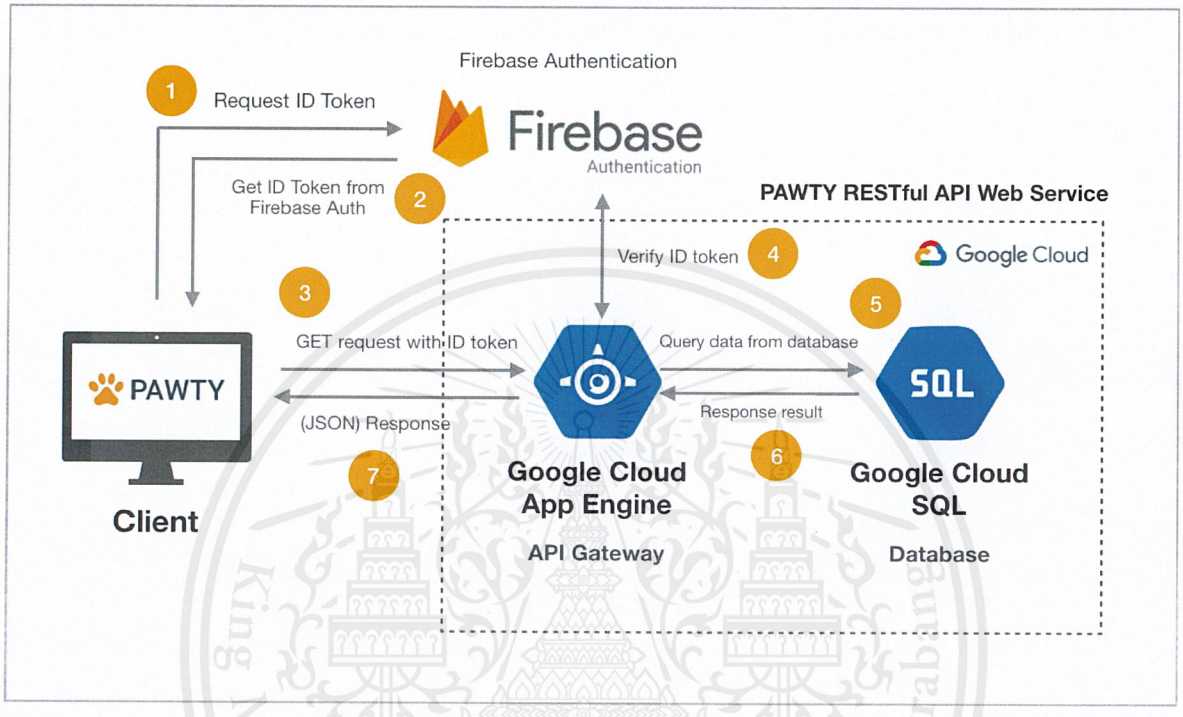

Figure 3.18 PAWTY RESTful Web Service System Architecture Design

This project uses a cloud computing technique, complied web server and RESTful web service to make it scale on-demand to support fluctuating workloads and determine the level of control as Platform as a service (PaaS).

3.4.2.1 Use Case Diagram

As demonstrated in Figure 3.19, before the user (pet owner) can start using the Pet ID and Medical Records System, they are required to get authentication in order to verify User ID (UID). Subsequently, the user will be able to register their new pet information and generate a Digital Pet ID Card with QR code. At the same time, the user can access the

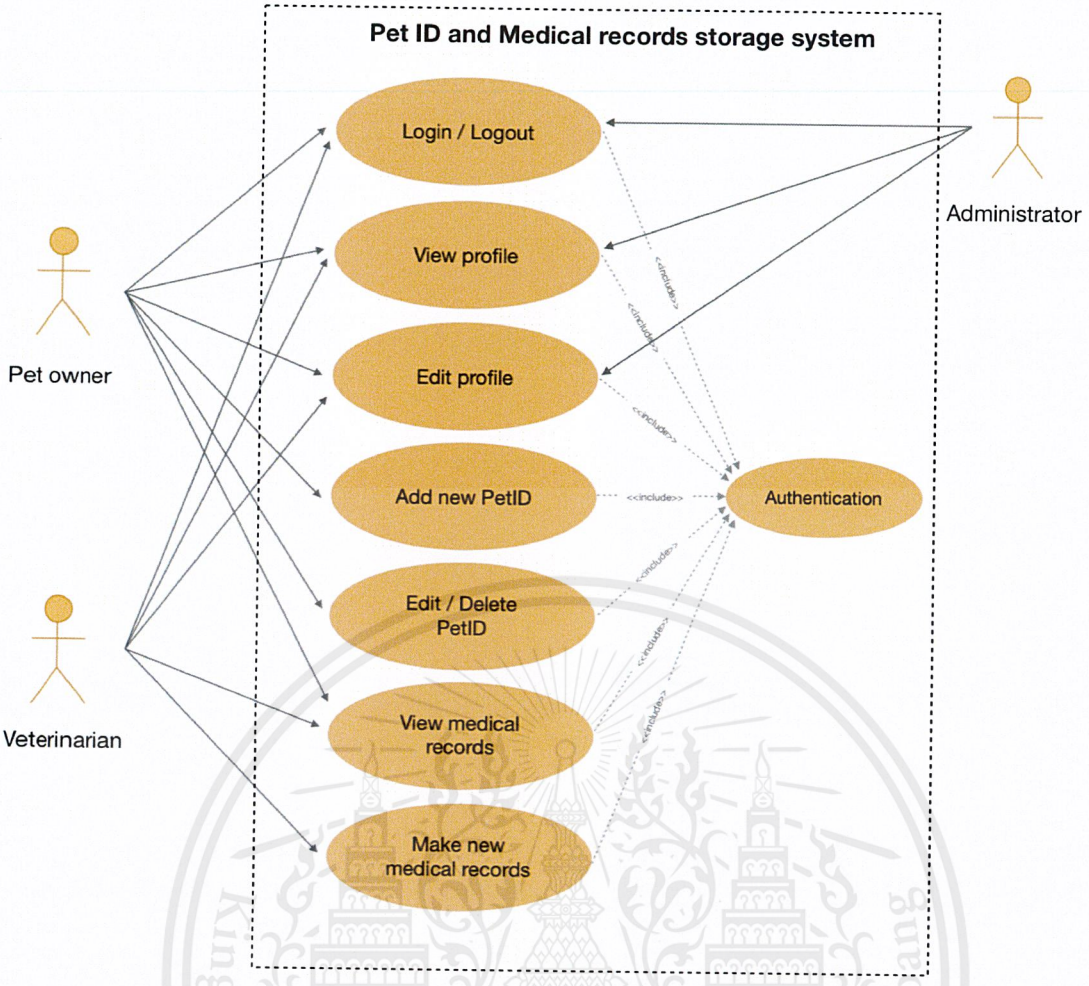

Figure 3.19 Use Case Diagram of the system

medical records of their pet but are not allowed to edit the medical records by themselves. Additionally, they can update or delete their Pet ID at any time. For the user (veterinarian), before start using the Medical Records System, they are required to get authentication in order to verify User ID (UID) and their license number. Subsequently, they will be able to add new medical records for each pet. Moreover, users can update their information such as License number, Contact or Hospital name.

3.4.2.2 Sequence Diagram in case by case

Sequence Diagram is one of the Unified Modeling Language (UML) used for object-oriented modeling in the system architecture design of this project. Unlike other UML layouts, they are sequences of interactions between objects displayed within various systems, such as, viewing profiles for users of both pet owners and veterinarians or editing user personal information. The sequence diagram from the use case for both pet owners and veterinarians consists of:

- Pet owner use case
    - Login / Logout
    - View profile
    - Edit profile
    - Add new Pet ID
    - Edit / delete pet information
    - View pet medical records
- Veterinarian use case
    - Login / Logout
    - View profile
    - Edit profile
    - Make new medical records
- Administrator use case
    - Login / Logout
    - View profile
    - Edit profile
    - View pet medical records

1) Login and logout use case sequence diagram

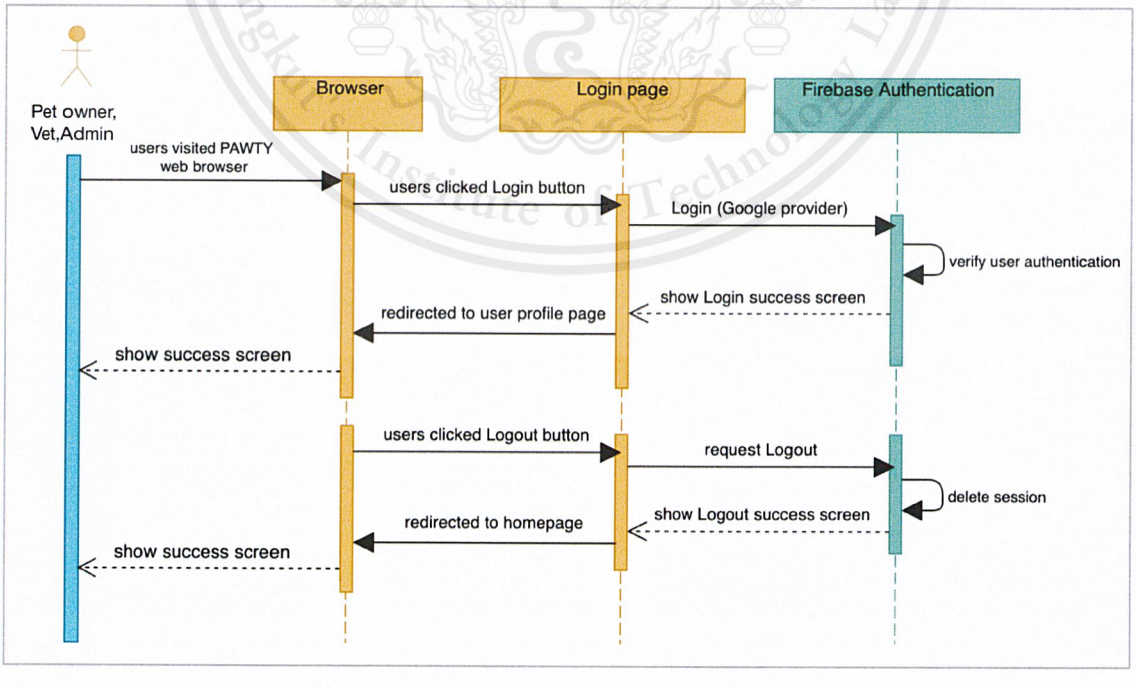

Figure 3.20 Login and logout use case sequence diagram

Figure 3.20 shows login and logout use case sequence diagram by explaining that when users visit the PAWTY web application in the web browser, they are required to first sign in. After they clicked the sign in button they will be brought to the Sign In with Google page, which is the process of the firebase authentication service. Following the successful authorization process, the user will be redirected to the success screen. In addition, if users want to logout from the web application, they are required to click logout button.

2) View profile use case sequence diagram

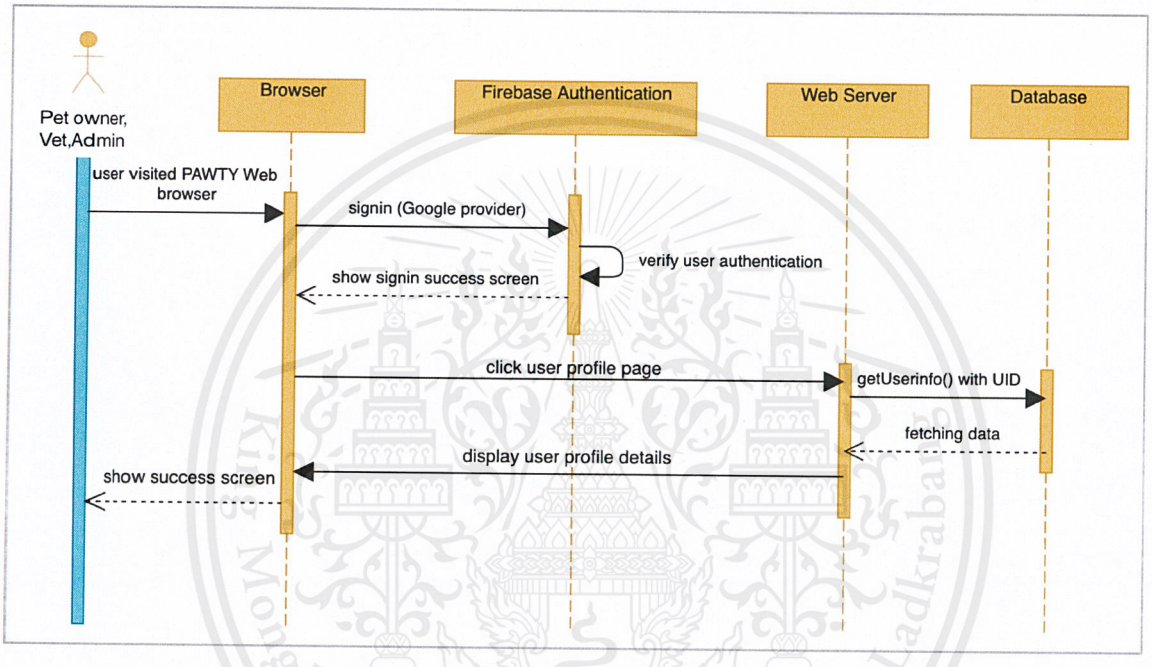

Figure 3.21 View profile use case sequence diagram

Figure 3.20 shows view profile use case sequence diagram by explaining that when users visit the PAWTY web application in the web browser, they are required to first sign in. After they clicked the sign in button they will be brought to the Sign In with Google page, which is the process of the firebase authentication service. Following the successful authorization process, the user will be redirected to the success screen. Once the user has successfully signed in, they will be able to see their profile as usual.

3) Edit profile use case sequence diagram

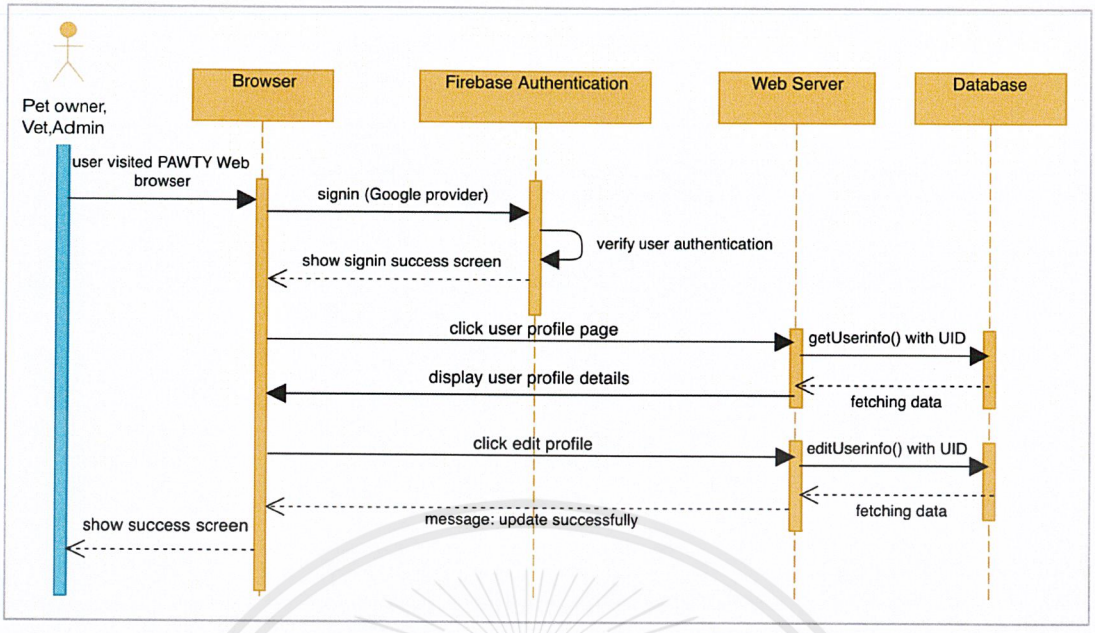

Figure 3.22 Edit profile use case sequence diagram (for pet owner)

Figure 3.21 demonstrates the edit profile use case sequence diagram indicating that when users want to edit their profile, they are required to first sign in. After they have successfully signed in and clicked on the edit profile button, they will be brought to the user information form where they can edit their profile. Following the successful profile editing process, the user will be redirected to the user profile screen.

4) Add new Pet ID use case sequence diagram

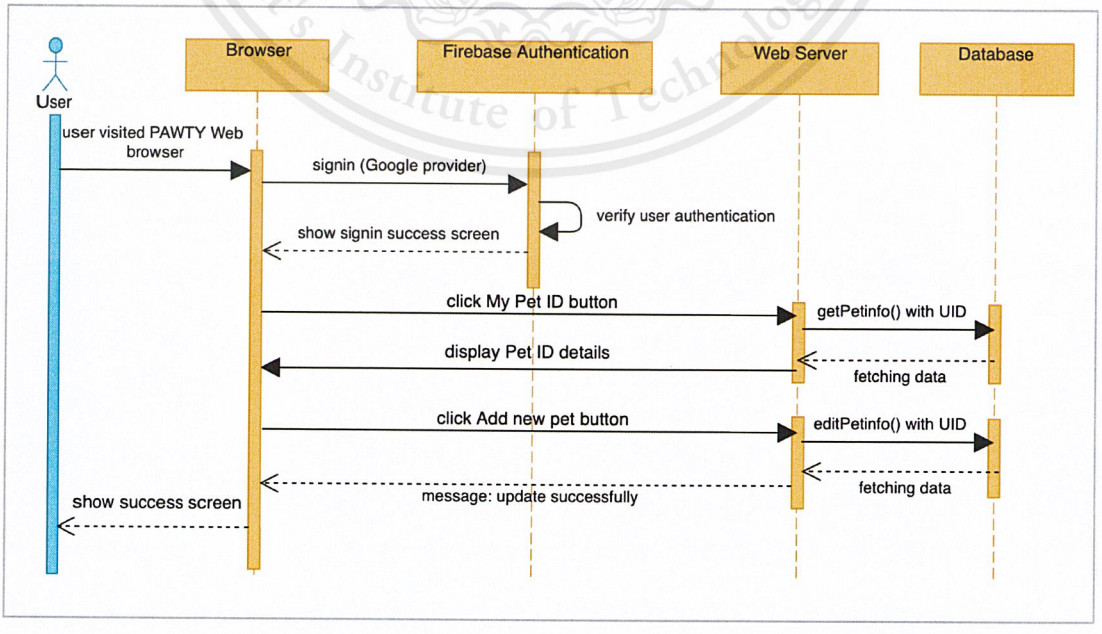

Figure 3.23 Add new Pet ID use case sequence diagram (for pet owner)

Figure 3.22 portrays the Add new Pet ID use case sequence diagram highlighting that when users want to add a new Pet ID, they are required to first sign in. After they have successfully signed in and clicked on the My Pet ID button, they will be brought to the Pet ID details page. Subsequently, when they click add new pet button, they will be brought to the pet information form where they can fill in the pet information and click the submit button. Following the successful add new Pet ID process, the user will be redirected to the My Pet ID page.

5) Edit and delete pet information use case sequence diagram

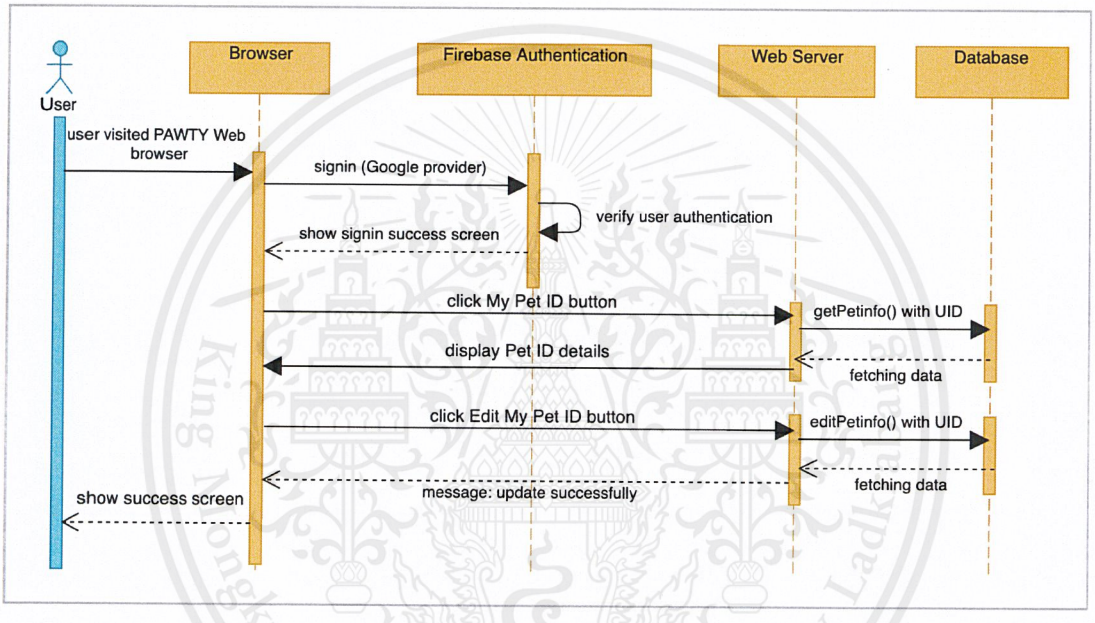

Figure 3.24 Edit and delete pet information use case sequence diagram (for pet owner)

Figure 3.23 shows the Edit and delete pet information use case sequence diagram indicating that when users want to edit or delete pet information, they are required to first sign in. After they have successfully signed in and clicked on My Pet ID button, they will be brought to the Pet ID details page. Following this, when they click on the edit my Pet ID button, they will be brought to the pet information form where they can edit the pet information and then click the submit button. Following the successful edit pet information process, the user will be redirected to the My Pet ID page.

6) View pet medical records use case sequence diagram

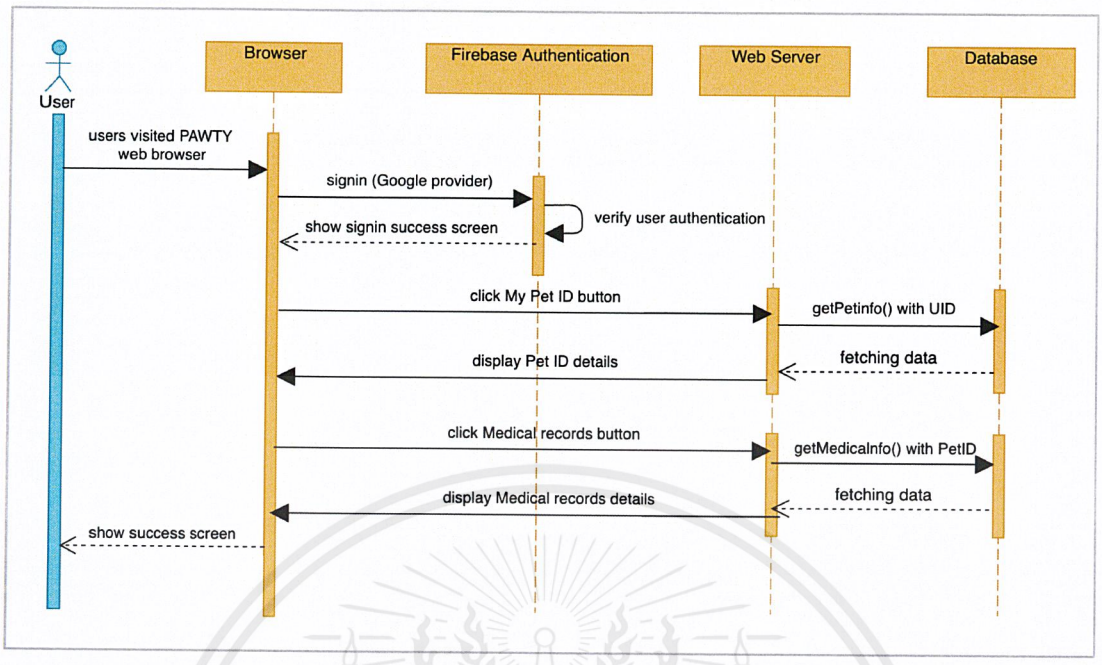

Figure 3.25 View pet medical records use case sequence diagram (for pet owner)

Figure 3.24 demonstrates the View pet medical records use case sequence diagram explaining that when users want to view pet medical records, they are required to first sign in. After they have successfully signed in and clicked on the My Pet ID button, they will be brought to the Pet ID details page. Subsequently, when they click on the Medical records button, they will be brought to the medical records history of their pet with details shown.

7) Make new medical records use case sequence diagram (for veterinarian only)

Figure 3.25 shows the Make new medical records use case sequence diagram indicating that when users (veterinarian) want to make new medical records, they are required to first sign in. After they have successfully signed in and clicked on the New medical records button, they will be brought to the medical records form where they will be required to fill in all the information. After checking the correctness of the information, they must click on the submit button to complete the process.

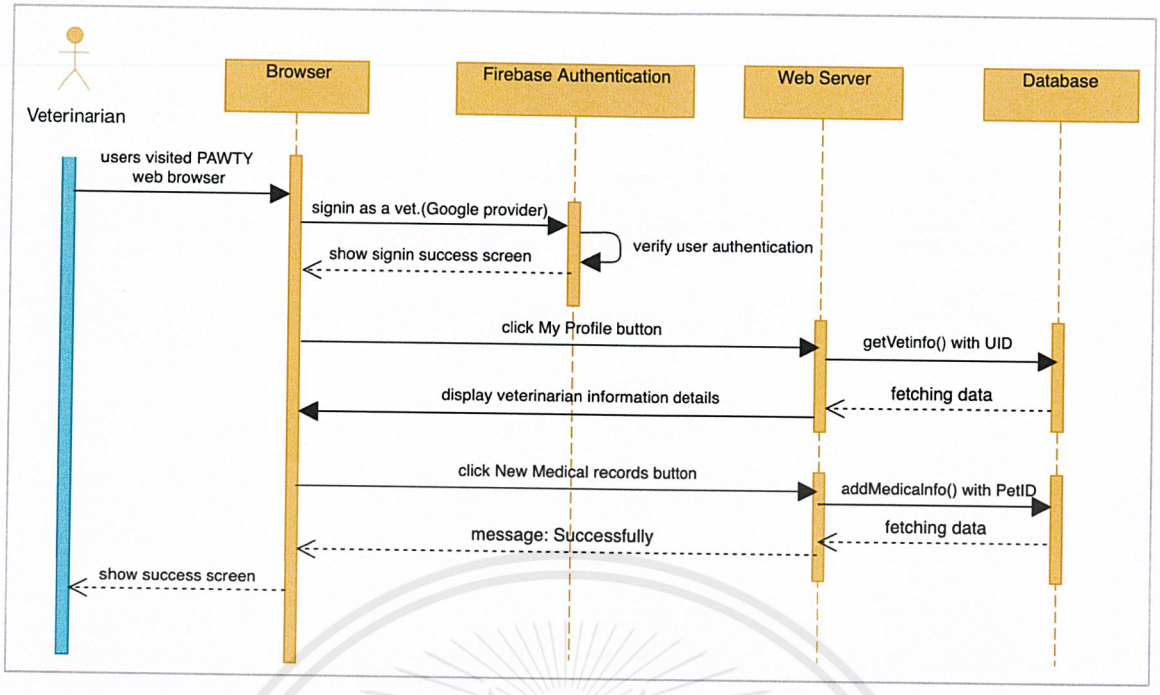

Figure 3.26 Make new medical records use case sequence diagram (for veterinarian)

3.4.3 Storage system

1) Database

The database of this web application is used for collecting various related data and information systematically. There is a clear relationship between multiple data in the database, which consists of several data files that contain data that are consistently relating to each other. This project uses MySQL, which is the relational database that stores the data and consists of four main tables, which are:

- Pet owner information
- Pet information
- Veterinary information
- Medical Records information

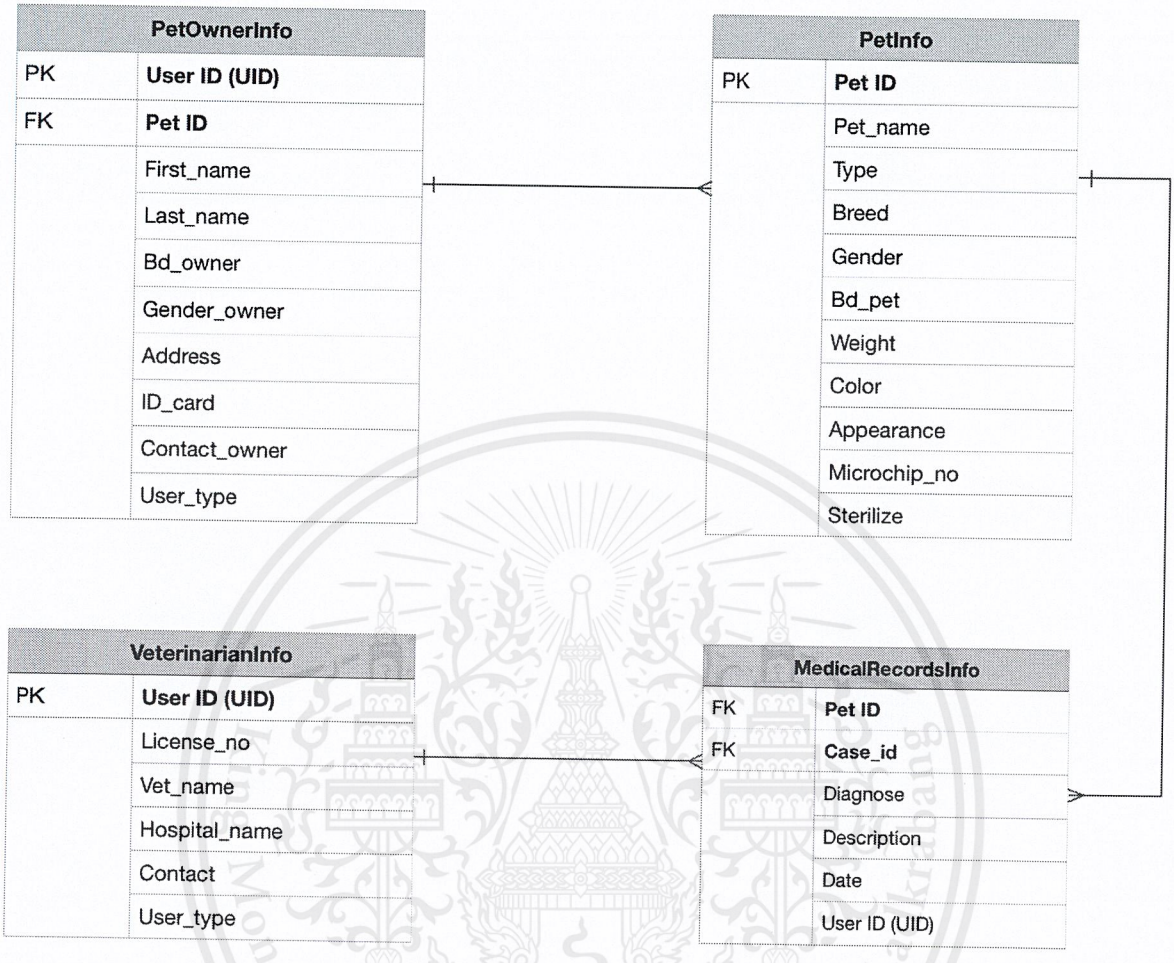

Figure 3.26 Database diagram of Pet ID and Medical records storage system

Figure 3.26 shows the database diagram design of the Pet ID and Medical records storage system in this web application. The following diagram outlines the relationships between all entities, which determines the primary key and foreign key for each table.

Table 3.1 Pet owner information details

Attribute	Data type	Description
UserID	String	User ID from Firebase Auth
First_name	String	User's first name
Last_name	String	User's last name
Gender	String	User's gender
Bd_user	Datetime	User's birthday
Address	String	User's address
ID_card	String	User's ID card number
Contact	String	User's contact

Table 3.2 Pet information details

Attribute	Data type	Description
UserID	String	User ID from Firebase Auth
PetID	String	Pet Id of each pet
Pet_name	String	Pet name
Type	String	Type of pets
Breed	String	Breed of pets
Gender	String	Gender of pets
Bd_pet	Datetime	Pet's birthday
Weight	Float	Weight of pets
Color	String	Pet color
Appearance	String	The appearance of pet such as eyes color, special characteristics

Attribute	Data type	Description
Microchip_no	Integer	Microchip number of pets (optional)
Sterilize	String	Sterilize history of pets

Table 3.3 Veterinary information details

Attribute	Data type	Description
UserID	String	User ID from Firebase Auth
Vet_name	String	Veterinarian's name
License_no	Integer	License number
Hospital_name	String	Hospital name where the veterinarian is working
Contact	String	Veterinarian's contact

Table 3.4 Medical records information details

Attribute	Data type	Description
Date	Datetime	The date that pet was diagnosed (YYYY-MM-DD)
Diagnose	String	Diagnosed description
Description	String	Description for visited
Vet_name	String	Veterinarian's name
License_no	Integer	License number
Hospital_name	String	Hospital name that pet was diagnosed
PetID	String	Pet ID

2) APIs section

API Gateway is essential for communication between clients and services. It is the Single Point of Contact, which will handle various requests in the service and is used to create a single-entry point to expose the endpoint of different APIs by revealing only one parameter and allowing the requests to come into the service pass context path.

Table 3.5 Pet ID and Medical Records APIs

APIs	Description	Input	Output
api/allpets	Used for getting all pet information	-	Listing all pet information
api/allpet/petid/<PetID>	Used for getting pet information in specified Pet ID	Pet ID	Pet information in specified Pet ID
api/allpet/petid/<UserID>	Used for getting pet information in specified UID	User ID (UID)	Pet information in specified UID
api/ownerinfo	Used for getting all pet owner's information	-	Listing all pet owner's information
api/ownerinfo/< UserID >	Used for getting pet owner's information in specified UID	User ID (UID)	User information in specified UID
api/allvets	Used for getting all veterinarian information	-	Listing all veterinarian information
api/allvets/< UserID >	Used for getting veterinarian information in specified License number	User ID (UID)	Veterinarian information in specified UID
api/allvets/<License_no>	Used for getting veterinarian information in specified License number	License number of veterinarians	Veterinarian information in specified License number

APIs	Description	Input	Output
api/register/pet	Used for registering new pet information	Pet information	Status success: “Created”
api/register/owner	Used for registering new pet owner information	Pet owner information	Status success: “Created”
api/register/vet	Used for registering new veterinarian information	Veterinarian information	Status success: “Created”
api/register/medical	Used for adding new medical records	Medical Records Diagnose	Status success: “Created”
api/allmedical	Used for getting all medical records	-	Listing all medical records
api/allmedical/<PetID>	Used for getting medical records in specified Pet ID	Pet ID	Medical Records in specified Pet ID
api/update/owner/<UserID>	Used for update pet or edit owner information	User ID (UID)	Status success: “Updated”
api/update/petid/<PetID>	Used for update or edit pet information	Pet ID	Status success: “Updated”
api/update/vets/<UserID>	Used for update or edit veterinarian information	User ID (UID)	Status success: “Updated”

CHAPTER 4

RESULT

The final product of this project is a web application platform for pet lovers, with a logo design as shown in Figure 4.1, and named "PAWTY", which was developed by using the Vue.js framework. The PAWTY web application is an intermediary between pet owners, pet services and veterinarians. This product was created by analytical thinking and using the principles of the lean startup method in order to truly know what the customers or users want.

Figure 4.1: PAWTY Logo

4.1 Test Results of RESTful API web service using Postman

API testing involves testing the collection of APIs provided by the RESTful web service and checking if they meet expectations regarding functionality, reliability, performance, and security and returns the correct response. Moreover, it is used to determine whether or not the output is well-structured and useful to the web application, check the response on the basis of input (request) parameter, and check how much time the API is taking to retrieve and authorize the data.

Figure 4.2 shows the testing result of POST request to the RESTful web service using Postman by sending the POST request to the API "/register/medical" (used for making a new medical record). After sending the POST request, if successful, it will return a "status: Created" response. If not, it will return a "Bad Request" response.

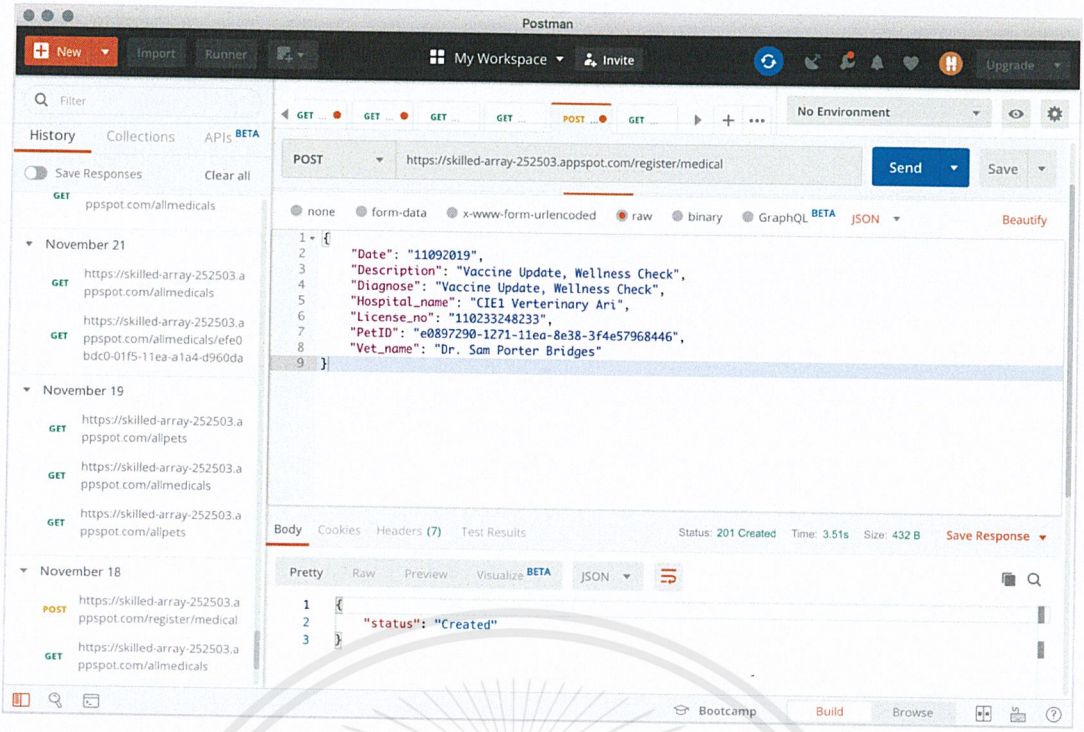

Figure 4.2 Testing POST request to the RESTful API web service using Postman

Figure 4.3 portrays the testing result of the GET request to the RESTful web service using Postman by sending the GET request to the API "/allmedicals" (used for showing all medical records). After sending the GET request, if successful, it will return a response that includes all the medical records details. If not, it will return a "Bad Request" response.

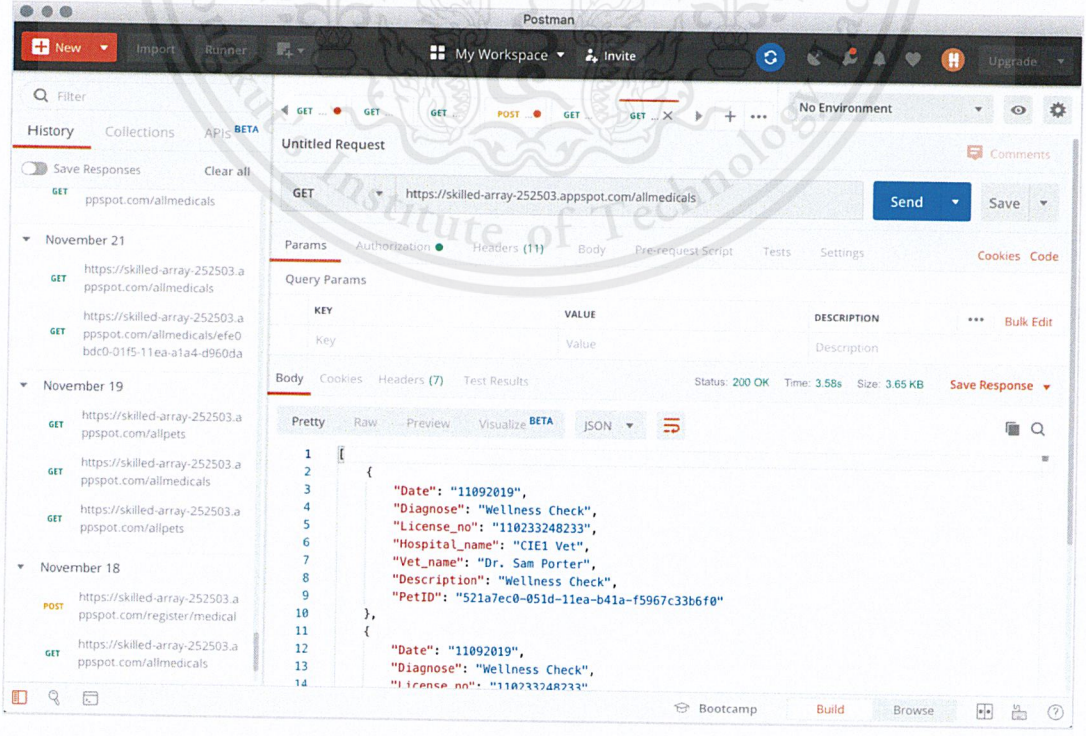

Figure 4.3 Testing GET request to the RESTful API web service using Postman

4.2 User Interface in Web application

The PAWTY web application is designed to be a responsive web by used Vue.js framework, which means that this web application will support various types of devices, such as, computer, mobile phones, smart phones, and tablets.

4.2.1) Pet Owner's User Interface

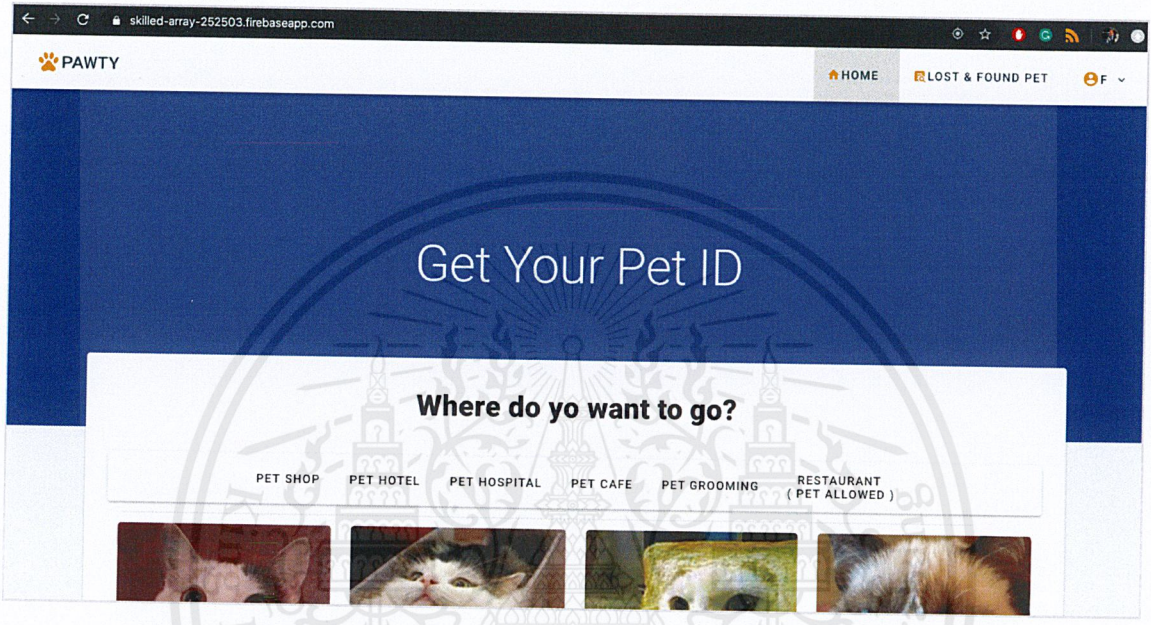

Figure 4.4 Home page of PAWTY web application

When users enter the homepage, as shown in Fig. 4.4, they will see the pet service or place recommendation page, which is one of the services of this web application.

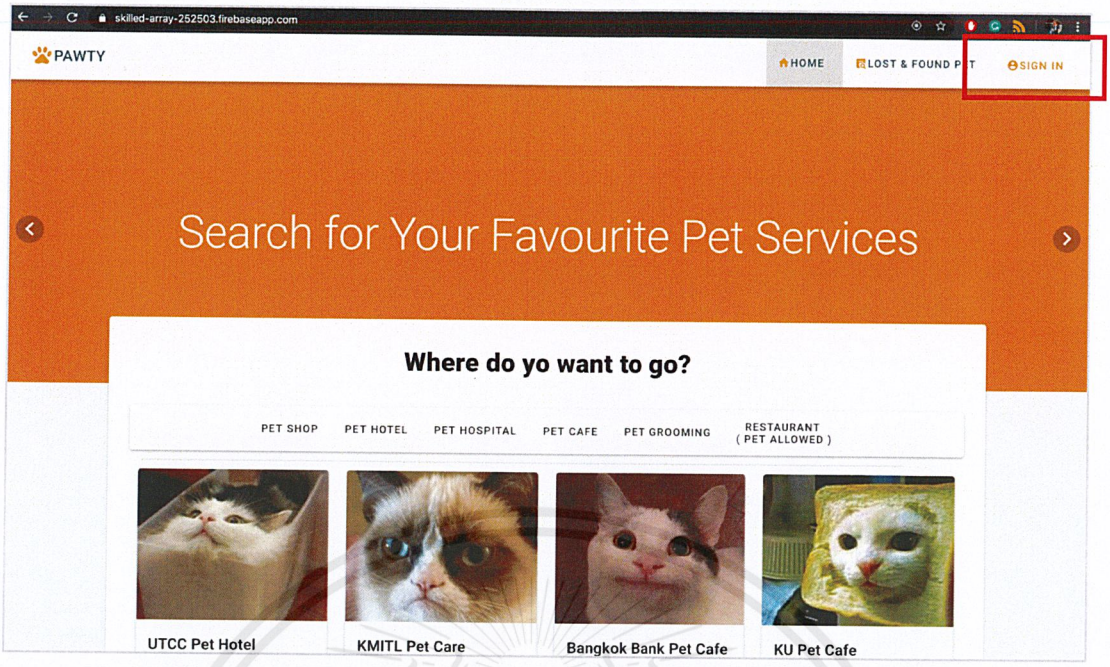

Figure 4.5 Sign In button in home page of PAWTY web application

Before users can access their profile details, they are required to sign in. The first step is to click the Sign in button, as shown in Fig. 4.5. Then, the users will be taken to the sign in method page.

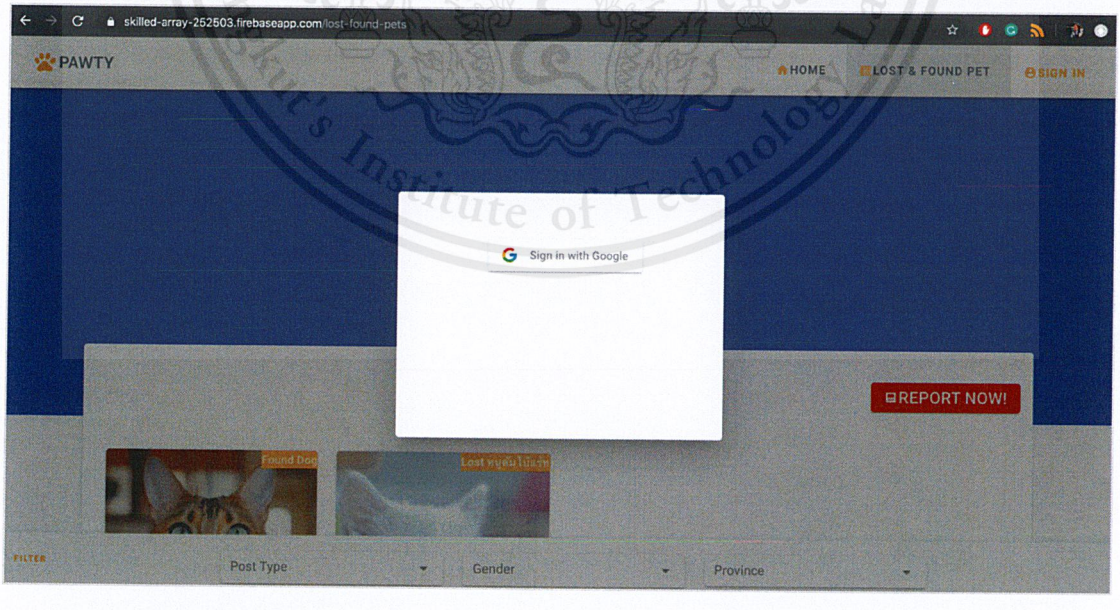

Figure 4.6 Sign In method page of PAWTY web application

Figure 4.6 shows the sign in method page, which is provided by Firebase Auth. After the user clicks the Sign in with Google button, they will be redirected to the Google authentication page where they can sign in using their Google account.

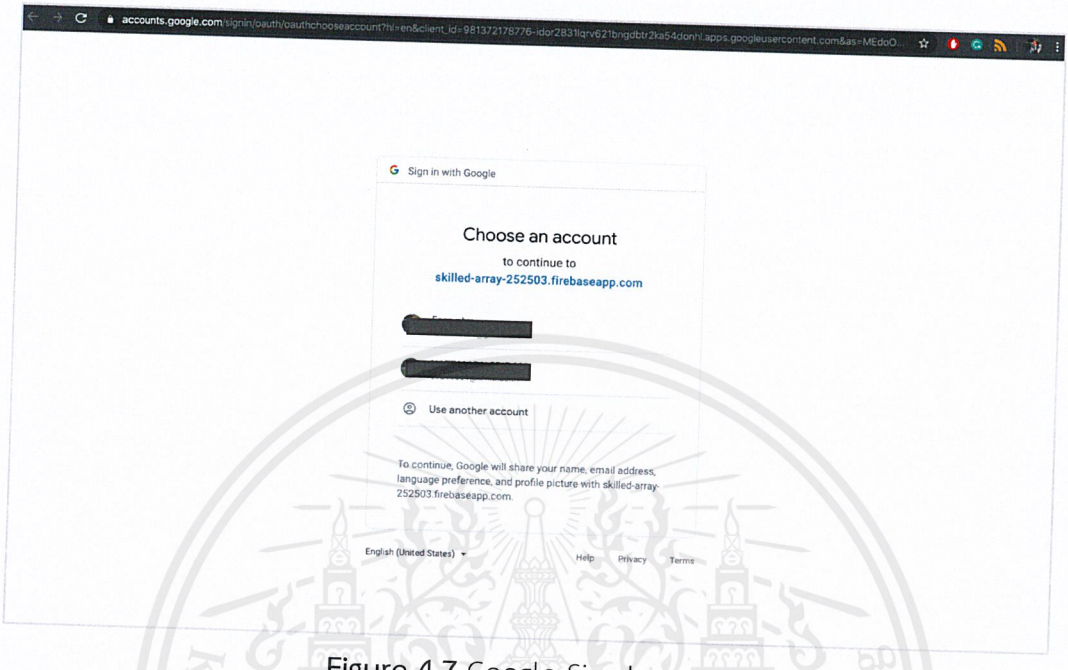

Figure 4.7 Google Sign In page

Figure 4.7 outlines the Google authentication page where users can sign in using their Google account. After successfully signing in, the user will be redirected to the homepage and will be able to see their profile as usual.

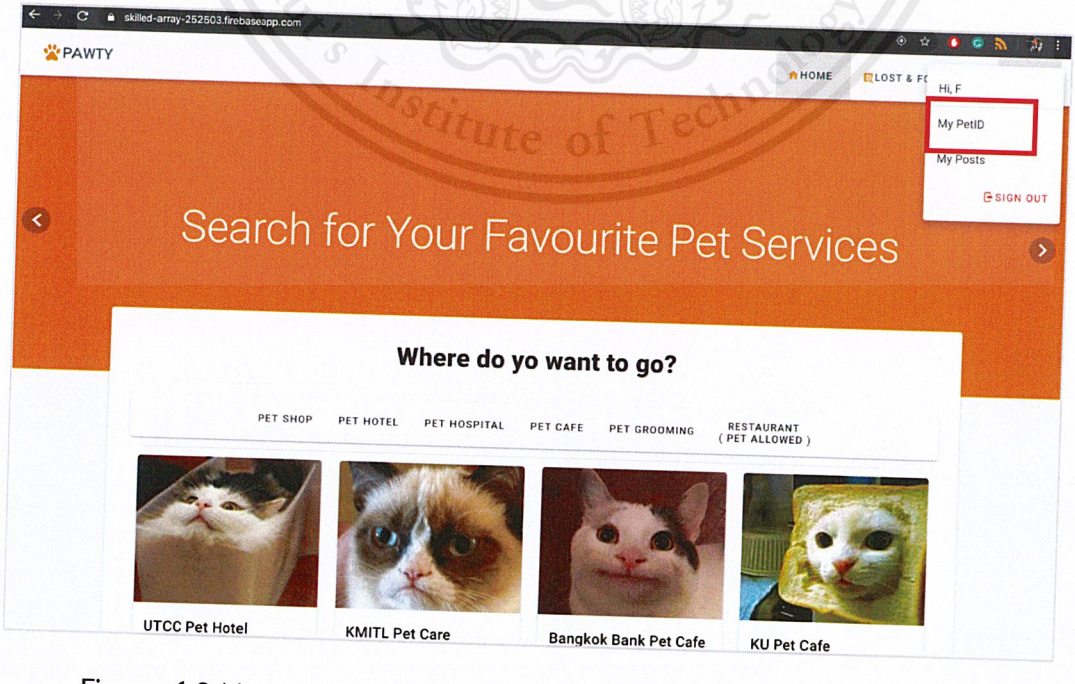

Figure 4.8 My PetID button in home page of PAWTY web application

After users have successfully signed in, they will be redirected to the home page once again where they will now be able to see and edit their profile by clicking on the My PetID button, as shown in Fig. 4.8.

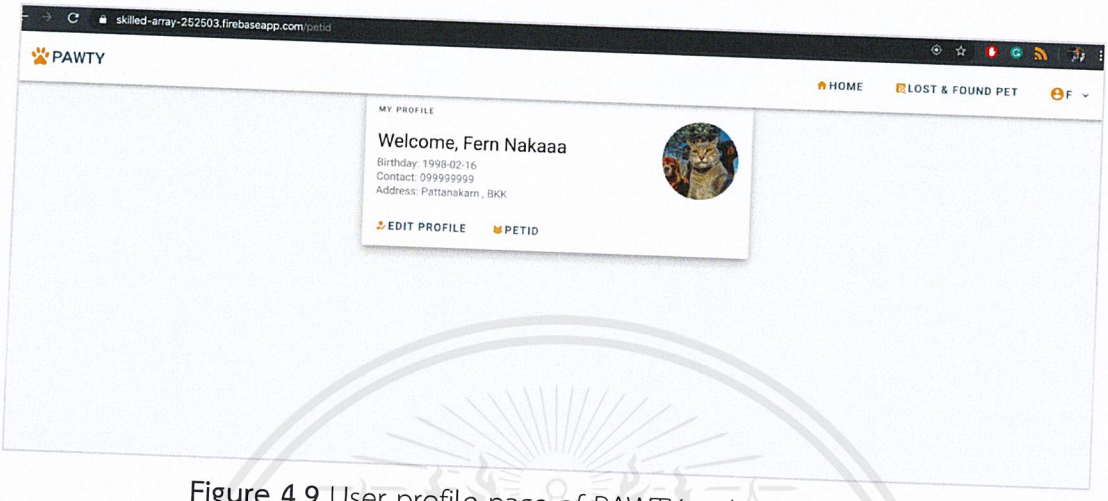

Figure 4.9 User profile page of PAWTY web application

After users click on the My PetID button, the website will bring them to the user profile card page, as shown in Fig. 4.9. This page will display user information, which includes Username, Birthday, Contact and Address. Moreover, at the bottom of the card two buttons are included, which are, Edit profile and PetID.

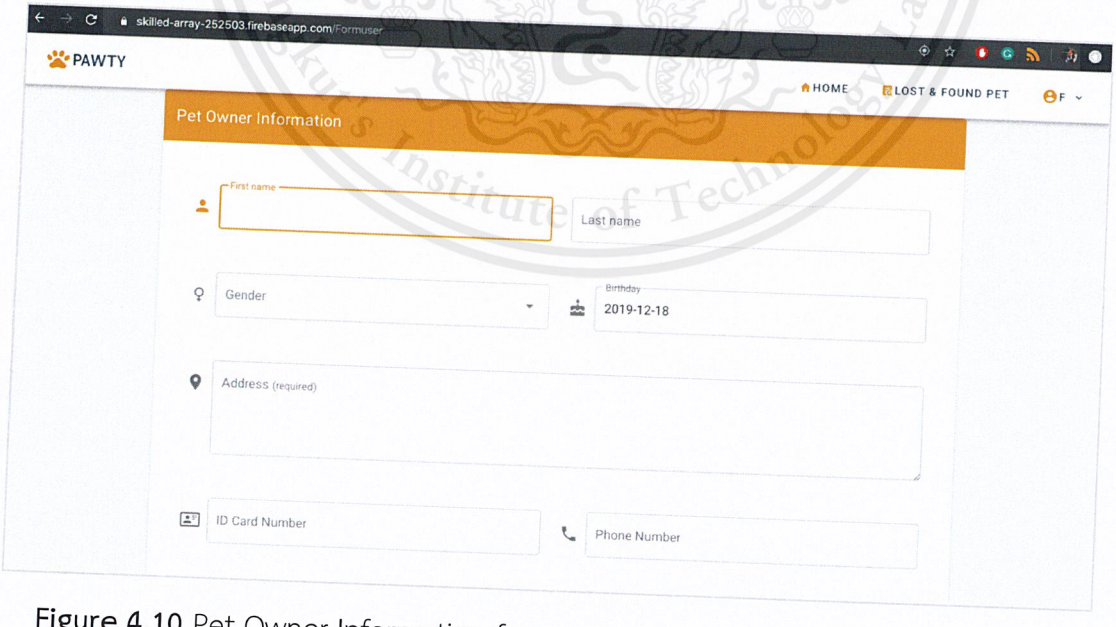

Figure 4.10 Pet Owner Information form page when clicked edit profile button

Figure 4.10 demonstrates the Pet Owner Information form page, which allows users to edit, update and delete their information. The pet owner information form consists of user's First name, Last name, Gender, Date of birth, Address, ID card and Contact.

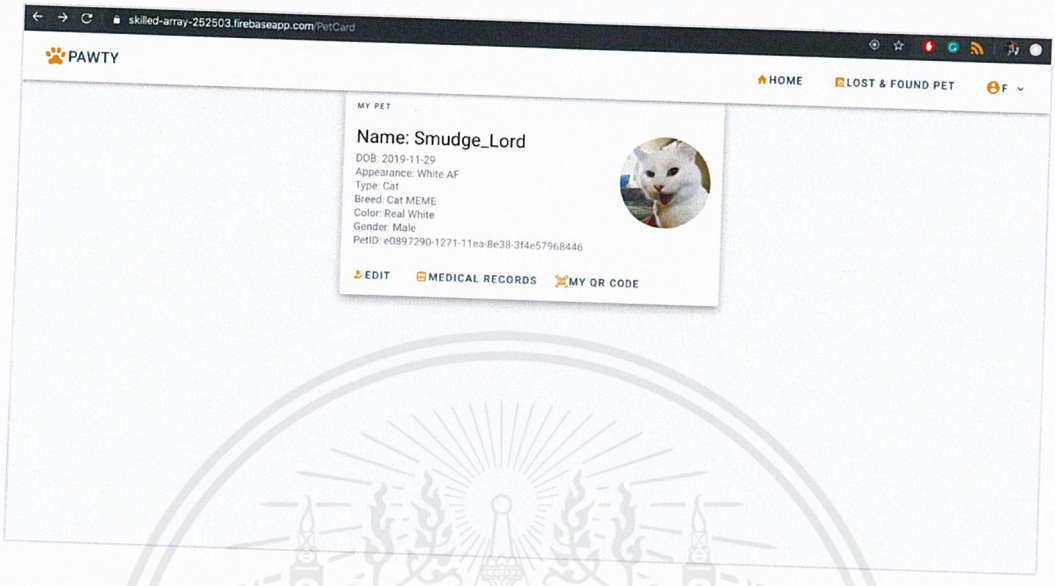

Figure 4.11 Pet Information page when clicked PetID button

After users click on the PETID button, the website will bring them to the pet card page, as shown in Fig. 4.9. This page will display pet information, which includes Pet name, Birthday, Appearance, Type, Breed, Color, Gender and Weight. Moreover, at the bottom of the card three buttons are included, which are, Edit, Medical Records and My QR code.

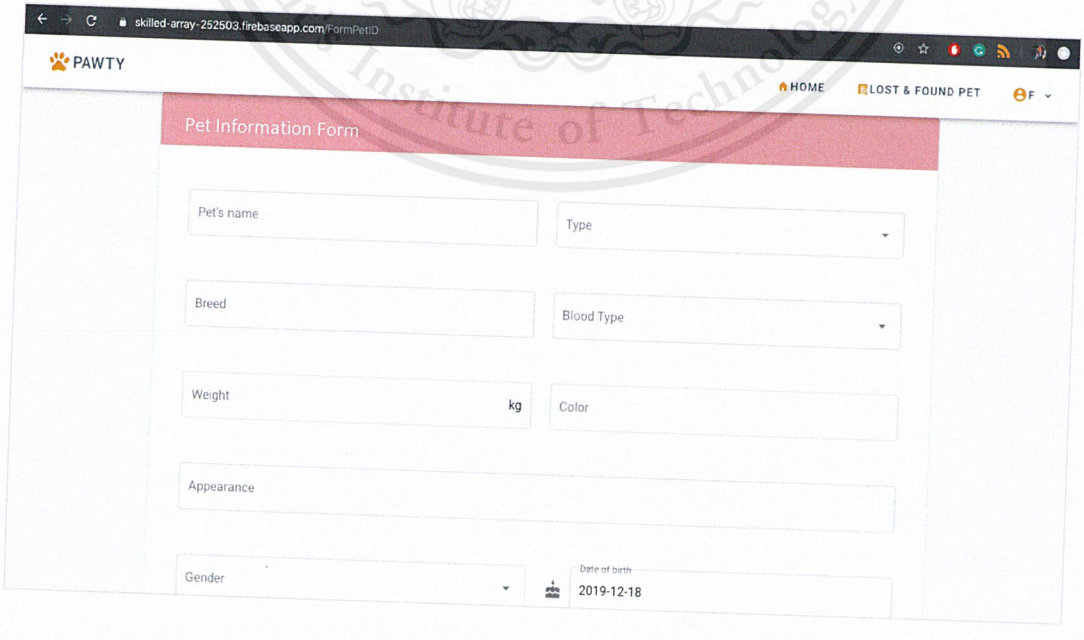

Figure 4.12 Pet Information form page when clicked edit button

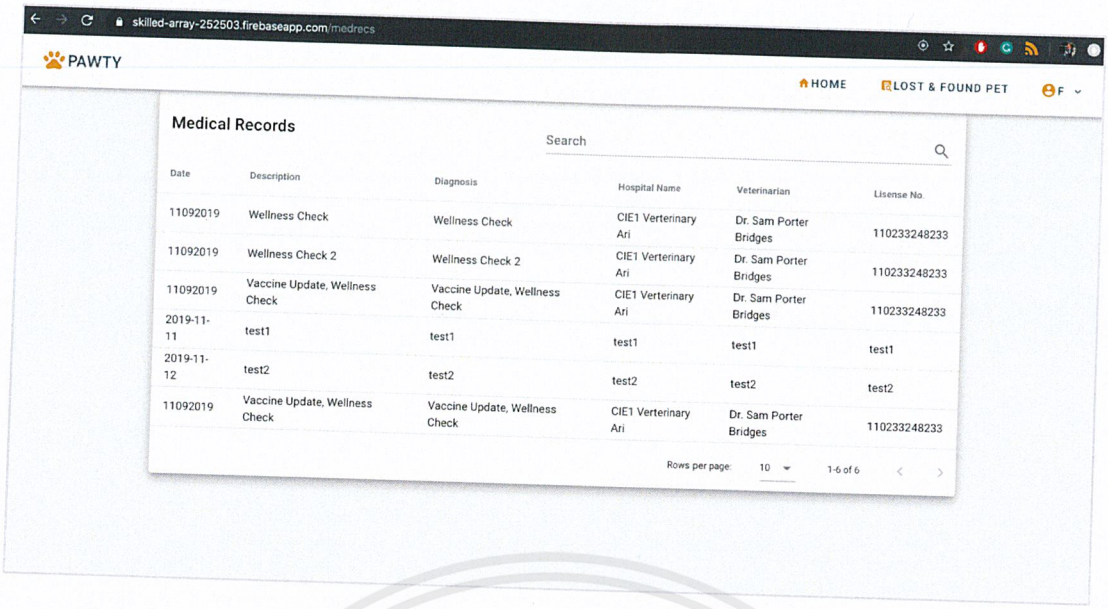

Figure 4.13 Medical Records page when clicked Medical Records button

After users click on the Medical Records button in the Pet Information page shown in Fig. 4.11, the Medical Records page will be displayed, as shown in Fig. 4.13, with thorough details of each pet.

Figure 4.14 Show the QR code popup when clicked My QR code button

After users click on the My QR code button in the Pet Information page shown in Fig. 4.11, the QR code of each pet will be shown, which includes PetID information, as shown in Fig. 4.14. The pet owner can show this QR code to the pet services or veterinarian

in order to share the PetID information. This will benefit the pet owners because they will receive convenient, quick and accurate information.

4.2.2) Veterinarian's User Interface

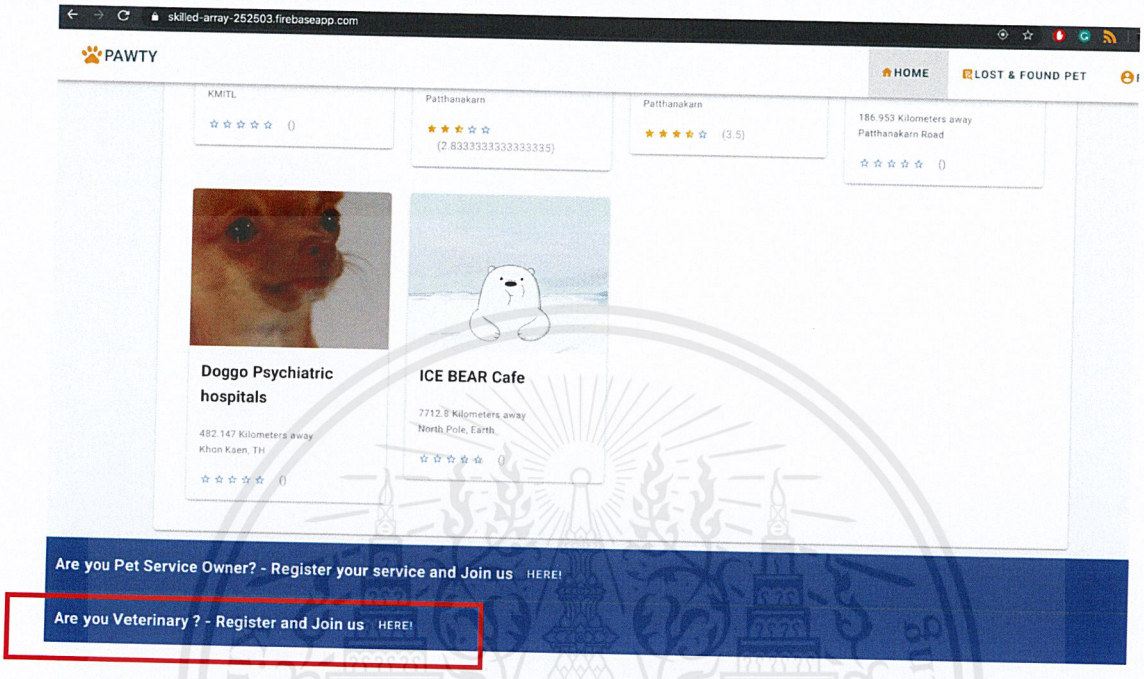

Figure 4.15 Show the button for Veterinary section

If the users are a veterinarian, they need to click the button at the bottom of the home page, as shown in Fig. 4.15. This will bring them to the veterinarian profile card page.

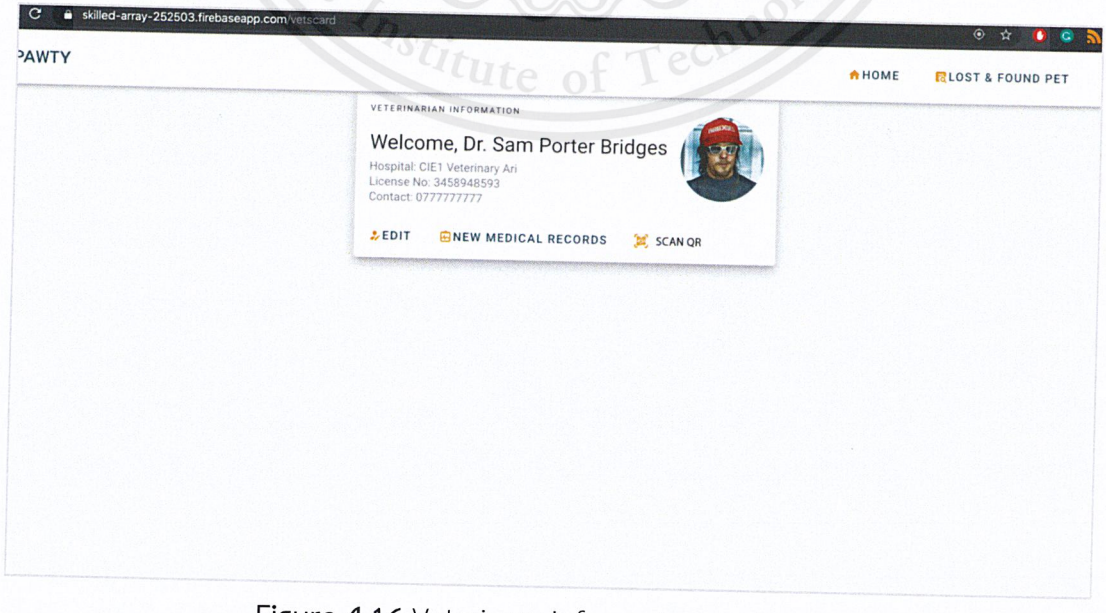

Figure 4.16 Veterinary Information card page

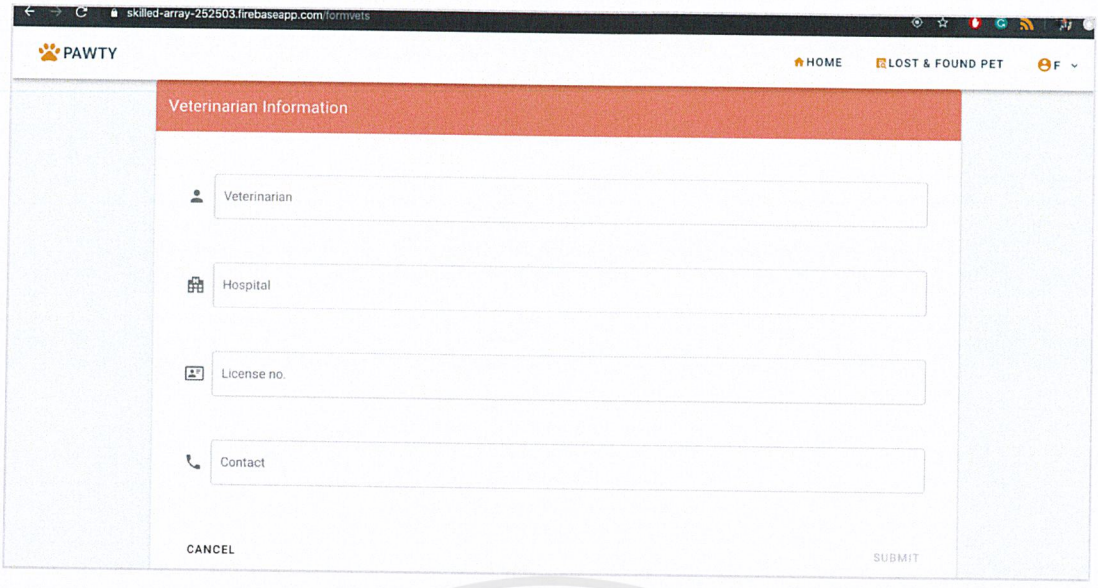

Figure 4.17 Veterinarian Information form page when clicked edit button

After the users click on the button in Fig. 4.15, the website will bring them to the veterinary card page shown in Fig. 4.16. This page will display veterinarian information, which includes veterinarian's Name, Hospital, License number and Contact. Moreover, at the bottom of the card three buttons are included, which are, Edit profile, New Medical Records and Scan QR code.

Figure 4.17 shows the Veterinarian Information form page, which allows users to edit, update and delete their information. The veterinarian information form consists of veterinarian's Name, Hospital, License number and Contact.

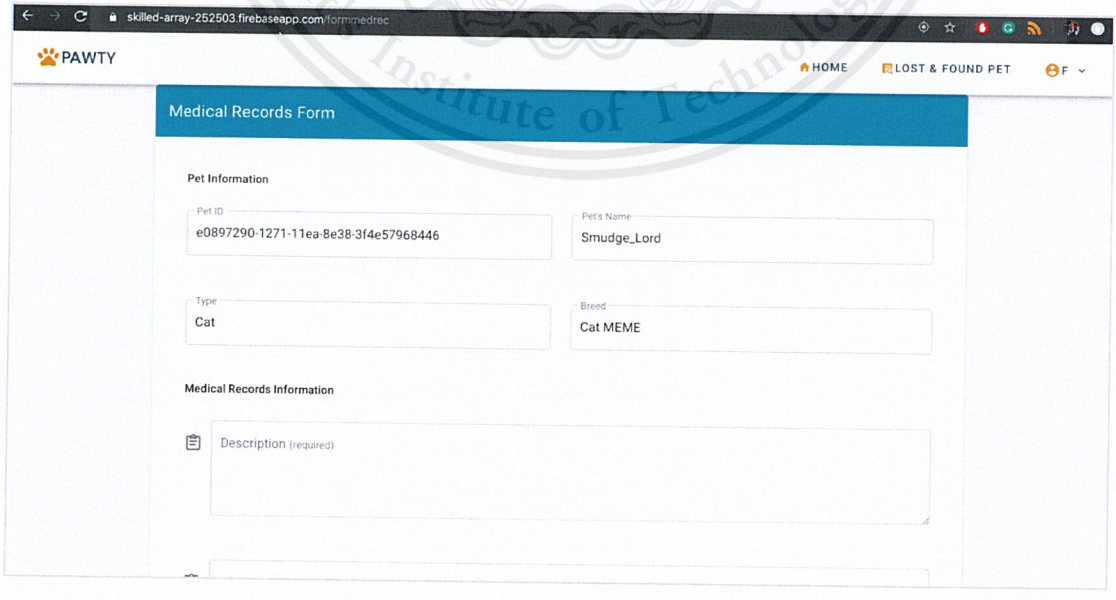

Figure 4.18 Medical Record form to add new medical records (1)

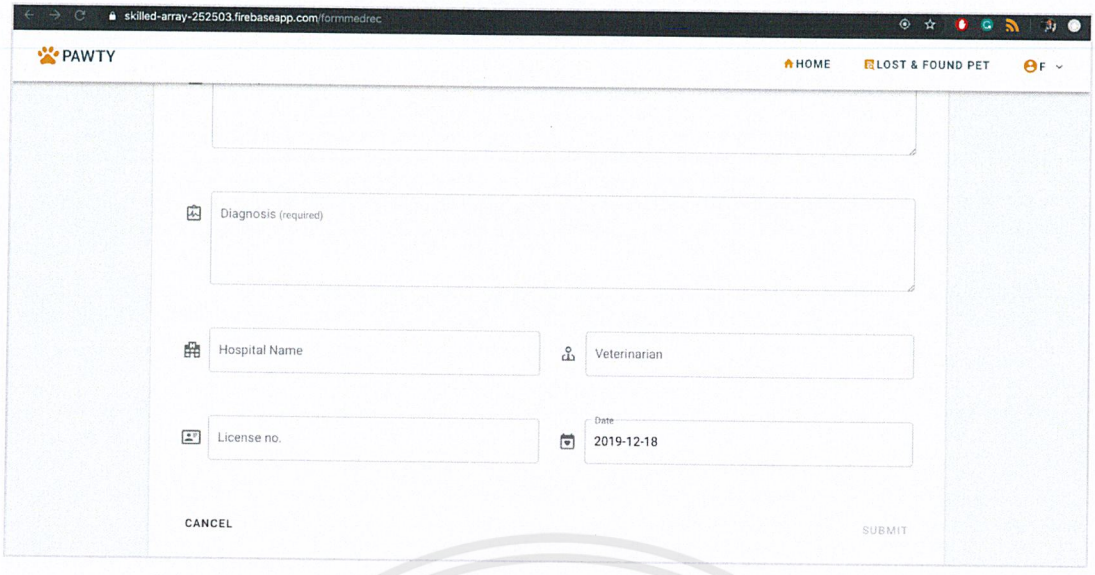

Figure 4.19 Medical Record form to add new medical records (2)

After the users click on the New Medical Record button from the Veterinary Information card page shown in Fig. 4.16, they will be redirected to the Medical Record form page, shown in Fig. 4.18 and 4.19. Only veterinarians have permission to access and edit this page.

CHAPTER 5

SUMMARY

The purpose of this project is to study and explore the problems of pet owners, such as, pet identification, raising, caring, giving time to care for their pet or even the cost associated with raising pets. The information collected was then used to determine pain points and customer insights in order to solve problems and develop applications that meet the needs of pet owners or even pet services, such as, pet grooming, pet sitting, or veterinary. Moreover, this project considers the issues of storing pet's medicals records. Presently, most veterinarians record the pet's medical records on their pet medical records organizer book, which means that pet owners need to bring the pet medical records organizer book every time they have an appointment with the veterinarian.

"PAWTY" is an intermediary between pet owners and pet services. This platform offers pet ID and medical records management in order to solve the problematic system management and to information keeping, including, pet owner verification and pet medical records accession.

Finally, the Digital Pet ID and Medical Records storage systems makes pet identification more efficient and convenient. Pet owners no longer need to bring a pet identification card or medical record book for their pets every time they visit the veterinary. Moreover, Pet ID will be generated with a QR code which can easily display pet information to pet services and veterinarians.

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BIOGRAPHY

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