DOGODO: IOT BASED ENHANCED MOBILE APPLICATION TO PROVIDE ESSENTIAL HEALTH SERVICES TO DOGS - BREED YOUR PET

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Dissertation submitted in partial fulfillment of the requirements for the Bachelor of Science in Information Technology Specializing in Information Technology

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October 2021

DECLARATION

We declare that this is our work, and this proposal does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any other university or institute of higher learning, and to the best of our knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgment is made in the text.

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The supervisor/s should certify the proposal report with the following declaration.

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor: Date

ABSTRACT

Nowadays most people like to spend some time with their pets. In the world of pets, the dog has a very interesting place. But some problems come about dogs their owners do not have much experience in those situations. We suggest this device with a mobile app like a smart assistant. From this app pets, owners can understand the situation and get an idea about the next step. The mobile app has four main components. Smart Health Analyzer, Smart translator, breed your pet, and Pet skincare are the main four components.

As my part, I will be doing the Breed your pet which is a component that will help the owner to Identify partners for their pets, analyze and provide a reliable statement about the breed, Analyze and provide the necessary treatments, medical routines, and food routines for newborn pets. Biological data from selected dogs will be used to predict new results of different breed crosses using this component. Using a modern machine-learning algorithm predicts crossing outcomes of different breeding in an innovative way. In addition, this app will give you the ability to find your dog matching partner.

Keywords: Machine learning, treatments, medical routines, food routines, newborn pets

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1. KASL - Kennel Association of Sri Lanka
2. IoT – Internet of Things
3. ML- Machine Learning
4. AI- Artificial Intelligence
5. ANN- Artificial Neural Network

INTRODUCTION

a. Background Literature

In the world of pets' dog is the most loyal animal for the human. The dog descended from an ancient, now extinct wolf. The dog was the first species to be domesticated by humans' gatherers more than 15,000 years ago. Dogs have been particularly attuned to human behavior because of their long relationship with humans. So, dogs are very loyal to humans. For centuries, the dog has been selectively bred for different traits, sensory abilities. Hunting, herding, pulling loads, protection, assisting police and the military, companionship is some of them. Because of those things people say, "dog is man's best friend". So, the dog is one of the perfect pets in the world. But a most common issue is having a lack of knowledge about their dogs and their feelings about their pet owners.

Because of those things people try to do some important things for themselves and their owners. Developing software, creating some IoT devices, developing some mobile applications are some useful things that they try to do for their convenience. But those apps and devices are very difficult to bring from other countries. Also, those things are not more accurate. Those apps have a lot of limitations for access to some functions. Sometimes devices prices are more expensive. Having problems like this are very difficult to use technology for the pet. With our application "Dogodo" we'd want to provide some answers to some of the issues that dog owners may have as a result of having a pet dog.

Dog breeding is one of the very important things for pet owners. Some peoples know what kind of pet will born to their dog. But there are a lot of people in the world who do not have much experience about dogs. But they are keeping dogs as their pets. Those people do not know what type of pet will born, how it is look like, what are the treatments, medical routines, and food routines for newborn pets.

Also, the pet owners have a very big problem which is identify the result of mix breeds. Because people most of time know the result of pure breed but they do not know the result

of mix breed. Because there are two type of pet owners in the world which are experience and inexperienced pet owners. Most of inexperience pet owners would like to know after crossing their dog with some other dog, what kind of pet will born for their dog. Also, they would like to know how they should threat to them, what are the medial routings and food recommendation for their newborn pet. Using this mobile application, the user can identify the result of pure breed, result of mix breed, what are the treatment and medical routings. Also, they can identify what kind of food is recommended for their newborn pet. In this application we are mainly considering the size of dog for these prediction and recommendations.

When we are talking about dog size, there are 4 kinds of breed sizes are considering in this project. Those sizes are toy, small, medium, and large.

Figure 1 Dog size chart

When we are talking about toy breed this breed of dog has been considered a very small breed of dog since ancient times. These can come in different sizes, and there are several different types. In general, they are very small compared to other dogs. These dogs are said to be descended from lapdog dogs of the past and are also considered small breeds of

hunting dogs or working dogs. They are not used for hunting and are bred by their owners as a symbol of wealth.[1]

Small size dogs are larger than toy dogs and smaller than medium size dog breeds. These are not strong dogs. But their activism is generally higher. Some breeds have a very delicate body, but some dogs are very tough. These dogs are unfamiliar with some types of sedentary lifestyles and prefer to live in quiet environments.[2]

Medium-sized dogs are neither too big nor too small. Many medium-size dogs show playful behavior. Furthermore, these dogs in general show a kind nature. Dogs of this type are very friendly and obedient. Because of those things, this type of dog is often bred as a domestic pet.[3]

When we are talking about large size dog breeds, these are larger than all other dog breeds. Generally, they prefer to rest for most of the day. They have been used primarily for hunting in the past. These dogs have an innate instinct. These dogs have been used in recent times for protection and as pets. However, it is best to exercise daily to maintain good physical health.[4]

There are more than 300 breeds of dogs in the world today. Here all the dogs are divided into the 4 groups mentioned above. In this project, we are only using 6 breeds for food recommendations. Those things are done for the dogs according to their size.

Figure 2 Food routings

Small pieces of food are best for small and toy dogs when considering their diet. They are very active and speed up their metabolism. For these reasons, small pieces of food are said to be more suitable for them. Providing a balanced diet in this way also helps them maintain good health.[5]

Medium size dogs can be seen in large numbers nowadays. These dogs need slightly more food than small dogs. Here the food recommendation we issue is made under full medical supervision. Therefore, giving these food recommendations will enable the dog to lead a healthier life.[5]

Similarly, when considering large size breeds, these dogs have a tendency to eat pet owners unknowingly. They think that these dogs are so big that they need to be fed a lot of food. But that is not correct. They grow very fast at a young age, so you need to consider your diet carefully. Excess growth can have a detrimental effect on health. Usually, the pet owner has to consult a veterinary doctor to get a food recommendation for this. Here we have done the study work and with the approval of the doctors, we have made arrangements to give this food recommendation to the pet owner through our app.

Figure 3 Essential Dog Vaccinations

Pet owners should also be concerned about the health of their pets. Pet owners pay special attention to dogs when they are young, and gradually reduce their concern for their health as they age. But most of all, health concerns should be addressed as the dog ages. Puppies should be vaccinated from 6-8 weeks of gestation to 3 years of age.

This usually happens when the pet owner goes to the medical office to find out. The advice given there is usually to treat their pet. But with the medical recommendation given by our app, the pet owner will be able to know all that information. This will allow them to know when to give their puppy the medication. The pet owner will also be able to understand what medications are being offered. The medical recommendation given here is generally suitable for puppies and may vary for dogs with special needs. The medical recommendation given here is issued under full medical supervision. By giving the medical recommendation given here properly, it is possible to give the best care to your pet.

Another important consideration for pet owners is finding a partner for their puppy. Here you can get the details of the dogs of the pet owners who have registered for this app. Here, dogs that are mainly related to their dog breed are shown in this app is registered. This will make it easier for the pet owner to find a suitable partner for his dog. Here you can get things like dog type, dog age, pet owner contact details.

With these points in mind, this component of the project will work. This allows the pet owner to easily know what kind of dog his puppy is born with. You will also gain an understanding and knowledge about food and medical recommendation. They also have the ability to easily find the right partner for their dog. In addition, the details of our survey are discussed below.

A survey was performed to assess the degree of the dog owner. A Google doc was used to build the survey. Around Sri Lanka, dog owners were chosen at random, and the survey was distributed to them via social media such as Facebook and WhatsApp. Also, the survey was also sent to several dog owners by email. The survey had questions to cover our entire group research and here only related to breeding your pet which is my topic will be evaluated. Around 58 responses were collected from dog owners. From the survey following figure shows the level of knowledge about dogs of dog owners.

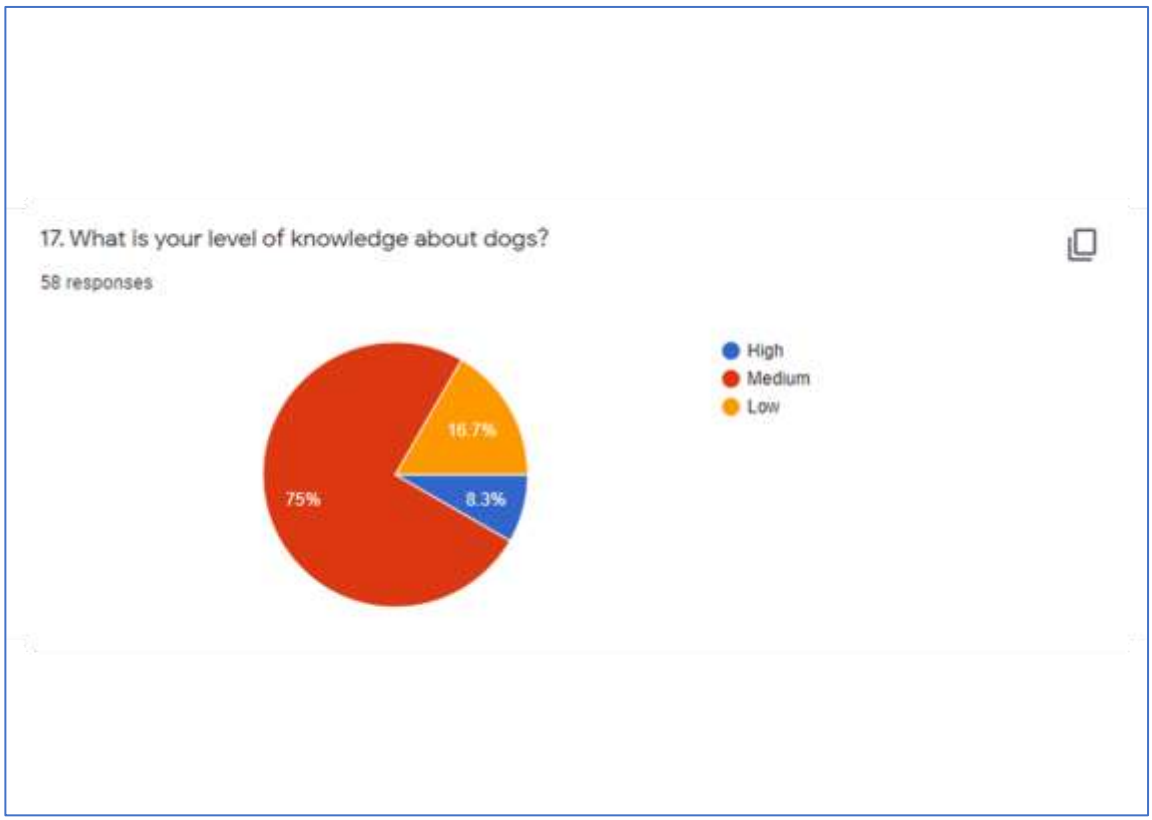

Figure 4 Level of knowledge about dog

According to this pie chart, most dog owners have a medium knowledge about dogs. According to the survey, 8.3 % of dog owners have the best knowledge about the dog. 75% of dog owners think their knowledge level is medium. Only 16.7 % of dog owners have low knowledge about their dogs.

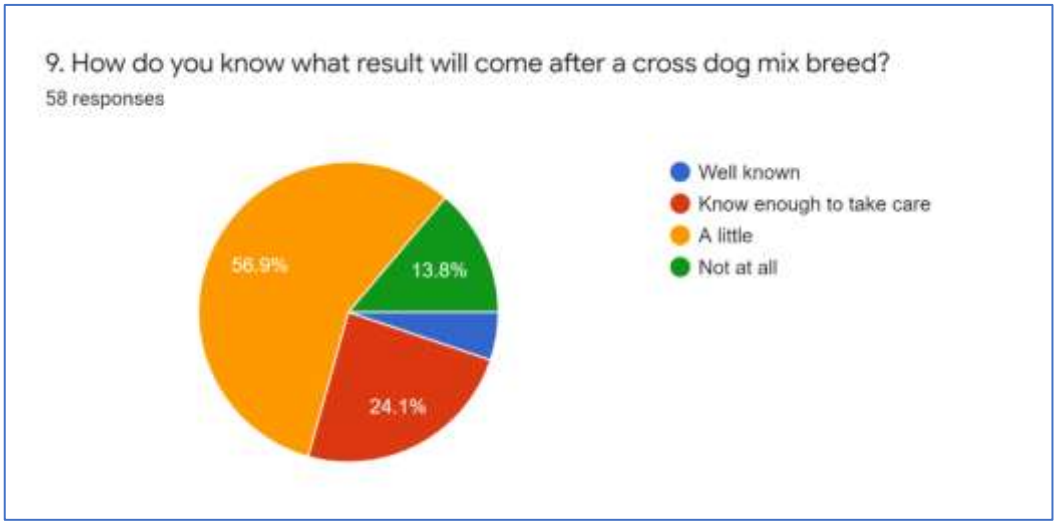

Figure 5 Knowledge about newborn pet

This is one of the major problems which is face by pet owners. According to the above graph, only 5.2% of pet owners exactly know what the result is after cross mix breed. From the experience, 24.1% of pet owners have the knowledge to know enough to take care. Most pet owners have a little idea about mix-breeds result which is 56.9%. Finally, from this graph, we can see 13.8% do not have any idea about dog mix breed results.

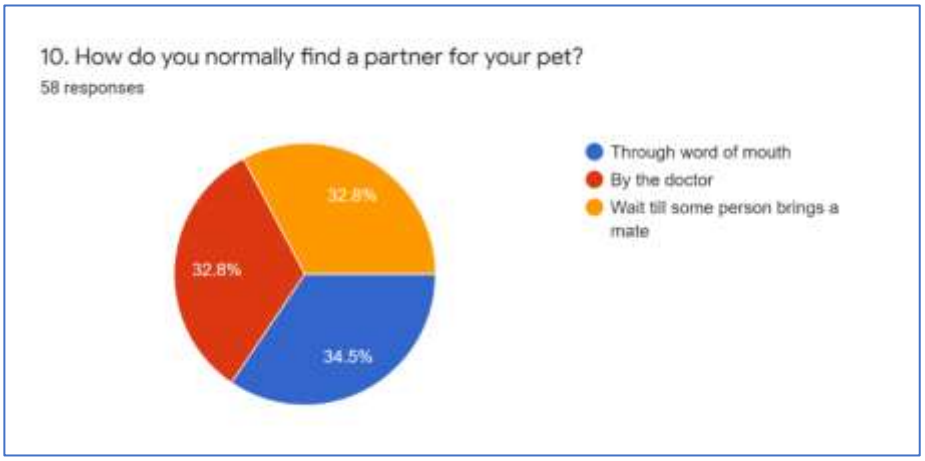

Figure 6 how do you find a partner for your pet

According to the above graph, dog owners have indicated How do you normally find a partner for their pet. According to the graph, we can see 34.5% of pet owners find a partner for their pet through word of mouth. Only 32.8% of dog owners think they should find a partner from a doctor.32.8% of pet owners wait till some persons bring dog formate. These steps are too slow and waste a lot of time to find a partner. Using new technology, we can find a partner for the pet is too easy.

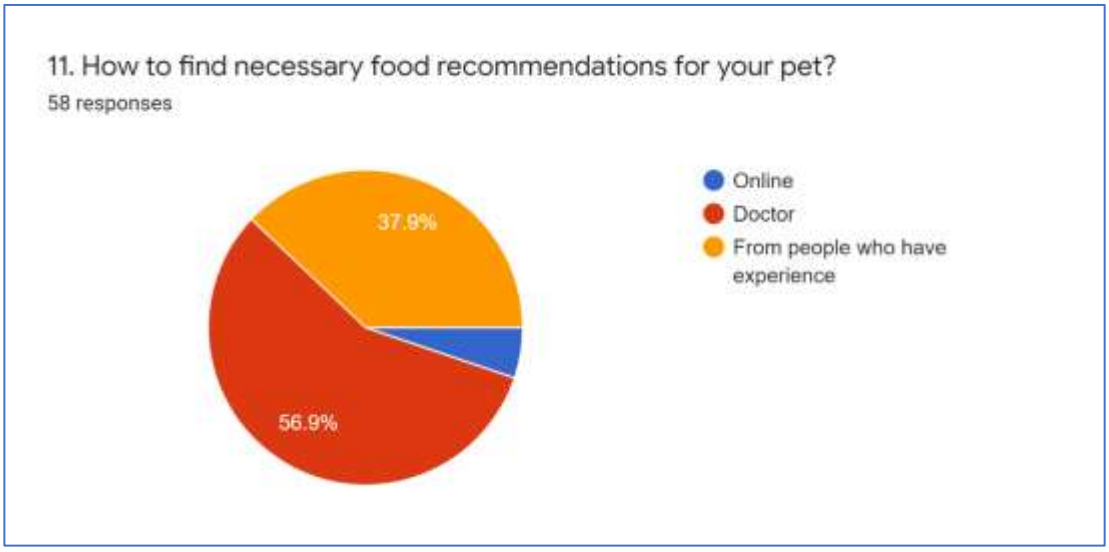

Figure 7 How to find a necessary food recommendation for your pet

Give the necessary food to a pet is a very important thing. Most pet owners are very careful when giving food to their pets. According to this graph, we can see most pet owners get food recommendations from doctors which is 56.9%. But 37.9% of pet owners get the food recommendation from people who have experience with dog foods. But only 5.2% of pet owners get the food recommendation online. We could find a reason for that during the study. Because there are no sites or applications for get the correct food recommendations from one place for the dogs.

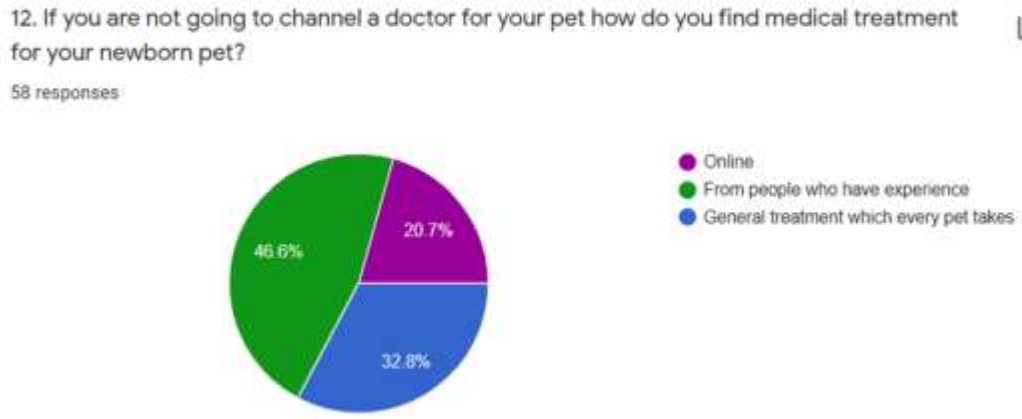

Figure 8 How do you find medical treatment

Medical treatment is very important to newborn pet. According to this graph 46.6% of pet owners get the knowledge from people who have experience about medical treatment. 32.8% of pet owners give the general treatment for newborn pet. Only 20.7% of pet owners get the knowledge about medical treatment from the online. We could find a reason for that during the study. Because there are no any web site or application for get the correct and trusted medical recommendations for new born pet.

b. Research Gap

There are some solutions in the market to identify the result of dogs' breed, recommending the food and medical treatment for the newborn pet. Also, there is not any application to find a perfect partner for your dogs. As for an instance, there are some applications that can identify the result of mixed breed using dogs' pictures. Some applications recommending food and medical routings without having knowledge about the newborn pet. But the main concern is providing the proper answer for the above problems. The main reason owner is not using an application to find the solution for the above problem which is those application does not get the necessary information about dogs to provide the proper answer about those problems. It is not providing the proper solution, only

generate common answers. Here are the gaps which I found in the community and can be filled with an innovative and efficient solution.

- "Find your pet's partner" Using this component owners can find the perfect partner for their pet.

  There are some websites available in the market [9]. But it has a lot of limitations. When creating an account on site it is not requesting medical information, high, weight, dog group, fur type, life span, and their parent information. And only one photo can upload your pet. Because lack of information, pet owners cannot find a suitable partner for their pets. To further elaborate how this gap has been affected to the pet owners is, withing that information system cannot automatically recommend the partner for their pets.

- "Breed your pet" Using this component owner can get a clear idea about the newborn pet.

  There are some applications available in the market which can find the type of dog using photos [10]. That means is after born a new pet we can identify what kind of do is it. But from a picture cannot get all the related information and give the proper answer. The owner cannot get a clear idea about the newborn pet before the pet is born. And those applications are not requesting much information as I mentioned earlier. Most inexperienced pet owners do not know what they should do after the pet is born. They do not know the food recommendations and medical recommendations for the newborn pet.

By considering the above requirement there is not any application provide to answer the above requirements. And the same time application and websites in the market have a lot of limitations and those services are very expensive.

RESEARCH PROBLEM

Dogs are sensitive, knowledgeable, social, and loyal companions to humans. When it comes to dog owners, we can also see that there are mainly two groups of dog owners, based on the survey data. They are experienced dog owners who have kept pets for a long time and inexperienced dog owners who are unfamiliar with newborn dogs, medical recommendations, and food recommendations. Inexperience dog owners does not like experience dog owners. Because they are very interesting to know all the information about newborn pet and how to care him. Without having knowledge about above problems people give them to food and medicine which used for peoples. Because of those things they have to face very bad situations. Sometimes they might be the death.

The other thing is both experience and inexperience pet owners want to find a proper partner for their pet. Base on the survey data we can see most of them find a mate to breed their dog from doctor and through word of mouth. Most people are busy with their day to activities. But when they are doing those things, they have to wait more time to contact them. Before contact, the other owner they do not have and clear idea about the other dog and mainly they do not know the health detail, history of that dog and some other important thinks.

There are not applications with machine-learning techniques have been used to find the result of newborn pet. With a machine learning approach can identify the pattern of newborn pet after analyzing the information. Find the solution for above problems using artificial intelligence and machine learning approaches has not been successfully completed yet.

Withing the current schedule and life pattern of people, they have become accustomed to do their things quickly. They try do their works by own. However, each problem has its own way of solving it. Therefor my research will bring up a solution for ‘find the result of newborn pet’, ‘recommending food and medical routings for newborn pet’, ‘help to find a perfect partner for your dog’ and create a platform like social media to share their information among registered pet owners.

RESEARCH OBJECTIVES

a. Main objective

The main objective is this component is not only providing the common answers which have to dog owners. Simply this module is more than that. Through this module, the application has two main components.

1.Breed your pet.

2.Find a partner for your pet.

For the first component data will be collected from veterinary doctors. And collected data will be analyze with user's requirements using machine learning algorithms. For the second component data will be collecting when user register to the application. Form both components generate very useful information to the user. Collected data will be directed to the real time data base to the storage purposes.

As mentioned, the first component will provide more accurate information using machine learning algorithms. Therefor the main objective is to provide an innovative useful solution to the pet owner for their dogs.

b. Specific objectives

1. Breed your pet component which help you to identify what kind of pet will born for your dog.

This is the main component we are going to focusing on this application. It is mainly focusing to generate the result of newborn pet. Firstly, all users have to register the application before they use this component. When they are registering to this application, they have to enter all necessary information about their dogs. Because application is analyzing that information using machine learning algorithms with pre train data in the database. From that we can get the clear idea about their newborn pet. It is the primary target of this component. But additionally, in this component this application generates the recommendations for food and medical treatments for that newborn

pet. Because of that thing people who have lack of knowledge about pet, can take care their dog and their newborn pet by own.

2.Find a partner for your pet.

This is the second component of this application. This component is mainly working such as social media platform. Because of that using this component user can find the proper partner for their pet. As I mention earlier when user is going to register the application, they have to enter all necessary information about their dogs. From that information application automatically shows the same breed dogs who registered in the application. Also, if you want to find some specific breed user can search and find the proper partner for their pet. When they are finding the partner, they can see all information about dog and of user want to contact that pet owner they can also get the contact details.

Because of this component user can find a proper partner without wasting time and the can get a clear idea about dog which they are going to breed their dog.

METHODOLOGY

a. System Diagram

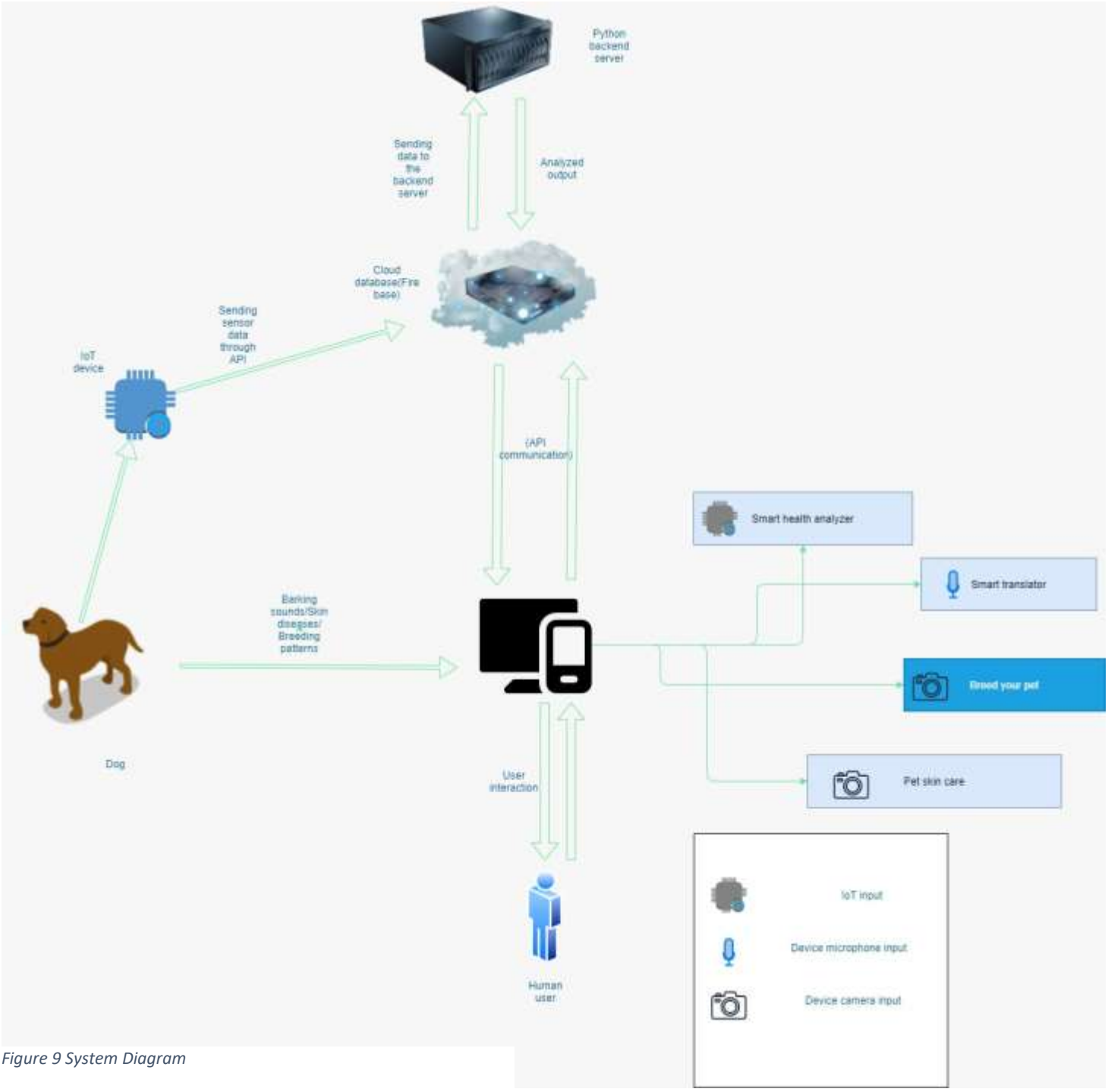

Figure 9 System Diagram

Note – The highlighted component in blue (Breed Your Per) is the component I will be covering in my research

b. System Overview

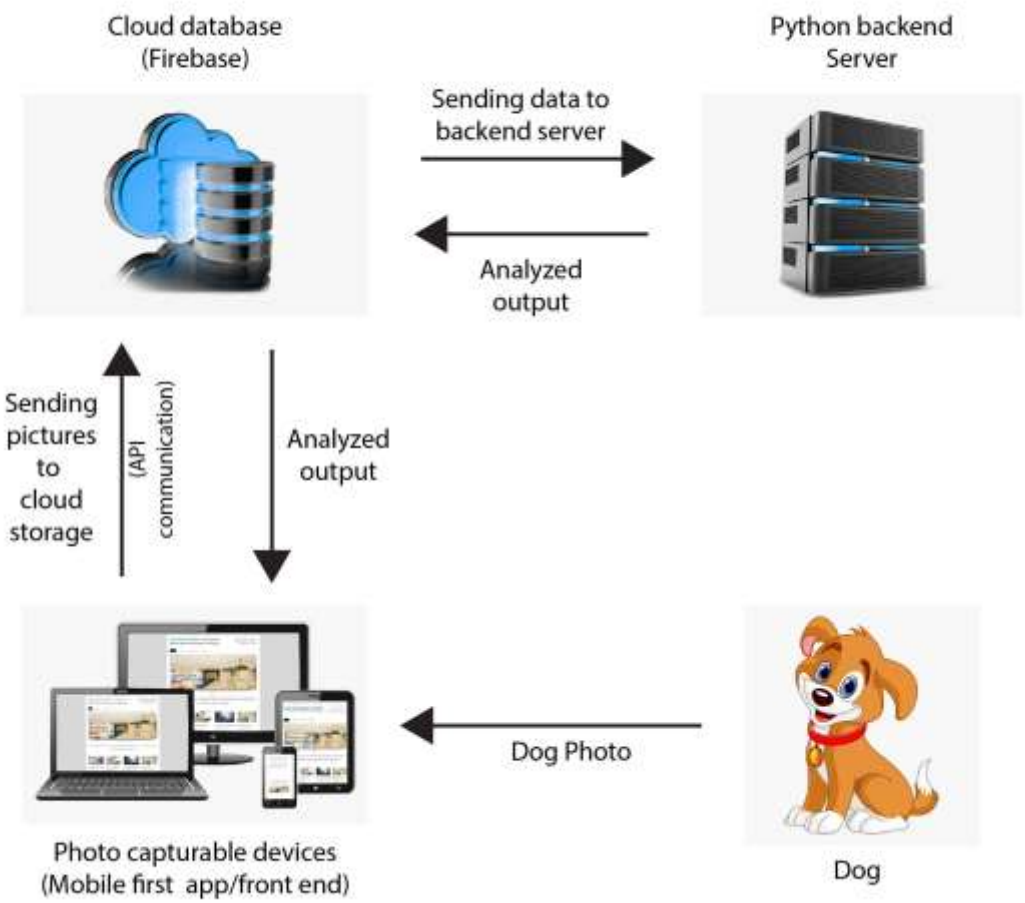

Figure 10 System Overview

The Dogodo app brings plenty of services to pet owners. Pet owners can use this app to solve many problems. The proposed system mainly covers the relevant areas things are expected to be covered in order to completely satisfy pet owners.

Essential health services are provided here. It outlines the problems that arise and what action to take. Dogs' barking sound has the ability to recognize and translate their emotions. There is also the possibility of learning about skin diseases and breeding patterns and breeding outcomes. The team's top objective is to highlight essential services that should be included in the mobile app and to deliver smooth services with fewer disruptions. Also, a service that has never been provided perfectly and exclusively to dog owners in one go. Finally, this service will bring to market both IoT gadgets and a helpful, eye-catching mobile app.

This application is very useful for inexperienced pet owners. Because this application working like personal assistance. Because of that pet owns can manage the essential things related to their dogs. There are four main components available in this mobile application.

- Smart health tracker
- Smart translator
- Breed your pet
- Pet skincare

Form these components provide a lot of answers for pet owners. Because from these component covers different areas dog owners might face when having a pet dog. In the following we are talking about one by one about all components.

- Smart health tracker

In this component shown, majority of the animal related health issues have been caused by either due to lack of exercise or proper nutrition. Commonly, domestically bred animals face heart related issues due to lack of movements in their daily routines. And also, due to being neglected or undiscovered symptoms, these dogs' health can be at stake. This component mainly focused on tackling down these symptoms at early stages to provide necessary remedies and eradicate symptoms which can cause major health issues in the long run. Research shows that if dog owners can track down the body temperature and heart rate of a dog, it can help the owner to get a high-level view of the health status of

the dog. As per this component, expectation is to provide a all-in-one IOT based solution which can be used to identify body temperature, heart rate and the foots steps of a dog at a any given time. Solution will be provided as a IOT device where it can be attached to the leash.

- Smart translator

In this component how to understand dogs feeling by their barking patterns. Normally dogs communicate in different ways with their owners. They communicate by wagging their tales, using different barking sounds and different expressions, and soft bites. Among these communicating ways, barking sounds are their main way of communicating with humans. In some of these instances, dog owners leave the dog without understanding how to respond to their behavior, breeding, and unique disease-related concerns relying on their health and behavioral issues. Due to the extreme frequent acts of people dumping dogs, the number of abandoned dogs has steadily risen. From this component providing a solution for that problem. Smart translator is a compound that will help the owner better understand the dog and what the dog is trying to communicate. Using a modern machine-learning algorithm.

- Breed your pet

From this component there are few areas covers. The main thing is using this component pet owners can identify what kind of pet will born to his dog. Because people are very curious to know how newborn pet look like. In addition, finding a partner for those who are looking to cross their dog has become a daunting task nowadays. But using this mobile application, this component is designed to let pet owners know that other dogs' owners who are hoping to cross their dogs. Because of this thing pet owners can save a lot of time which they want to use to find a partner by other methods. Also, one of the most common problems people face is not knowing the medical routine and food routine that should be given to puppies at an early age. Using this component pet owners can learn about medical routing and food routing for these newborn pets.

- Pet skincare

The last component assists the user in determining the skin condition the dog is experiencing. The owner must take a snapshot of the disease and let the app to evaluate it before determining if it is a small or big problem. The app will generate a skin-related illness based on image findings.

c. Data Source and Collection

Here we use photos of dogs as data. Special machine learning algorithms were used to analyze and identify these images. Examples are Color histograms, Haar Wavelet, Canny. These algorithms are discussed below. As a result, we'll give you a short overview of the methods in the section below. During the training phase, the pictures are pre-processed and resized to 225x225 pixels.

The data set we used here contained more than 20,000 photos of 120 different breeds of dogs.[6] But due to a lack of resources, we have used only a few dog breeds for our project. Here we have selected dog breeds that include all four dog sizes we discussed earlier. Here we used the 6 most common breeds of dogs in Sri Lanka. More than 1800 selected photographs have been used for this project. The data thus collected were divided into two main parts. 70% of the data collected was used for training and the remaining 30% was used for data testing purposes to verify accuracy.

Data collected from various resources on the Internet must be properly categorized and organized for maximum effective use. Because of that, all the data had to be preprocessed before using it. For the preprocessing method, the following techniques of this research have been used to organize the data.

- Data cleaning
- Data transformation
- Data reduction

The dogs we have selected here include Boxer, Great Dane, Pitbull, Pug, Ridgeback, and Shitzu. The data obtained here were divided into three categories as a male dog, a female dog, and a pet dog and used for testing. In order to increase the accuracy, more than 100 photos have been included in each category. The pet owner will get a more accurate answer no matter what photos are included within the above type of dogs.

d. Feature extraction

Feature extraction is mainly expected to reduce the number of features of the dataset by creating new features from the existing ones. This latter identifies important features or attribute in data.

This research mainly uses machine learning techniques to find out what a puppy is born with after two dogs cross. We mainly use photos here. Here we can use *Color Histograms* to represent the distribution of the composition of colors in the image. It makes it easy for us to see different types of color appeared and the number of pixels in each type of color appeared. In addition, *Haar Wavelet* compressions are used to compare lossless and lossy images. To generate a sparse or nearly sparse matrix, it uses averaging and differencing values in an image matrix. A sparse matrix may be efficiently stored, resulting in reduced file sizes. Also, we are using the *Canny* edge detection algorithm to detect the wide range of edges in images. The OpenCV method cv2. Canny () accepts our input picture as the first parameter and its aperture size (min and max value) as the second and third arguments.

In addition, dogs can be grouped into toy breeds, small breeds, medium breeds, and large breeds. Here, for example, the data entered by the pet owner identify the category in which the puppy is born. Then the general food and medical recommendation for that category are given. This food and medical recommendation will be given for especially for the first six months and till 3 years. That all of the above-suggested food and medical

recommendations and related prescriptions are designed under the guidance of specialized doctors.

e. Splitting the dataset into training and test dataset

Before we can train our models, we must divide our dataset into two sections. The first section is for training and the second section is for testing. To begin with, it will help in the training of the neural network as a training set. The neural network's accuracy level may be checked. This partitioning can be changed depending on the use case. Normally, the training set comprises 70% of the proportion of the data set and we are using 30% of dataset for testing purposes.

f. Image Segmentation

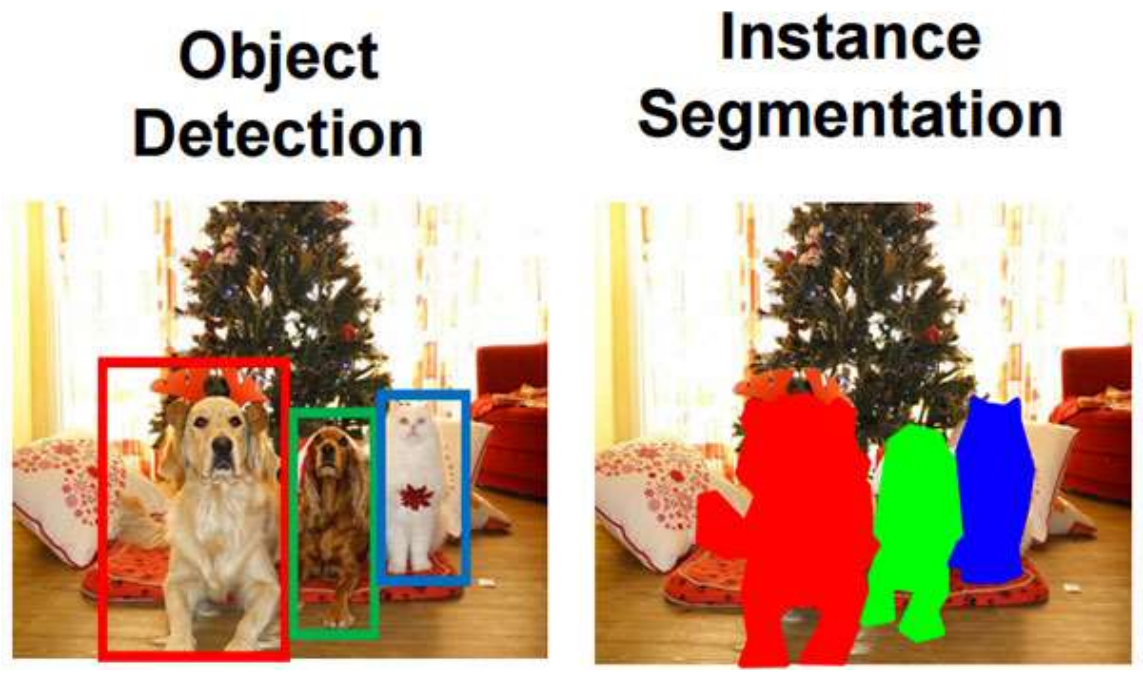

Figure 11 Image Segmentation

Image segmentation is a crucial problem in image processing and computer vision, and it includes identifying objects or regions in an image that have similar characteristics. Segmentation, classification, and interpretation are only a few of the tasks involved in

image analysis. Individual pixels are labeled in image classification depending on prior knowledge of the topic at hand.[7]

g. Convolutional neural network

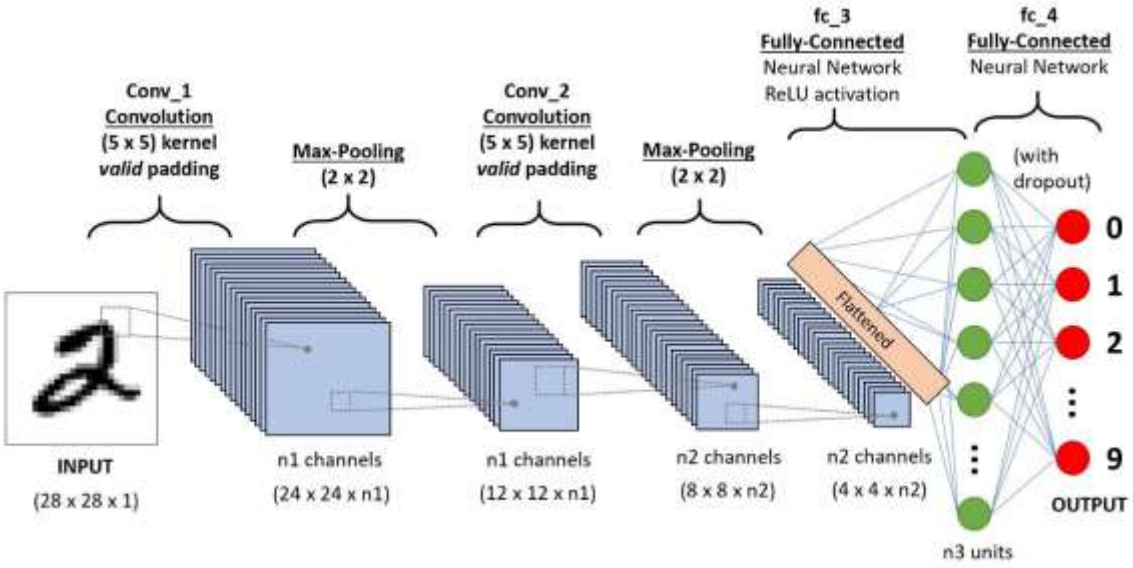

Figure 12 Convolutional neural network

An input layer, hidden layers, and an output layer make up a convolutional neural network. Any intermediary layers in a feed-forward neural network are referred to be hidden since the activation function and final convolution hide their inputs and outputs.[8]

h. System Development Process

We describe how this part is created and how it connects with the main structure in this portion of the proposed research. Because this is a research and development project, we'll take an Agile approach. It enables for continuous development, integration, and testing iteration. The authors' solution would focus on the system established through the literature survey and the survey executed, resulting in continuous improvements since Scrum can test and adapt to changing needs.

Figure 13 System Development Process

i. Gantt chart

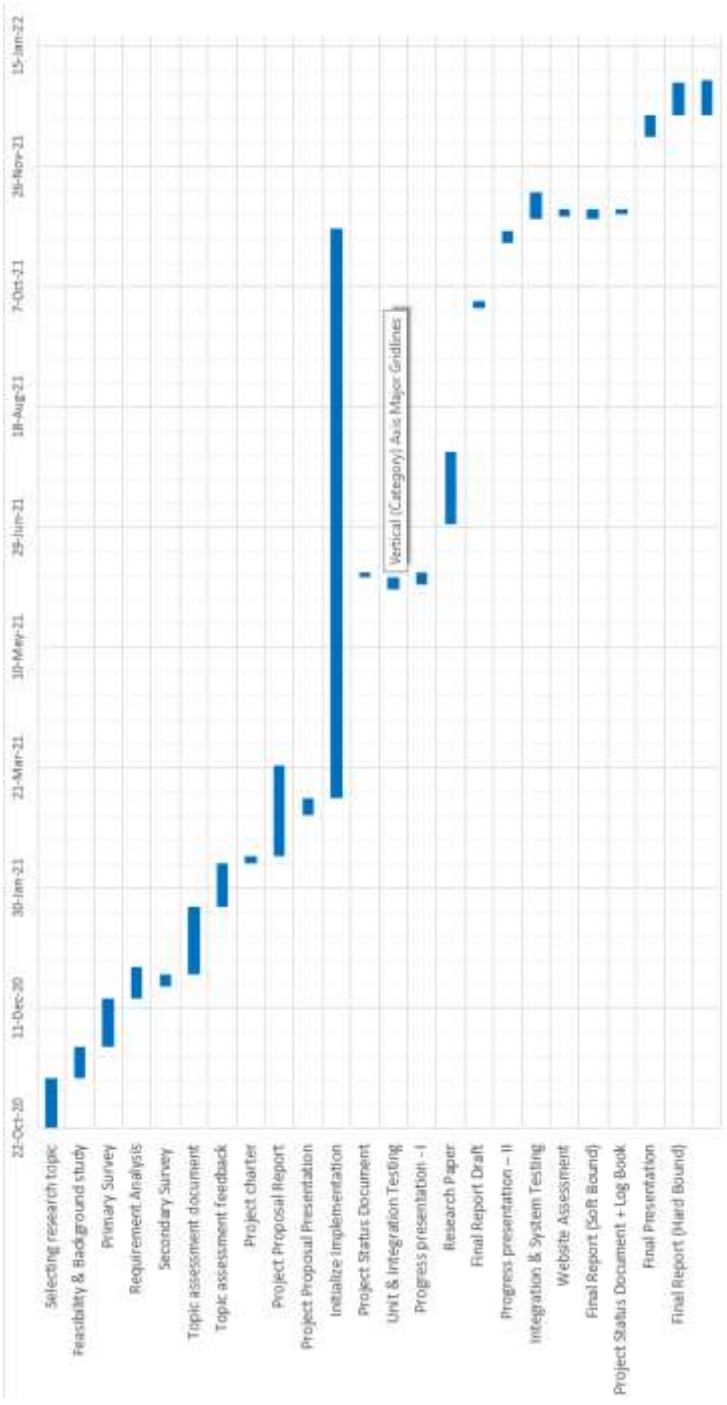

Figure 14 Gantt chart

j. Work Breakdown Structure

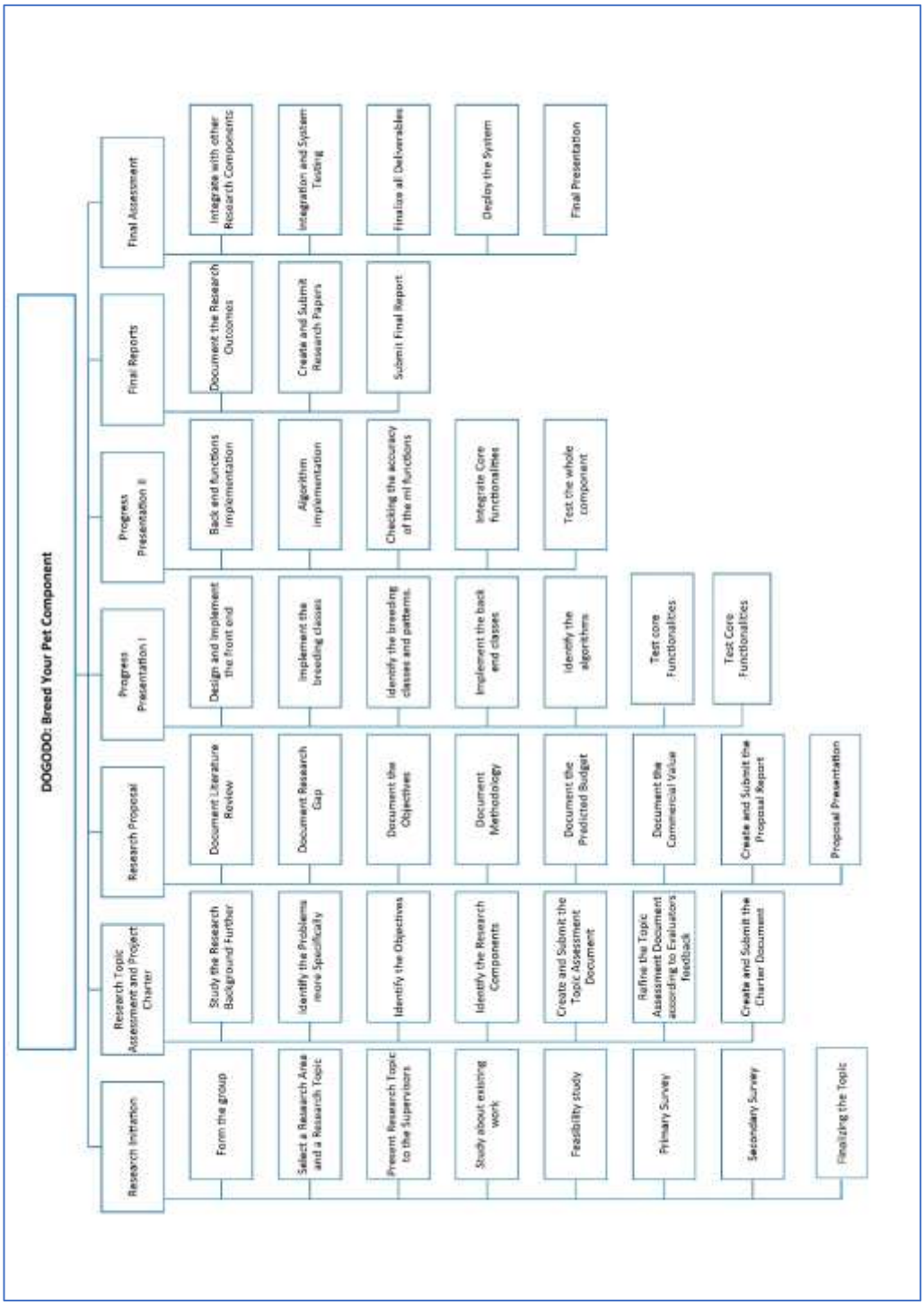

Figure 15 Work Breakdown Structure

k. Commercialization of the Product

- Target audience

This application is mainly focusing about inexperience pet owners. But both experience and in experience pet owners can use this application to manage their task and finding solution for their problems. Because of that any kind of dog owners can purchase this application and use it. The proposed solution is provided as a package. In the package we are providing application and IoT device. But this application can use without IoT device. That is an advantage for pet owners. Without IoT related service customer can use the application without having any problems.

- Benefits to end-users

    - Inexperience pet owners can get knowledge related to dogs.
    - User can identify what kind of pet will born to his dog and how that dog look like
    - People who are using this application can get a knowledge about what are the food recommendation for their newborn dog.
    - Also pet owners can get idea about what are the essential medical recommendation fir newborn dogs.
    - In additionally recommending food and medical routings for dogs till three years.
    - The pet owners can easily find a partner for their dog.
    - Less experience dog owners can manage their task by using this application
    - Any user can access these services at any time, anywhere.
    - Without buying IoT device people can still can use the application without having any kind of problems.

- Advertising and commercialization

    - Mainly we are using social media platforms such as Facebook and Instagram for marketing purposes.
    - In the Facebook and Instagram, we will create separate pages for the application, and we will create some advertisements as post.
    - In Facebook we can share the post among the related groups.
    - In additionally we will be use Google advertisement service for promoting our product.
    - In the YouTube we will be creating a new channel for promoting this product.
    - Using this YouTube channel, we can explain about entire application and IoT form a video tutorial.
    - The IoT device will be available in the Supermarkets, Pharmacy, Kennel clubs in Sri Lanka and also this device available in dog product selling shops.
    - After we publish the application and IoT device, we will be created a website to publish our product.
    - Also we will be created some posters for promoting our product.

TESTING & IMPLEMENTATION

The major goal of this phase is to test all system components and determine if the system fulfills all of the functional and non-functional criteria obtained from dog owners. Also, to ensure that the system is bug-free. There are several levels of testing that may be used to evaluate a product's behavior and performance.

- Unit testing

In this level, we will be testing the component one by one. We have tested the all component separately and if there and issue we have been fix those problems.

- Integration testing

In this stage, we will be testing the integrated component and additionally the data flow from one model to another will be checked. If some error occurs during the integration, we can fix those bugs in this stage.

- System testing

In this level we will be testing the entire system whether it full fill all functional and non-functional requirements.

- Acceptance testing

The final step in the testing process is acceptance testing. Typically, this is done via user or client debuggers. Client debugging is the process of identifying specific implementation problems or defects in a program or system. These localization problems and flaws must also be addressed. Stakeholders should assess a web system for accessibility preferences in this regard. Administrators, IT technicians, and dependents of the dog owner who will be utilizing the app are examples of stakeholders.

Once the system is up and operating, it's critical to devise a maintenance strategy. It's a good idea to debug the system from time to time for security flaws, performance issues, and out-of-date software.

RESULTS & DISCUSSION

a. Results

Some of the test cases we used to test the 'Breed your pet' component are listed below. We were only able to conduct limiting test cases on limited test participants because to the current pandemic situation (Dogs)

- Test case 01

Table 1 Test case 1

Test Scenario ID	Login-01	**Test Case ID**	Login 1-A
Test Case Description	Login -positive test case	**Test Priority**	High priority
Pre-Requisite	The user should have a valid user account	**Post-Requisite**	N/A

Test Execution Steps:

S. No	**Action**	**Inputs**	**Expected Output**	**Actual Output**	**Test Browser**	**Test Result**	**Test Comments**
1.	Launch application	Cmd:npm start	Launch http://localhost:3000/	http://localhost:3000/	Google chrome	Pass	[Gihan 5.00 P.M. 05/10/2021] Launch successful
2.	Enter user credentials and enter log in button	Email id: mg1@gmail.com Password:123	View the dashboard	View the dashboard	Google chrome	Pass	[Salman 5.01 P.M. 05/10/2021] Log in successful

- Test case 02

Table 2 Test case 2

Test Scenario ID	Login-01	**Test Case ID**	Login 1-B
Test Case Description	Login -Negative test case	**Test Priority**	High
Pre-Requisite	N/A	**Post-Requisite**	N/A

Test Execution Steps:

S. No	**Action**	**Inputs**	**Expected Output**	**Actual Output**	**Test Browser**	**Test Result**	**Test Comments**
1.	Launch application	Cmd:npm start	Launch http://localhost:3000/	http://localhost:3000/	Google chrome	Pass	[Gihan 5.05 P.M. 05/10/2021] Launch successful
2.	Enter valid mail and invalid password and enter log in button	Email id: mg1@gmail.com Password:569	Username and password incorrect	Username and password incorrect	Google chrome	Pass	[Gihan 5.08 P.M. 05/10/2021] Log in unsuccessful
3.	Enter invalid mail and valid password and enter log in button	Email id: mgg1@gmail.com Password:123	Username and password incorrect	Username and password incorrect	Google chrome	Pass	[Gihan 5.10 P.M. 05/10/2021] Log in unsuccessful

- Test case 03

Table 3 Test case 3

Test Scenario ID	Image input-02	**Test Case ID**	02-A
Test Case Description	Image input - positive test case	**Test Priority**	Medium
Pre-Requisite	1. The user should be logged in 2. A photo of your dog 3. A photo of dog's partner 4. Breed-Great Dane 5. Dog owner-Sandagomi 6. Experience- 10 years 7. Image - Clear	**Post-Requisite**	

Test Execution Steps:

S.No	**Action**	**Inputs**	**Expected Output**	**Actual Output**	**Test Browser**	**Test Result**	**Test Comments**
1.	Select 'Breed your pet and enter	N/A	Breed your pet UI	Breed your pet UI	Google chrome	Pass	[Sandagomi 5.20 P.M. 05/10/2021] Navigation successful
2.	Select 'Choose file'	Your dog Image and dog's partner image	Great Dane Puppy	Great Dane Puppy	Google chrome	Pass	[Sandagomi 5.23 P.M. 05/10/2021] Correct prediction]
3	Click 'log out'	N/A	Log in screen	Log in screen	Google chrome	Pass	[Sandagomi 5.27 P.M. 05/10/2021] Log out successful]

- Test case 04

Table 4 Test case 4

Test Scenario ID	Image input-02	**Test Case ID**	02-B
Test Case Description	Image input - Negative test case	**Test Priority**	Medium
Pre-Requisite	1. The user should be logged in 2. A photo of your dog 3. A photo of dog's partner 4. Breed-Great Dane 5. Dog owner-Sandagomi 6. Experience- 10 years 7. Image - Not Clear	**Post-Requisite**	

Test Execution Steps:

S.No	**Action**	**Inputs**	**Expected Output**	**Actual Output**	**Test Browser**	**Test Result**	**Test Comments**
1.	Select 'Breed your pet and enter	N/A	Breed your pet UI	Breed your pet UI	Google chrome	Pass	[Sandagomi 5.30P.M. 05/10/2021] Navigation successful
2.	Select 'Choose file'	Your dog Image and dog's partner image	Great Dane Puppy	Great Dane Puppy	Google chrome	Pass	[Sandagomi 5.35 P.M. 05/10/2021] Correct prediction]
3	Click the log out button	N/A	Log in screen	Log in screen	Google chrome	Pass	[Sandagomi 5.38 P.M. 05/10/2021] Log out successful]

- Test case 05

Table 5 Test case 5

Test Scenario ID	Image input-03	**Test Case ID**	03-A
Test Case Description	Image input - Negative test case	**Test Priority**	Medium
Pre-Requisite	1. The user should be logged in 2. A photo of your dog 3. A photo of dog's partner 4. Breed-Great Dane 5. Dog owner-Sandagomi 6. Experience- 10 years 7. Image - Low gradient different	**Post-Requisite**	The user should log out from the system

Test Execution Steps:

S.No	**Action**	**Inputs**	**Expected Output**	**Actual Output**	**Test Browser**	**Test Result**	**Test Comments**
1.	Select 'Breed your pet and enter	N/A	Breed your pet UI	Breed your pet UI	Google chrome	Pass	[Sandagomi 5.40 P.M. 05/10/2021] Navigation successful
2.	Select 'Choose file'	Your dog Image and dog's partner image	Great Dane Puppy	Great Dane Puppy	Google chrome	Pass	[Sandagomi 5.45 P.M. 05/10/2021] Correct prediction]
3	Click 'Back'	N/A	Main menu	Main menu	Google chrome	Pass	[Sandagomi 5.50 P.M. 05/10/2021] Navigation successful]

- Test case 06

Table 6 Test case 06

Test Scenario ID	Image input-03	**Test Case ID**	03-B
Test Case Description	Image input - Negative test case	**Test Priority**	Medium
Pre-Requisite	1. The user should be logged in 2. A photo of your dog 3. A photo of dog's partner 4. Breed-Great Dane 5. Dog owner-Salay 6. Experience- 4 years 7. Image - high contrast	**Post-Requisite**	The user should log out from the system

Test Execution Steps:

S.No	**Action**	**Inputs**	**Expected Output**	**Actual Output**	**Test Browser**	**Test Result**	**Test Comments**
1.	Select 'Breed your pet and enter	N/A	Breed your pet UI	Breed your pet UI	Google chrome	Pass	[Salay 6.30 P.M. 05/10/2021] Navigation successful
2.	Select 'Choose file'	Your dog Image and dog's partner image	Boxer	Boxer	Google chrome	Pass	[Salay 6.35 P.M. 05/10/2021] Correct prediction]
3	Click 'Back'	N/A	Main Menu	Main menu	Google chrome	Pass	[Salay 6.40 P.M. 05/10/2021] Navigation successful]

- Test case 07

Table 7 Test case 07

Test Scenario ID	Image input-04	**Test Case ID**	04-A
Test Case Description	Image input - Positive test case	**Test Priority**	Medium
Pre-Requisite	1. The user should be logged in 2. A photo of your dog 3. A photo of dog's partner 4. Breed-Great Dane 5. Dog owner-Salay 6. Experience- 4 years 7. Image - Normal contrast	**Post-Requisite**	The user should log out from the system

Test Execution Steps:

S.No	**Action**	**Inputs**	**Expected Output**	**Actual Output**	**Test Browser**	**Test Result**	**Test Comments**
1.	Select 'Breed your pet and enter	N/A	Breed your pet UI	Breed your pet UI	Google chrome	Pass	[Salay 11.30 A.M. 07/10/2021] Navigation successful
2.	Select 'Choose file'	Your dog Image and dog's partner image	Boxer	Boxer	Google chrome	Pass	[Salay 11.35 A.M. 05/10/2021] Correct prediction]
3	Click 'Back'	N/A	Main Menu	Main menu	Google chrome	Pass	[Salay 11.40 A.M. 07/10/2021] Navigation successful]

- Test case 08

Table 8 Test case 08

Test Scenario ID	Image input-04	**Test Case ID**	04-A
Test Case Description	Image input - Negative test case	**Test Priority**	Medium
Pre-Requisite	1. The user should be logged in 2. A photo of your dog 3. A photo of dog's partner 4. Breed-Great Dane 5. Dog owner-Salay 6. Experience- 4 years 7. Image - dark	**Post-Requisite**	The user should log out from the system Ridgeback

Test Execution Steps:

S.No	**Action**	**Inputs**	**Expected Output**	**Actual Output**	**Test Browser**	**Test Result**	**Test Comments**
1.	Select 'Breed your pet and enter	N/A	Breed your pet UI	Breed your pet UI	Google chrome	Pass	[Salay 11.50 A.M. 07/10/2021] Navigation successful
2.	Select 'Choose file'	Your dog Image and dog's partner image	Boxer	Boxer	Google chrome	Pass	[Salay 11.55 A.M. 07/10/2021] Correct prediction]
3	Click 'Back'	N/A	Main Menu	Main menu	Google chrome	Pass	[Salay 11.58 A.M. 07/10/2021] Navigation successful]

- Test case 09

Table 9 Test case 09

Test Scenario ID	Image input-05	**Test Case ID**	05-A
Test Case Description	Image input - positive test case	**Test Priority**	Medium
Pre-Requisite	1. The user should be logged in 2. A photo of your dog 3. A photo of the dog's partner 4. Breed-Great Dane 5. Dog owner-Shashini 6. Experience- 12 years 7. Image - Light	**Post-Requisite**	The user should log out from the system

Test Execution Steps:

S.No	**Action**	**Inputs**	**Expected Output**	**Actual Output**	**Test Browser**	**Test Result**	**Test Comments**
1.	Select 'Breed your pet and enter	N/A	Breed your pet UI	Breed your pet UI	Google chrome	Pass	[Shashini 12.10 A.M. 07/10/2021] Navigation successful
2.	Select 'Choose file'	Your dog Image and dog's partner image	Ridgeback	Ridgeback	Google chrome	Pass	[Shashini 12.15 A.M. 07/10/2021] Correct prediction]
3	Click 'Back'	N/A	Main Menu	Main menu	Google chrome	Pass	[Shashini 12.20 A.M. 07/10/2021] Navigation successful]

- Test case 10

Table 10 Test case 10

Test Scenario ID	Image input-05	**Test Case ID**	05-B
Test Case Description	Image input - Negative test case	**Test Priority**	Medium
Pre-Requisite	1. The user should be logged in 2. A photo of your dog 3. A photo of dog's partner 4. Breed-Great Dane 5. Dog owner-Shashini 6. Experience- 12 years 7. Image - Blur	**Post-Requisite**	The user should log out from the system

Test Execution Steps:

S.No	**Action**	**Inputs**	**Expected Output**	**Actual Output**	**Test Browser**	**Test Result**	**Test Comments**
1.	Select 'Breed your pet and enter	N/A	Breed your pet UI	Breed your pet UI	Google chrome	Pass	[Shashini 12.30 A.M. 07/10/2021] Navigation successful
2.	Select 'Choose file'	Your dog Image and dog's partner image	Ridgeback	Ridgeback	Google chrome	Pass	[Shashini 12.35 A.M. 07/10/2021] Correct prediction]
3	Click 'Back'	N/A	Main Menu	Main menu	Google chrome	Pass	[Shashini 12.40 A.M. 07/10/2021] Navigation successful]

b. Research Findings

The major objective of this discussion is to analyze the system in relation to its requirements and to rectify any current faults. We'll look at how different photo quality affects how dog breed classification algorithms perform. The findings of the above test cases are summarized in the table below. Each breed's test scenarios were repeated ten times. On the basis of device output, 10 test points will be granted. One point will be awarded for each correct prediction.

Dog breed: Great Dane

Condition	Prediction Right	Prediction Wrong
Image - Clear	10/10	N/A
Image - Not Clear	7/10	3/10
Image - Low Gradient different	8/10	2/10

Dog breed: Boxer

Condition	Prediction Right	Prediction Wrong
Image - high contrast	8/10	2/10
Image - Normal contrast	9/10	1/10
Image - Dark	7/10	3/10

Dog breed: Ridgeback

Condition	Prediction Right	Prediction Wrong
Image - Light	9/10	1/10
Image - Blur	7/10	3/10

Due of the current covid 19 pandemic situations, we were only able to conduct tests on a few dog breeds. These experiments were carried out on Great Danes, Boxers, and Ridgebacks.

c. Discussion

We discovered that the model performs differently in various scenarios. When it comes to a prediction it is mainly considered about picture quality. Even though to train the model we have used around 1800 photos the model did face difficulties identifying the sound correctly. The algorithm may be able to forecast properly if the number of dog images in each class is increased. We utilized high-quality photographs of dogs to train the model. If we can raise the number of photographs in the dog category, we must also increase the number of photographs in the backdrop category.

d. Summary of Each Student's Contribution

Table 11 Summary of Each Student's Contribution

Registration Number	Name	Functions
IT18062816	Wijethilaka M. G. R.	• Implement the function for identifying how the newborn pet looks like • Identifying the dog breed and the color after we select a photo • Generate the food recommendations for the newborn pet. (it is a pdf file, for each breed size there is a unique food recommendation)

		• Generate the medical recommendation especially for the newborn pet. In additionally recommending till 3 years • Implement a suggestion for finding the partner for your dog

CONCLUSIONS

We used machine learning algorithms and deep learning algorithms to identify that dogs can be identified by photographs with greater accuracy. In addition, we found that we can find out what the newborn looks like in relation to the photos included. In addition, food recommendations and medical recommendations are given to these dogs. Also, this app also helps you to find a suitable partner for your dog. This comparable software experience provided by 'Dogodo Breed Your Pet' may be compared to a more experienced dog owner aiding a less experienced dog owner in properly identifying newborn pet outcomes, food recommendations, medical recommendations, and finding a suitable companion.

In some cases, humans are able to predict information faster than algorithms. But these algorithms are able to maintain an average accuracy level of 70%. Convolutional neural networks detect image edges, identify gradient defects, manage high contrast values, and provide a clearer photo for prediction.

```
In [218]: test_accuracy=model.evaluate(X_test,y_test,verbose=0)
          print(test_accuracy[1])

          0.6992289533615112
```

From the system of what newborn puppies look like, food and medical routing and pet owners can find a proper partner for their dog.

The main function of this component of this project is to find the result of a newborn pet. For that, we have the ability to insert photos from the device. For this reason, it can be used anywhere, anytime. More than 1800 total images were used for this test. For that reason, the accuracy of the information received is high.

This component takes into account three factors. Three objectives were met over the course of this study. The conclusions are linked to the goals because they may have an impact on whether or not all of the goals are accomplished. It's fair to say that all of the results were rather impressive. This study focuses on the convolutional neural network, which is very useful in image categorization technologies. Starting with the picture assembling, training model, and classification, the CNN technique was studied in further depth. CNN's epoch's function was able to keep track of accuracy while also preventing underfitting. Some problems were encountered during the study and were able to be resolve by increasing the image dataset, changing the hyperparameters, Using RBG, HSL, HSI, Morphological edge threshold for feature extraction, and using the CNN algorithm (Convolutional neural network)

As future work, we can improve the results of all dog breeds in the world. In addition, using advanced machine learning algorithms, it is possible to make a more accurate prediction based on the amount of data we have considered in this project. Initially, the six most common breeds of dogs in Sri Lanka were used to create nearly 1800 photos, but in the future, this number could be increased to project. Due to our limited resources, we used only these six breeds. It can also improve the ability to capture photos in various formats, such as blurring photographs and enhance the ability to capture blurry images in various formats. All of this can be improved, and the main thing is to need more data.

Furthermore, this web application is a mobile-first application. Because of those things pet owners who are in the difficult provinces, it might be very helpful to have an application like this

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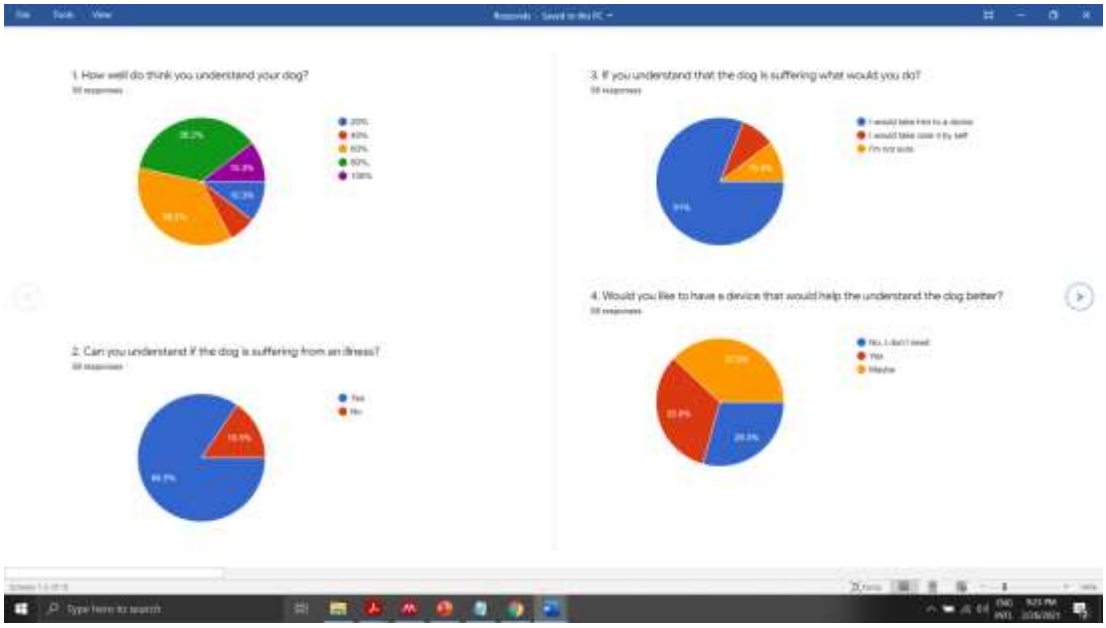
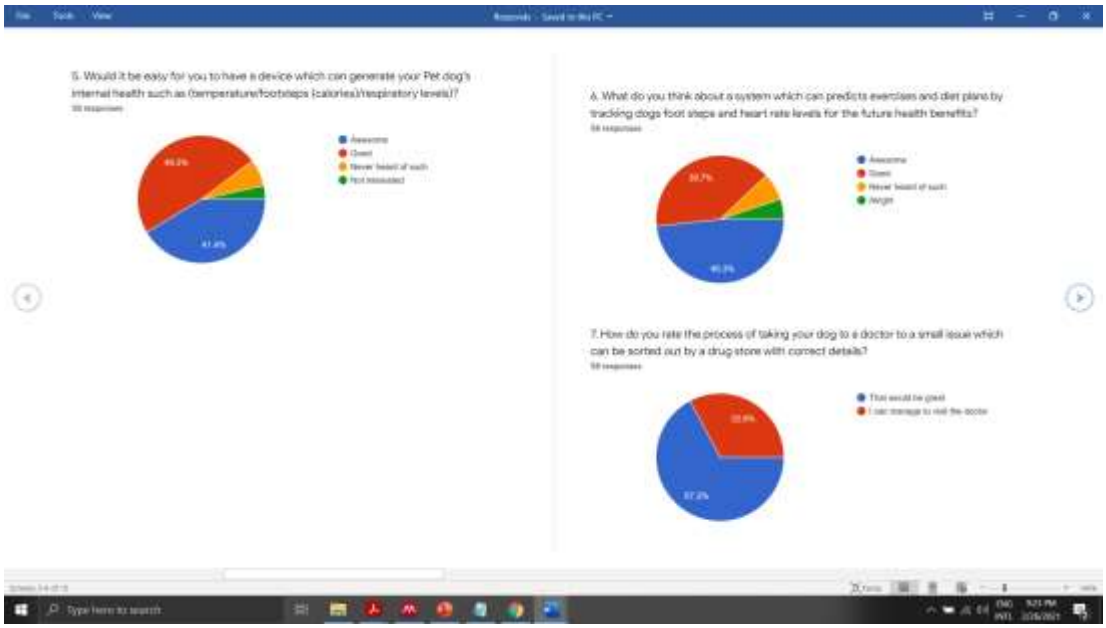
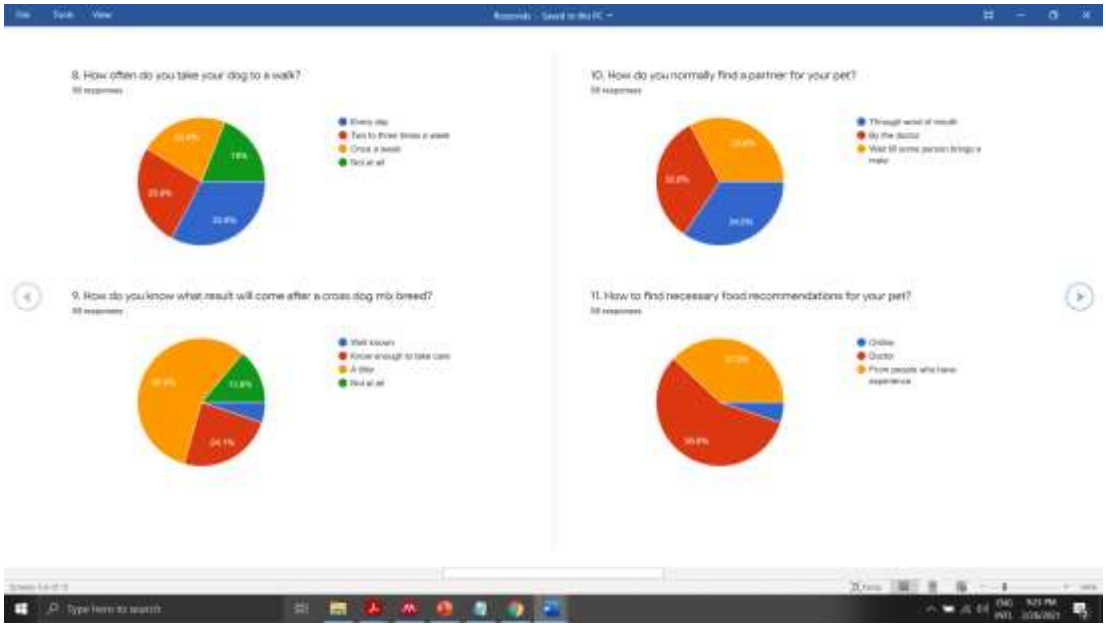
GLOSSARY

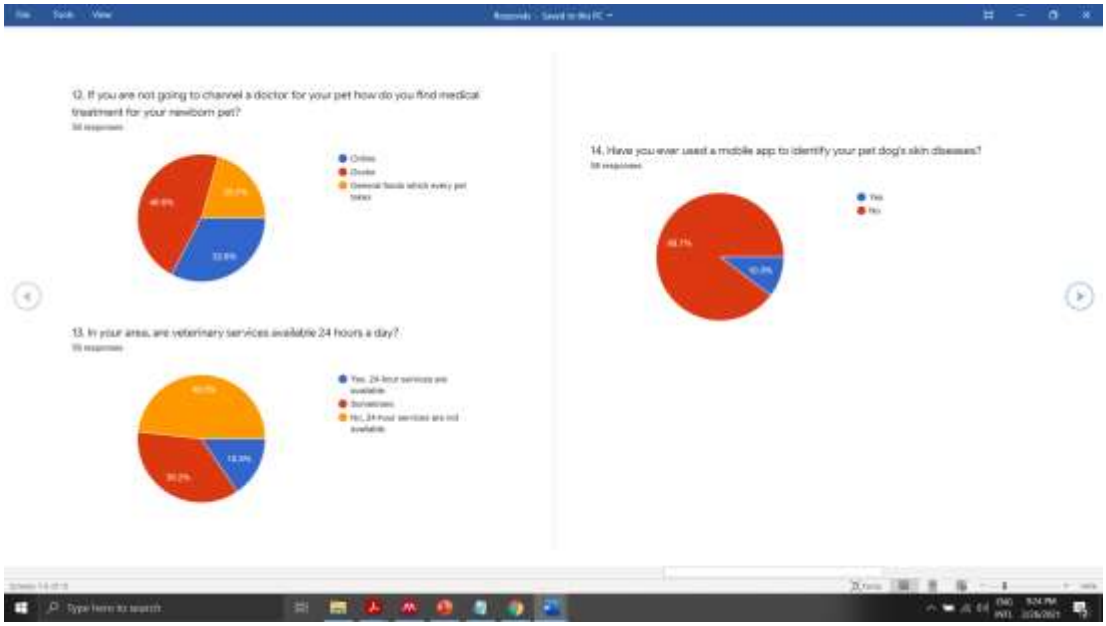
APPENDICES

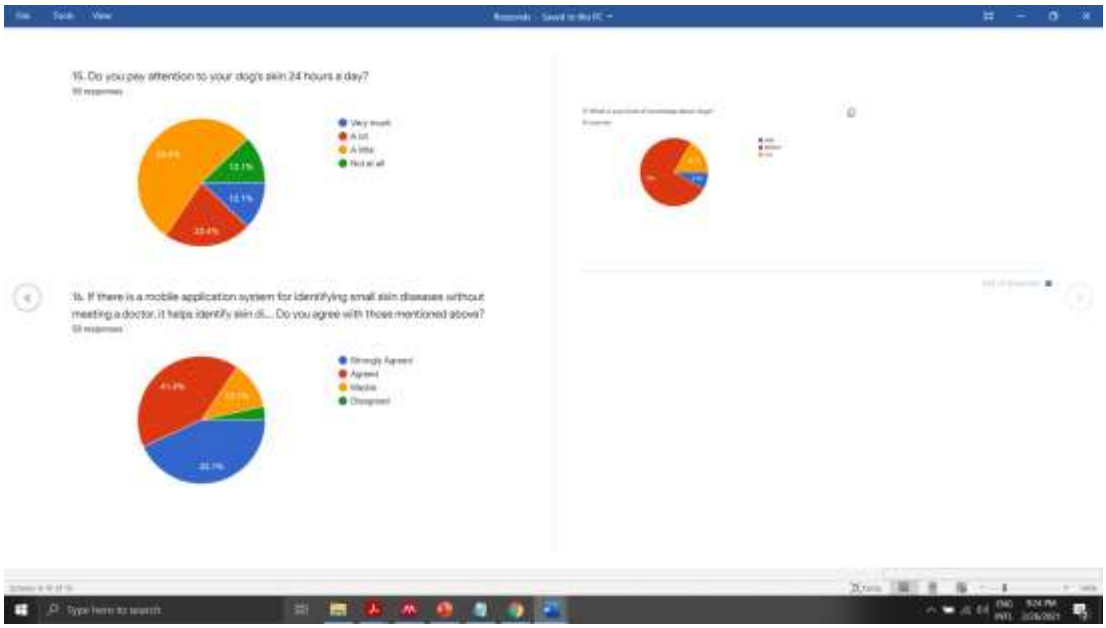
Appendix A: Complete questionnaire results



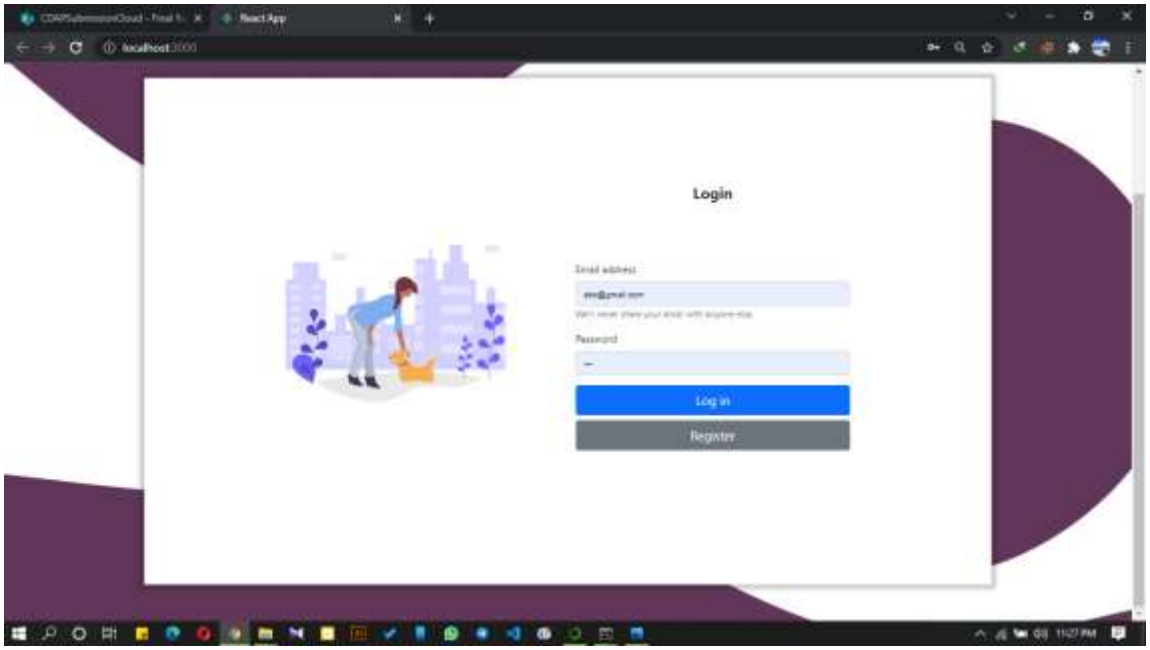


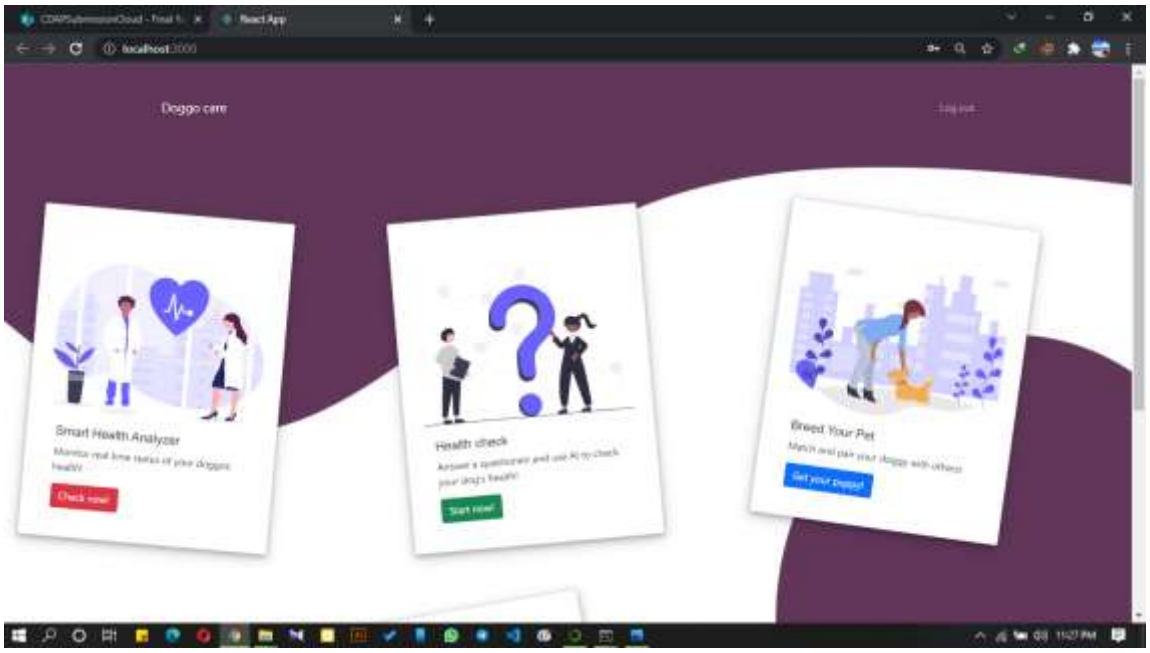

8. How often do you take your dog to a walk?
10. How do you normally find a partner for your pet?
9. How do you know what result will come after a cross dog mix breed?
11. How to find necessary food recommendations for your pet?

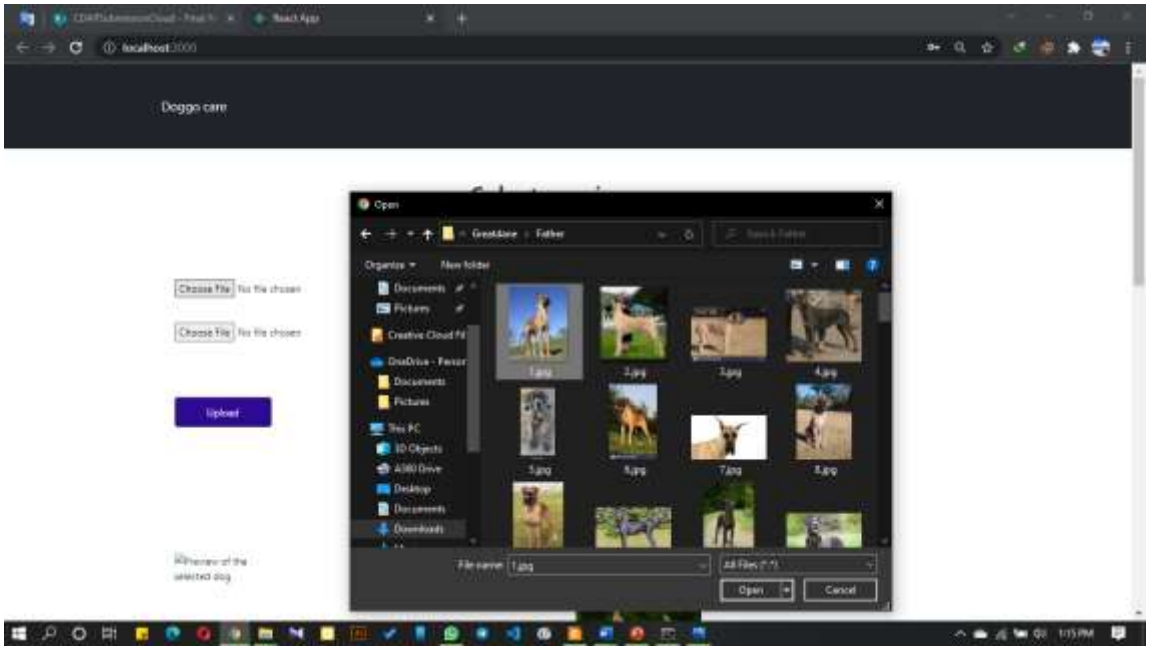

12. If you are not going to channel a doctor for your pet how do you find medical treatment for your newborn pet?
14. Have you ever used a mobile app to identify your pet dog's skin diseases?
13. In your area, are veterinary services available 24 hours a day?

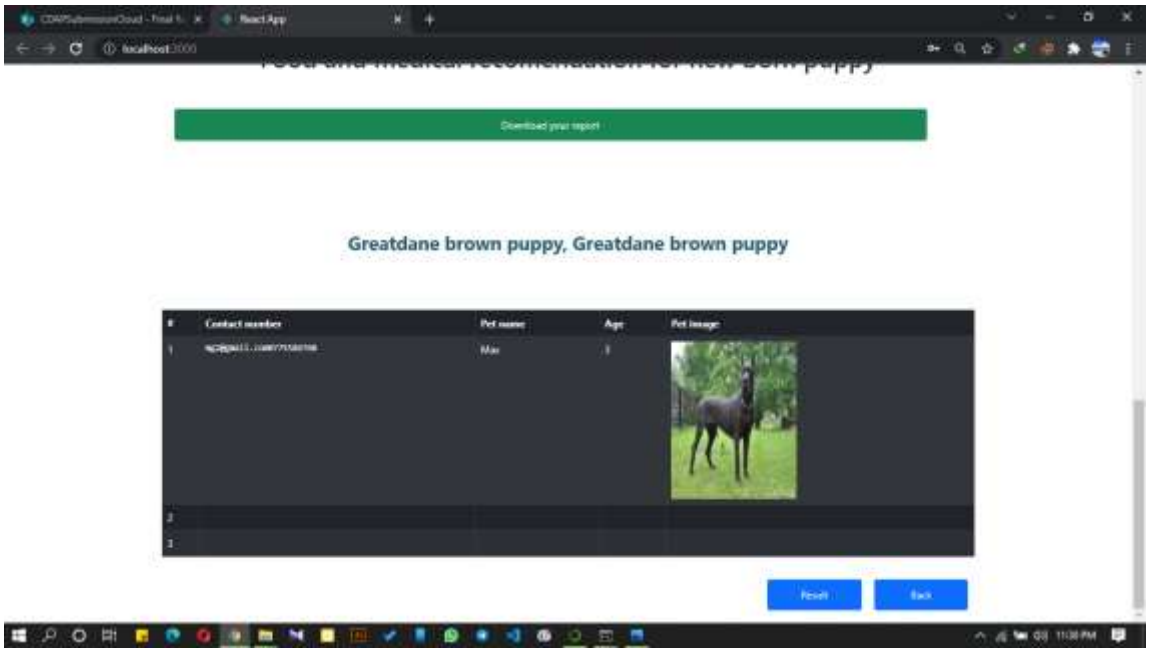


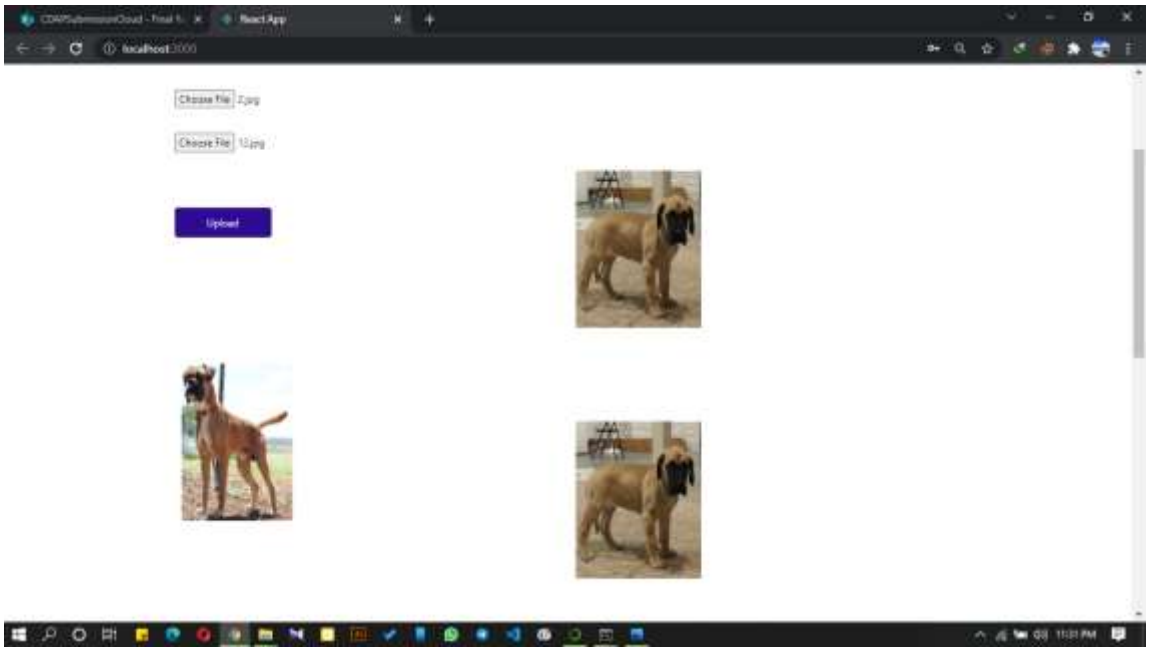
Appendix B: User Interface




Doggo care
Smart Health Analyzer
Health check
Breed Your Pet


Doggo care
Choose File
Upload
Open
Cancel


Download your report
Greatdane brown puppy, Greatdane brown puppy
Contact number
Pet name
Age
Pet image
Max
Result
Back


Choose File
Choose File
Upload