

**DOGODO: IOT BASED ENHANCED MOBILE
APPLICATION TO PROVIDE ESSENTIAL HEALTH
SERVICES TO DOGS**

2021-162

Project Proposal Report

T.S. Chethana Fernando

BSc (Hons) in Information Technology Specializing in
Information Technology

Department of in Information Technology

Sri Lanka Institute of Information Technology

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T.S. Chethana Fernando - IT18001730

Supervisor: Ms. Disni Charuka Sriyarathna

Co – Supervisor: Ms. Shalini Rupasinghe


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DECLARATION

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

Name	Student ID	Signature
T.S. Chethana Fernando	IT18001730	

The above candidate is carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor

Date

.....

.....

(Ms. Disni Charuka Sriyarathna)

Signature of the Co-supervisor

Date

.....

.....

(Ms. Shalini Rupasinghe)

ABSTRACT

Skin is generally one of the first places where dogs show signs of recurrent disease. While most dogs' skin problems are not emergencies, and it is vital to get an accurate analysis of how this condition can be treated. In recent times, computer vision applications have been developed to allow artificial intelligence to identify patterns in images quickly. Notwithstanding these advances in technology, the process is not yet adequately automated to identify pet dogs' skin diseases, making dog skin diseases challenging to identify and time-consuming. To reliably classify skin diseases, we use a two-stage method that effectively incorporates Mobile Vision-based technology with image processing and Machine Learning on scientifically evaluated features. The skin disease images are subjected to different pre-processing techniques in the first step, followed by feature extraction. The second stage entails applying machine learning algorithms to classify diseases dependent on histopathological characteristics discovered during skin analysis. The capture images are evaluated using sample images from the Amazon Web Services (AWS) database and image sorting. Furthermore, it specifies the expected outcome on the application's ability to interpret the captured image and provide the information needed. An online user can also detect skin diseases in dogs, make available advice on severe skin diseases, or proceed with popular automated products for skin diseases in a specific short period through the chatbot. This research proposes a feasible solution for dog owners. Automated away medicinal chatbots are conversationally established with technology in mind, with the possibility to minimize healthcare expenses and facilitate access to medical services and information. The research study chatbot provides dog skin diagnostics for further operations and provides dog owners with a simple analysis and conversational approach to accurately diagnosing pet dog skin diseases, improving dog training, and pet dog food knowledge.

Keywords – Dog Skin Diseases, Image Processing, Machine Learning, Mobile Vision-based technique, Automatized, Chatbot

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LIST OF ABBREVIATIONS

Abbreviation	Description
ANN	Artificial Neural Network
AWS	Amazon Web Services
CNN	Convolutional Neural Network
DT	Decision Tree
ML	Machine Learning
NPL	Natural Language Processing
NUL	Natural Language Understanding
OpenCV	Open-Source Computer Vision
POS	Parts-of-Speech

1 INTRODUCTION

1.1 Background

Dogs are probably the best friend of man anywhere in the world, particularly to real pet enthusiasts. Dogs understand their owners' feelings and are open to their owner's emotions. There are only a couple of the explanations that most people choose to have a dog as a friend than some other kind of pet. However, it is an undeniable reality that these lovable animals are to various skin diseases, especially their skin, as it is the most extensive and most accessible organ of skin in their body. Comparable to humans; unfortunately, skin diseases are prevalent in dogs [1].

According to a local veterinarian, there are two main types of skin diseases of dogs: the curable and the incurable kind of skin diseases. The curable ones range from acute to self-limiting issues, while the incurable one is known as a persistent condition needing lifelong care. Additionally, many incurable skin diseases originate in dogs, which are the most common inherited skin diseases [2]. As examples, contagious skin diseases include parasitic, bacterial, fungal, and viral skin diseases. The non-contagious skin diseases include mange, mites, and lice, all fall within this category, along with flea and tick infestations [1] [3].

Despite the existence of technologies, there will still be limited use of mobile vision-based applications to identify skin diseases in dogs, and it can only detect two kinds of skin diseases as it is not properly localized. According to local dog owners who took part in the survey, dogs with skin diseases are underestimated, and their skin diseases are ignored due to a lack of time to see a veterinarian. Further, many dog owners have limited knowledge of dog skin diseases. Therefore, most dogs' owners agree with having the mobile vision-based solution.

16. If there is a mobile application system for identifying small skin diseases without meeting a doctor, it helps identify skin di.... Do you agree with those mentioned above?
58 responses

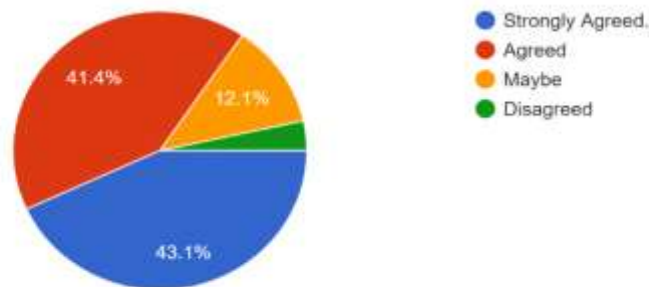


Figure 1.1- Summary of responses for mobile application for identifying diseases

Therefore, the aim of this research is to develop a mobile application on the Android platform for the use of dog owners and to introduce a chatbot to assist dog owners in finding veterinarians about dog skin problems and finding popular market products for skin diseases. With this, dog owners can use a camera on the back of an Android-powered phone to take an image of their dog's skin disease, and then upload it via the mobile app's chatbot to detect skin diseases. If it is a minor issue that can be healed by popular products in the market, it will pop up via the chatbot in the mobile app. (for example, powders for swollen skin resulted from tick bites, dog shampoos for dry skin, rash creams, Etc.). The user is informed through the chatbot in the mobile app that their pet dog needs medical treatment for a serious problem. Features of the mobile app allow the user to find veterinarians and veterinary centers in the nearest city. Moreover, the chatbot provides information on dog skin diseases for further operations and provides a conversational approach to accurately diagnosing pet dog skin diseases. It also provides dog owners with a simple analysis and conversational approach to improving their knowledge of dog training, and pet dog food. The research study component proposes to offer a feasible solution for dog owners.

1.2 Literature Review

The main goal of this study is to develop a mobile application-based platform for dog owners to identify their dog's skin issues, remind them of the need for medical attention according to the severity of their pet dog's skin disease, and identify common market products for their skin. Here the skin diseases related to the classification of those diseases are identified. The skin diseases related to the classification are stated below: Ticks, Redness (Color or Texture Changes), Shedding and Hair Loss, Rashes, Dry or flaky skin, Mange (Mites), Fleas, Swelling, Lumps, Hot spot [2].



Figure 1.2- Skin diseases types

Many researchers have suggested image-based techniques to classify pet dogs skin diseases. Hereabouts, we quickly study some of the technologies and techniques mentioned in the literature review. This approach is suggested to identify skin diseases with a chatbot using color representations without veterinarians' involvement. The strategy entails various stages: the first identify skin diseases using color image processing methods, K-means clustering, and color gradient techniques to recognize

diseased skin in dogs, and the second implements a CNN to classify skin disease patterns. The K-means algorithm attempts to reduce the square error in the next object function. The goals function is as follows:

$$J = \sum_{j=1}^c \sum_{i=1}^n \|z_i^{(j)} - v_j\|^2,$$

Figure 1.3- K-means algorithm [4]

where $\|z_i^{(j)} - v_j\|^2$ is the chosen distance measure between every point, $z_i^{(j)}$, and the cluster, v_j [4]. The value of this function represents how close the data clusters n is to their cluster models. The steps of the algorithm are as follows:

- I. For the space comprising the grouped items, choose the k mark. These are the designs for the first group.
- II. Assign each object to the team that has the most similar prototype.
- III. Recalculate the positions of the k prototypes once all objects have been allocated.
- IV. Repeat steps II and III until the prototype values do not alter any more. As a result, items are divided into categories, and the metric to be reduced will be computed.

The first step of identifying skin diseases is to identify image features. In this system, the higher the number of characteristics from an image, the higher the system's accuracy [7]. The focus here is on analyzing the different segmentation methods that can be used to classify different skin diseases using image processing. A mechanism of disintegration is defined, and it falls on the boundaries of the infected site to add more features [7]. This process focuses on sophisticated algorithmic databases and images from various pet dog skin tools and suggests developing a technique for dark skin diseases. In this case, the numerous pet dog skin diseases listed above may lead to severe issues by spreading to different regions. Therefore, the proposed system automatically determines the severity of skin diseases.

The system uses the Open-source Computer Vision (OpenCV) to identify and interpret images of captured skin diseases and the trained CNN model to determine the skin disease and its classification [10]. To improve object detection, both TensorFlow and OpenCV will be used together. The object defined with OpenCV is not optimal and utilizing TensorFlow extends the reach of network and algorithm research. TensorFlow is designed for data access and handling, while OpenCV is optimized for data access and handling. As a result, these are used to detect objects together [9]. The new technique is proposed to identify pet dog skin diseases using a chatbot combined with machine learning. The suggested CNN algorithm would be included in the current study [10]. CNN's procedural phases are represented in Figure 1.3. The CNN reduces the scale of the input images to make them easy to process. The mobile vision role is to extract image features, while machine learning is used to detect skin diseases. The system will be evaluated on ten types of skin diseases with categorizes of minor and severity issues. In the next stage, Train a model for the popular market production for pet dog skin diseases. There are three types of machine learning techniques: supervised, unsupervised, and reinforcement learning [8] [10].

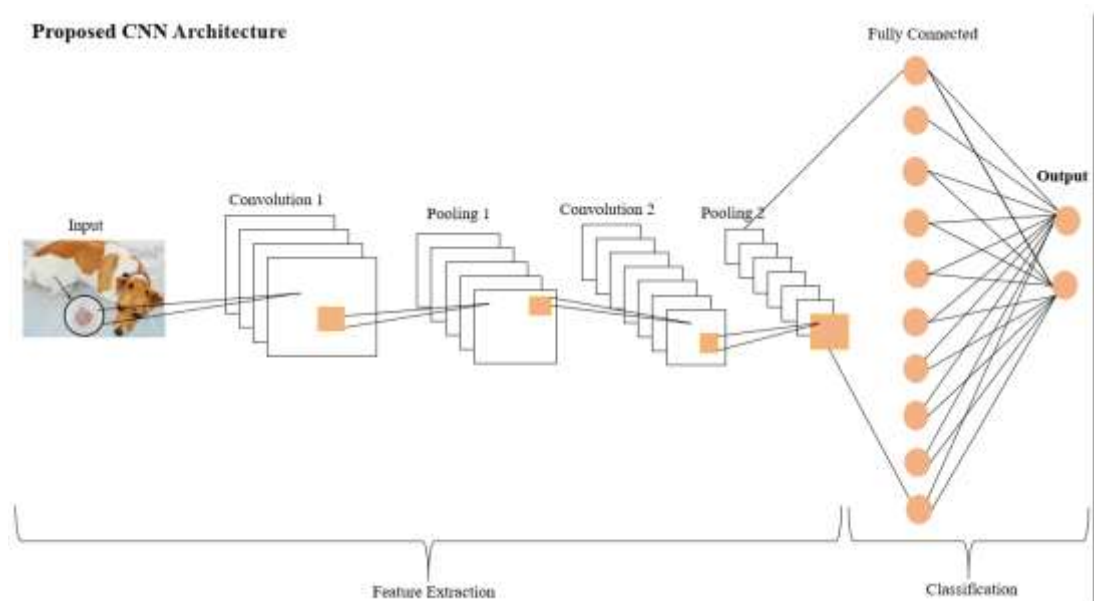


Figure 1.4- Proposed CNN Architecture

Hereabouts, Decision Tree (DT), CNN, and Nive Base are examples of machine learning algorithms that have been used to forecast popular market production for a variety of minor issues concerning pet dog skin diseases [8,10]. If it is a severe skin disease, suggestions to find veterinarians through a combined recommendation framework are made via chatbot. It will provide fast service to pet dog owners through the mobile-based app in circumstances of emergencies. Cluster analysis considers some findings correlated and helps explore new important future predictions for minor skin problems that were not part of the basic conceptualization of the effects of pet dog skin diseases.

Chatbots are a computer-aided program that mimics user activity on one side of a chat conversation. They are simulation systems that pretend that the two are engaged in a conversation. They serve as a model for efficient and intelligent relationships with the user on the other end. They provide services similar to those provided by advertisers, sellers, consultants, and other intermediaries. Chatbots are used in a variety of domains. Marketplace, Business, Stocks, Customer Service, Wellness, Counseling, Recommendation Systems, Support Systems, Media, Brokers, Journalism, Web Grocery & Accessories Shopping, Travel Chat, Financial Chat Boat, Recipe Guide, and more are just a few examples. The user of this mobile application will notify the chatbot about their pet dog skin issues, and the chatbot will instruct them on what health measures they should take. The dataset includes general knowledge about diseases. Therefore, the chatbot instance will provide the user with disease and treatment information. After analyzing different pet dogs' symptoms of the disease, it ultimately forecasts the disease and offers a guide to more detail about the treatment. After segmentation and utilizing the image process step, the POS (Parts-of-Speech) tagger joins the pet dog skin diseases images [10]. Natural language understanding, also known as NLU, is a subset of NLP (Natural Language Processing) that helps a machine comprehend natural language or spoken language. In normal circumstances, human conversational language is not as perfect as a formal language [10]. It is not concerned with words or grammar. As a result, it is tough for a machine to figure out what the sentence's purpose is. The user's input is received in an unstructured text

format that the device is unable to comprehend. As input, only organized models are accepted [10]. The unstructured text derived from the user is converted into a structured format by extracting keywords and trends from the user text using NLU methods.

NLU technology detects if the machine is being used by the user while chatting with the chatbot. NLU systems do not directly understand the context of user sentences. A series of procedures must be followed to determine the true intent of the sentence. To completely comprehend a phrase, the NLU system would comprehend every word. The first is to break down the phrases for dog skin diseases, dog training, and pet dog food into their constituent phrases. In order for the system to comprehend the expression, it must first comprehend the syntax of the phrase. Knowing the elements of each word spoken in the statement is one way to do this. Each word's grammatical weight is decided, and then they are all evaluated to see how dependent they are on one another. This is the most crucial stage, as it is at this point, the most reliant term is extracted, and the system's purpose is revealed. It is possible that the knowledge-based user did not send the exact wording. It may mean the same thing as the preceding statement, so it is written differently. Contemporaries and matching sentences may also be determined when balancing this type of synonymous phrase. The multiple tasks undertaken by the NLU engine and the processes used to execute them are given more focus.

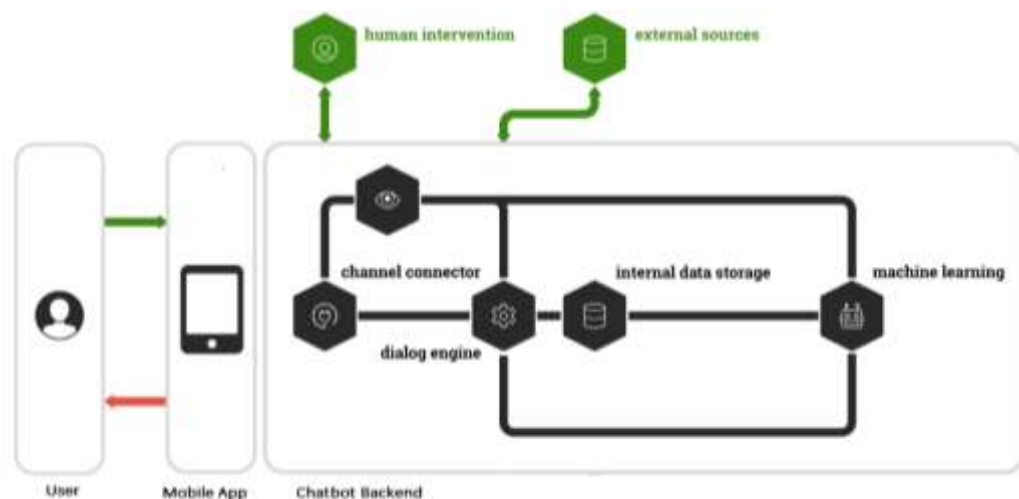


Figure 1.5- NLU Architecture

1.3 Research Gap

During the literature review, I have found several ways to detect dogs' skin diseases and analyze systems. Hereabouts, the relevant research on existing skin disease systems is considered and compared.

- ✓ Skin Infection Detection in Android using Image Processing

The software helps people to be more knowledgeable of their skin health status to recognize skin diseases. Infected skin must be collected to recognize and scan the captured image utilizing the OpenCV image processing feature. The system then tracks the signs and effects, evaluation, and care of the skin's contaminated region. Of these, utilizing that only two forms of skin diseases can be described [1].

- ✓ Segmentation and Classification of Skin Lesions for Disease Diagnosis.

This study included five separate skin infections: seborrheic keratosis, melanoma, bullae, squamous cell carcinoma, and shingles. To eliminate external noise and hair, the fragmentation procedure is done by filtering the skin image and absorbing the injured regions. The application of image fragmentation was also used in the analysis to classify the injured areas with the characteristics of the derived color and texture [11].

- ✓ Design and Development of Online Dog Diseases Diagnosing System.

This study focuses on common dog diseases and aims to implement a platform in the future that will detect dog diseases such as parvo, distemper, glaucoma, jaundice, colitis, whooping cough, virus, and leptospirosis. The research demonstrates the importance of early detection of the above diseases. Furthermore, the device assists dog owners in identifying the condition and including clinical instructions regarding outcomes and advice [12].

✓ Skin Cancer Detection Using Artificial Neural Networking.

The study's aim was to create an automatic application that uses images of skin lesions taken with a digital camera to predict a patient's likelihood of developing melanoma [13]. The study concentrated on the benefits of neural networks in the analysis of skin cancer pictures. ANN has been used in cancer diagnosis to overcome issues that cannot be solved by other recognition methods or conventional image recognition.

✓ M-Health Skin: Disease Analysis System Using Smartphone's Camera.

The analysis showed a smartphone-based technology that helps users to identify the skin for skin diseases. M-Health solution is a smartphone-based skin health analysis system that requires mobile neural networks to identify regular skin images and irregular skin images. An intelligent learning algorithm and a mobile phone's camera are used [14].

✓ Automating skin disease diagnosis using image classification.

Skin cancer incidence is progressively rising, especially in Caucasian population countries that inspire this research. The study aims to minimize the dependence on doctors' opinions by making usage of a feature based on texture analysis and diagnosing the lesion by using the artificial neural network as a classification technique [15].

proposed system displays the detected skin diseases and analyses the severe and minor skin diseases of the common dogs' skin diseases. Furthermore, predicting the of popular medicine products in the market. (for example, powders for swollen skin resulted from tick bites, dog shampoos for dry skin, rash creams, Etc.). It also provides future predictions for the possibility of recurrence of these minor skin diseases. All the functionality through the chatbot system.

Table 1.1 - Comparison of Existing Solutions

	Skin Infection	Skin Lesions	Online Dog Diseases	Skin Cancer	M-Health Skin	Automating skin	Proposed System
Chatbot suggest the skin diseases symptoms	X	X	X	X	✓	✓	✓
Uploading an image in to chatbot	X	X	X	X	X	✓	✓
Prediction of treatment products	✓	✓	X	✓	✓	✓	✓
Find veterinary	X	✓	X	X	✓	X	✓
QA for pet dog training and foods	X	X	X	X	X	X	✓
Future prediction for the possibility of recurrence	X	X	X	X	X	X	✓
Online Clinical Book	X	X	X	X	X	X	✓

1.4 Research Problem

One of the research study's main problems is targeting to identifying common skin diseases in canines. Usually, the dog's skin diseases can be caused by environmental factors, food, insect bites, or various dog activities. Most people lack the proper knowledge about the skin diseases of dogs. Most of the time, these skin diseases can be easily treated with over-the-counter medication [3]. Often, canines develop skin diseases that need immediate relief. However, veterinarians' availability and the costs associated with the hospital visit delay the diagnosis and treatment. This is especially an issue if the dog is abandoned or stray [3]. The most common solution to skin problems is for owners to take their pet dog to the pet. However, in some areas, veterinary services are not available 24 hours a day. Such that, the Lack of alternative treatments directly affects the dog owner and the dog.

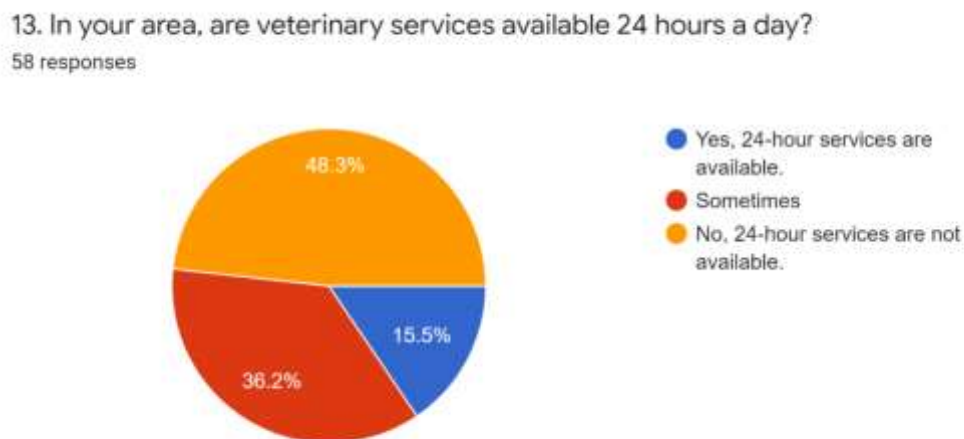


Figure 1.6- Summary of responses regarding 24-hour veterinary service

In some cases, dog owners abandon the dog based on their health and behavioral issues without knowing how to react to their disease-related issues. The number of stray dogs has gradually increased due to the repeated action of people abandoning dogs. We can see a lot of such problems in recent times. The conclusion from these facts is the existing ways used to identifying skin diseases for dogs are inefficient and not

systematic. If users are busy, they may not have enough time to concentrate on the dog 24 hours a day. As shown in Figure 1.7, more than 51% of survey respondents say they do not have enough time to focus on the dog 24 hours a day.

15. Do you pay attention to your dog's skin 24 hours a day?

58 responses

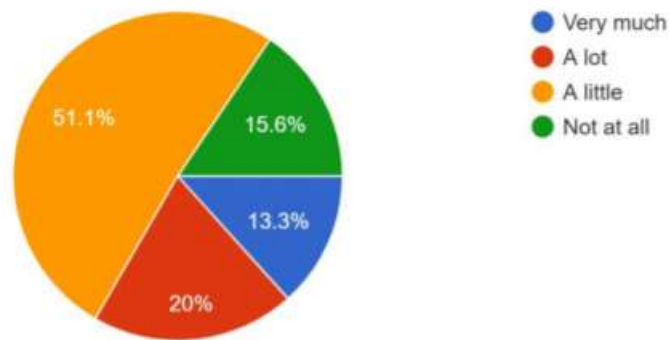


Figure 1.7- Summary of responses regarding pet owner's attention

Therefore, users are looking for the easiest way to take care of their pet dogs. Because, for absolutely anything today, there is an app. As shown in Figure 1.8, more than 42% of survey respondents say they Strongly agree with a localized mobile app chatbot for identifying skin diseases.

16. If there is a mobile application system for identifying small skin diseases without meeting a doctor, it helps identify skin di.... Do you agree with those mentioned above?

58 responses

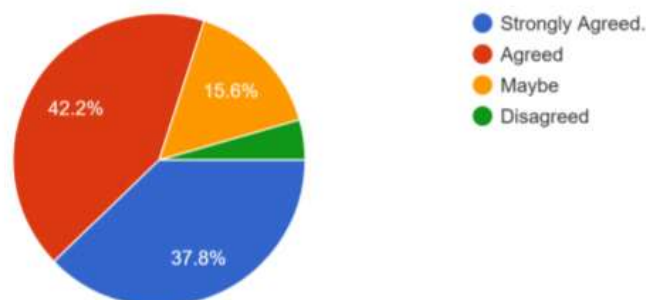


Figure 1.8- Summary of responses regarding user agreed with mobile solution

2 OBJECTIVES

2.1 Main Objectives

The component's main purpose is to introduce a technology-based mobile vision to dog owners to identify different types of skin diseases in pet dogs. This component will use preprocess images from reliable resources to compare device upload images to predict skin-related disease in an accurate way. Therefore, only the mobile camera should be used to detect skin issues, and this component is useful for users. Based on image observations, the app will determine whether skin-related diseases are minor or severe. Therefore, dog owners can get to the best conclusion about their dog's skin diseases.

2.2 Specific Objectives

The following specific aims can be obtained in the research study to gain a high precision dog skin detector. For analyzing the dog skin's disease images, necessary images will be collected with the assistance of two veterinarians from the Animal Hospital, Negombo, and the Animal Clinic, Nittambuwa. The connection images are taught by using the image processing and decision tree algorithm. Skin issues are categorized in two ways, severe issues, and minor issues.

- **Implement a Chatbot**

The chatbot handles the main component and sub-components. The user to identify skin diseases uploading image via a chatbot. After the conversation with chatbot, the user can view the skin diseases of the pet dog and the level of the diseases.

- **Minor issues Detection**

Hereabouts, the system will detect the pet dogs' minor skin diseases and analyze and verify the minor issue level of features. After this step, the mobile app chatbot will generate detailed information about the pet dog's skin diseases.

- **Severe issues Detection**

The system will detect the pet dogs' severe skin diseases and analyze and verify features of the severe issue level. The mobile app chatbot will generate detailed information about the pet dog's skin diseases.

- **Prediction of Popular products for minor issues**

If it is a minor issue that can be healed by popular products in the market, train a model for the product suggestion. It will pop up through the mobile app chatbot. (for example, powders for swollen skin resulted from tick bites, dog shampoos for dry skin, rash creams, Etc.).

- **Prediction of veterinarians related to the area**

The user is informed that their pet dog needs medical treatment for the severe issue through the mobile app chatbot. For this suggestion, there will a training model with details about the veterinary surgeons and veterinary centers. Features of the mobile app allow the user to find veterinarians and veterinary centers in the nearest city.

- **Implement skin diseases symptoms**

This component enables the user to select skin diseases without uploading the image. Then the chatbot will communicate with the user and suggest the symptoms of skin diseases. The component provides knowledge about the symptoms of skin diseases.

- **Future prediction for the possibility of recurrence of skin diseases**

For minor problems, a training model can predict the probability of recurrence of pet dogs' skin diseases. The chatbot will generate descriptive information about the probability of recurrence.

- **Implement QA for pet dog training and pet foods through the chatbot**

The user can communicate with the chatbot about the questions of the pet dog training and pet foods. The user can get a better experience with QA conversion with a chatbot.

3 METHODOLOGY

The proposed mobile-based app chatbot to enhance the user experience for identifying skin diseases of pet dogs.

- Enable to identify skin diseases from the easiest way.
- Utility of veterinarians and expenses related to hospital visits delay diagnosis and treatment. Therefore, the app demonstrates a feasible solution for all matters.

Feasibility studies and user research were conducted as the first task, as there are many areas that need to be covered in order to provide an optimal solution.

3.1 User Research

The requirement gathering stage is the first phase in the product development process. Hereabouts, we created a questionnaire on dog owners' knowledge of the pet dog and gathered information. The domain literature was also studied to identify users' needs and identify needs that have not been implemented.

14. Have you ever used a mobile app to identify your pet dog's skin diseases?

58 responses

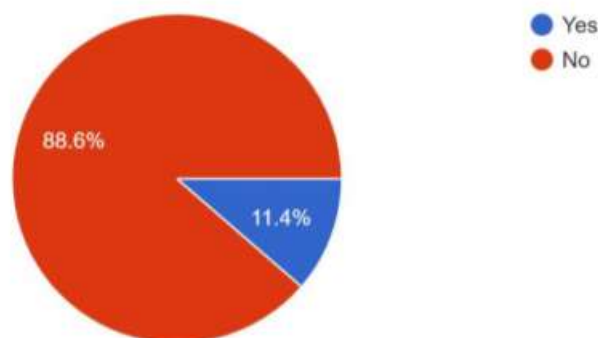


Figure 3.1 - Summary of responses regarding use a mobile app for skin disease

As shown in Figure 3.1, more than 89% of the survey respondents said they had never used a localized mobile app to identify pet dog skin diseases. Since there no proper localized method for identifying dog skin diseases, we compared our proposed system with other skin disease detection systems, designed a case scenario, and examined user needs.

3.2 Feasibility Study

✓ Technical Feasibility

When evaluating previous research reports, we looked at the latest technology stack, and we discussed the Technical feasibility of this project. It is feasible with the latest technology stack and with the proposed framework. However, we need to improve this component development knowledge because it is essential throughout the product development process.

✓ Economic Feasibility

The application's components are distributed among the team members for us to complete the application with all the functions integrated effectively. Identifying pet dog skin diseases will be very useful for the successful development of the system and will reduce the cost of free access using a mobile phone without consulting a veterinarian.

✓ Scheduling Feasibility

The proposed system should also be completed before the deadline. We examine the Scheduling Feasibility and establish our tasks by the deadlines. Furthermore, present for delivering the final product on schedule.

- Implementation Stage

The implementation phase is consistent with the following functional development,

- 1) Build a chatbot
- 2) Implement the discussion of skin diseases identification
- 3) Implement level of skin diseases level
- 4) Implement popular market products for minor diseases
- 5) Implement a suggestion for finding the veterinarians (For severe issues)
- 6) Implement QA discussion for pet dog foods and training
- 7) Implement probability of recurrence for skin diseases
- 8) Implement pet dog online clinical book

These functions will be developed with mobile User Interfaces.

- Testing Stage

As appropriate, attention should be taken when examining components for skin disease issues of pet dogs. Therefore, the first testing phase should be performed under the pet clinic's permission.

- ✓ Operational Feasibility

Make available advice for severe skin diseases or proceeds automated popular products for skin diseases in a specific short period through the chatbot. As well as the get proper knowledge about the pet dog training and pet dog foods with communication the chatbot. The user can easily maintain the online clinical book. The user benefits from this feasible solution. The mobile app will help users to avoid the problem of pet dogs.

3.3 System Overview

- OpenCV (Open-Source Computer Vision Library) – Image recognition and optimizing
- TensorFlow – Images preprocessing and classification
- Google Collab – to gain computation power to train the image recognition model.
- AWS S3 - Amazon S3 buckets are equivalent to file directories include that they store objects which have data and descriptive metadata. Images uploaded by users are stored on the AWS S3.
- MongoDB Atlas – Database server
- Python – Backend development language
- Apollo / GraphQL – It is a way to bring data from an API into an application by loading data from a server to a client.
- React Native – Development language of the mobile application.



Figure 3.2 – System Overview

3.4 Software Solution

In this section of the proposed study, we detail how this section is designed and how it integrates with the main structure. We will use the Agile approach since this is a research and development project [14]. It allows continued iteration of development, Integrates and testing phases. The authors' solution would be focused on the system developed by the literature survey and the survey implemented, which will result in continual improvements since Scrum can test and adapt to evolving requirements.



Figure 3.3 – Agile Software Development Lifecycle [14]

3.5 Work Breakdown Structure

The working breakdown structure of the development process is shown in Figure 3.4.

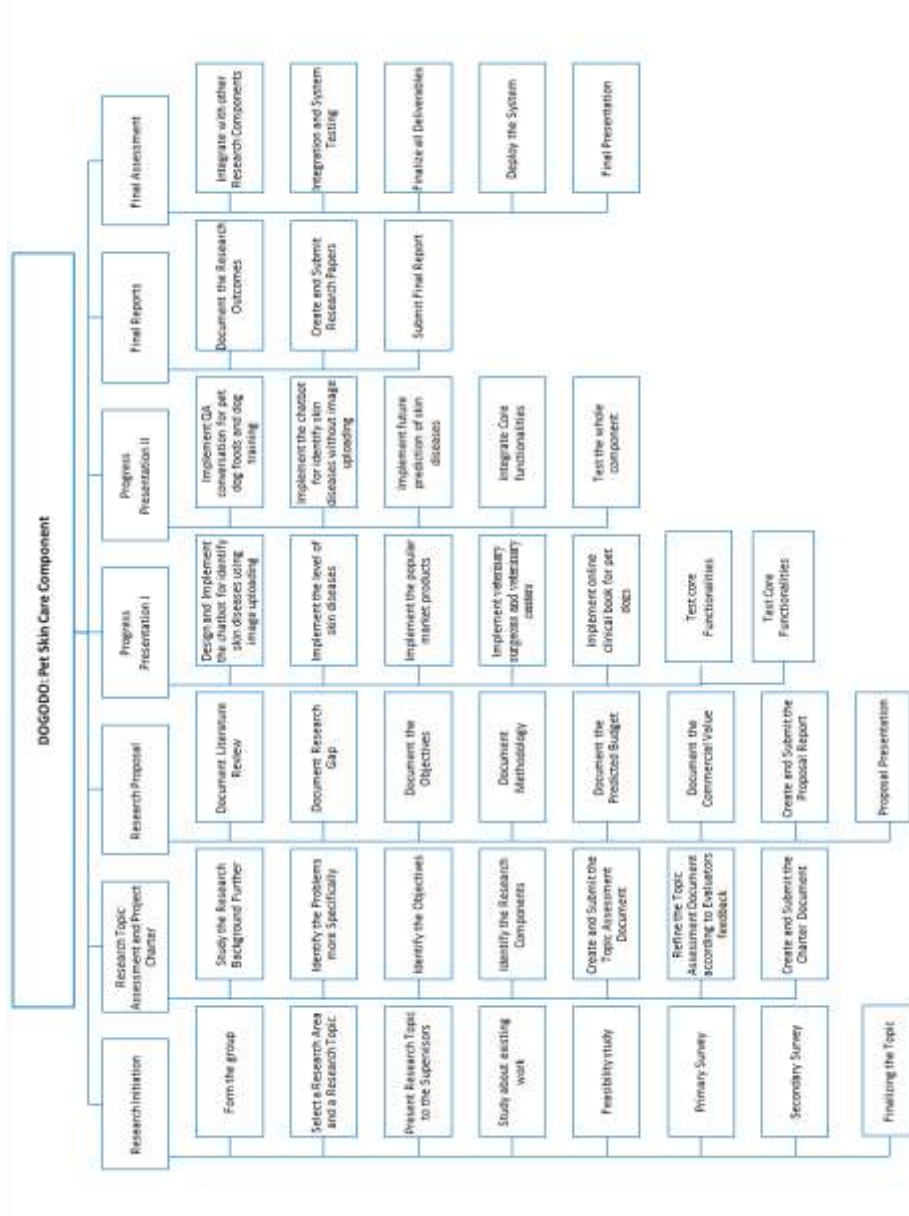


Figure 3.4 – Work Breakdown Structure

3.6 Gantt Chart

The Gantt chart of the development process created according to the temporal time periods is shown in Figure 3.5.

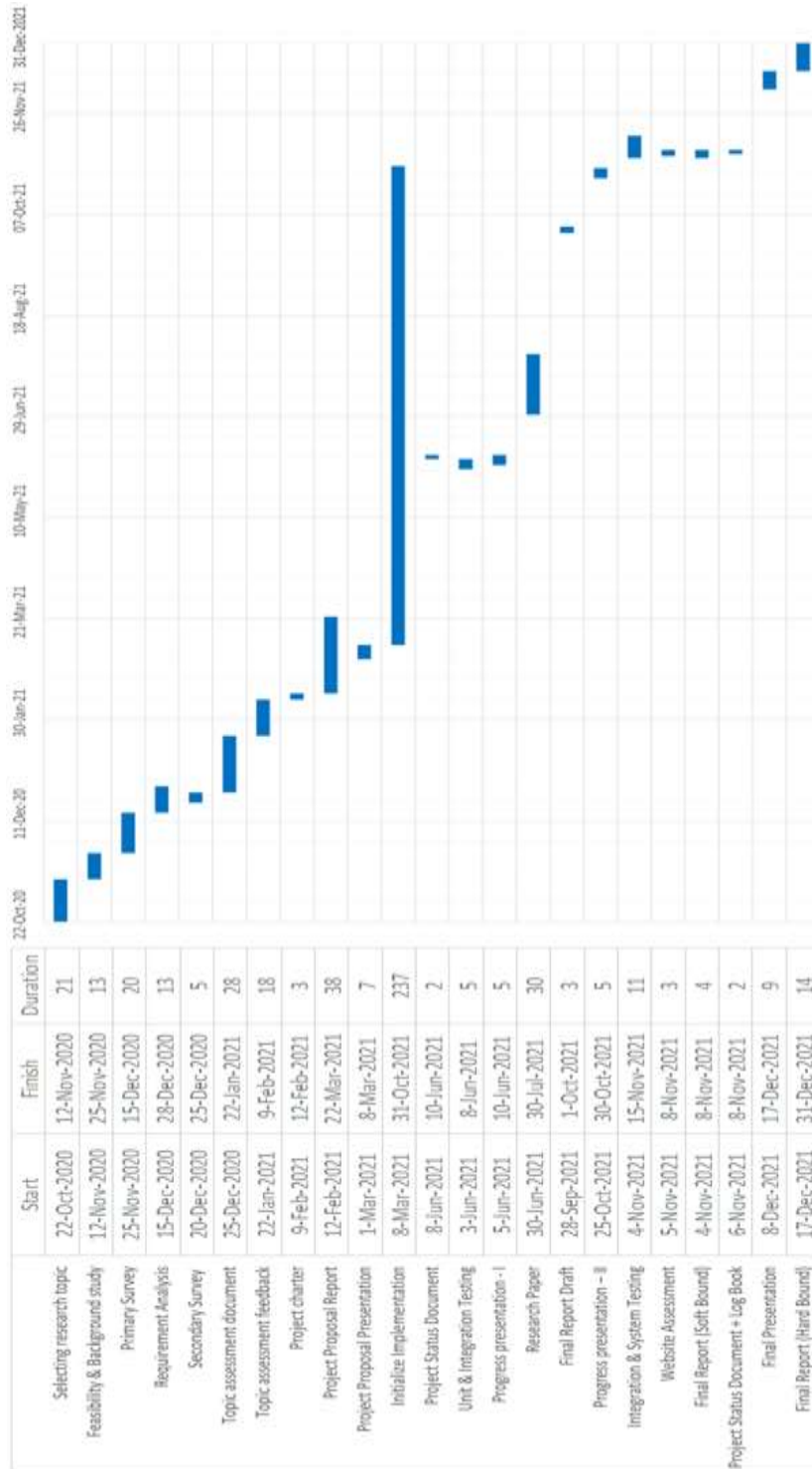


Figure 3.5 – Gantt Chart

4 PROJECT REQUIREMENTS

4.1 Functional Requirements

- ✓ The pet dog owner should be able to communicate with the chatbot to get feasible solutions for skin diseases uploading images.
- ✓ The user should be able to select skin diseases and view the symptoms.
- ✓ The user should be able to view popular market products for identified minor skin diseases through the mobile application chatbot.
- ✓ The user should be able to view the level of the severe issue. Then user to suggest veterinarians' attentions through the chatbot.
- ✓ The pet owner should be able to maintain the pet dog online clinical book.

The main operational requirements are listed preceding. Moreover, the use-case diagram with other functions is depicted in Figure 4.1

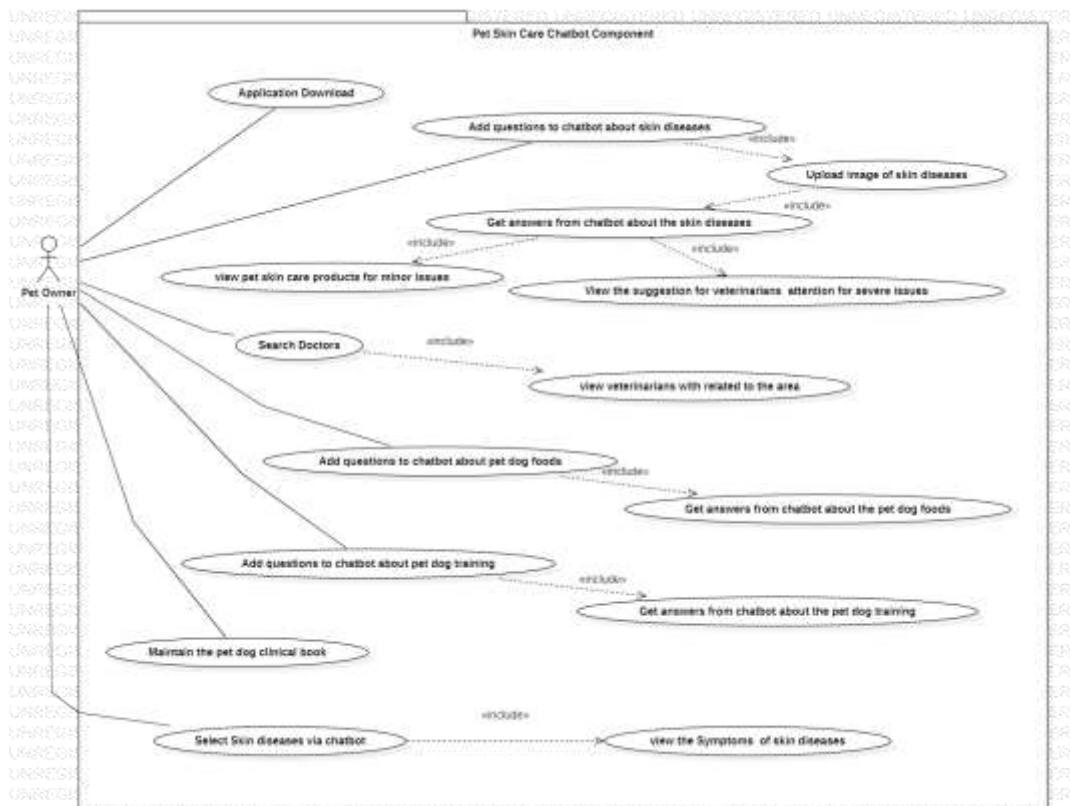


Figure 4.1 – Usecase Diagram

4.2 Non-Functional Requirements

✓ Availability

The AWS S3 service is required to store images uploaded by the user. The AWS S3 Service must have high availability; otherwise, the end-users service will be disrupted.

✓ Usability

The study aims to develop a mobile application on the Android platform to use dog owners and add a chatbot to help veterinarians find out about skin issues in dogs and explore popular market products for skin diseases. The end-users should be able to use the solution efficiently and easily.

✓ Modifiability

The development process remains the agile process, and there are always requests for codebase changes. Therefore, the codebase needs to be changed from time to time to change the project's requirements.

✓ Capacity

Since this system is installed and used as a mobile application, the devices' storage capacity should be taken into consideration.

✓ Performance

There are open-source libraries of pre-made components that can further speed up the process of React Native applications.

5 DESCRIPTION OF PERSONNEL AND FACILITIES

5.1 Tasks assigned to the component

The tasks allocated to the component are shown in the Table.

Table 5.1 – The tasks allocated to the development of the component

Registration Number	Name	Functions
IT18001730	T.S. Chethana Fernando	<ul style="list-style-type: none">• Build a chatbot• Implement the discussion of skin diseases identification• Implement level of skin diseases level• Implement popular market products for minor diseases• Implement a suggestion for finding the veterinarians (For severe issues)• Implement QA discussion for pet dog foods and training• Implement probability of recurrence for skin diseases• Implement pet dog online clinical book

5.2 Resource Personnel for development

The table shows the resource personnel who assist in providing the database to the pet dog skin identification process.

Table 5.2 – Resource Personnel

Name	Designation	Company
Dr. Gunawardhana	Veterinarian Surgeon	Animal Hospital, Negombo
Dr. W.C.R. Kumara	Veterinarian Surgeon	Animal Centre, Nittambuwa

5.3 System and Software Requirements for development

System and software requirements will be needed to execute the proposed solution effectively. Each aspect of the system and software specifications is described below.

✓ System Requirements

- Android Phone/tab
 - Android Version: Below 10.0
 - Memory: 1GB
 - Free Space: 256MB
 - Back Camera: Minimum 5MP

✓ Software Requirements

- Android Studio 4.0
- NPM
- NodeJs
- GraphQL API

6 COMMERCIALIZATION PLAN

6.1 Targeted Audience

The proposed solution will mainly target pet dogs with their owners. Dog owners/veterinarians /pet clinics will be the end-users of this system.

6.2 Benefits to the end-users

- The user can get a solution to their pet dog skin diseases in a short period
- Without going to a veterinary surgeon, identify skin diseases
- Improve the knowledge about pet dog training and foods using the chatbot
- Get service from the mobile app anytime

6.3 Advertising and Communication

Commercializing an all-purpose tool would be extra valuable for users in the target domain and can be considered a simple however rewarding innovative venture.

- ✓ The app is mainly promoted through social media
- ✓ Dog owners can usually share the device with supermarkets, grocery stores, and stores.
- ✓ A Facebook page and a YouTube channel will be established to advertise the mobile app in detail.

7 BUDGET AND BUDGET JUSTIFICATIONS

Justification

Excluding indirect costs for the project, travel costs, Etc. There is a need for budgeting due to project needs. In our case, we need to purchase some servers for our system. As we calculated, the following plan is produced. These may change with the project flow.

Budget

The estimated development cost for the research project is stated below:

Table 7.1 - Development cost

Description	Amount (USD)	Amount (LKR)
AWS S3 Cloud Service	7.54	1500.00
Data Connection Cost	10.21	2000.00
Miscellaneous (Other)	2.51	500.00
Total Cost	20.26	4000.00

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APPENDICES

Appendix A - Turnitin Similarity Report

Proposal_Report_Pet_SkinCare			
ORIGINALITY REPORT			
13%	12%	4%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS
PRIMARY SOURCES			
1	www.warse.org Internet Source	6%	
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