AI Driven Solutions for Comprehensive Canine Healthcare

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Draft Report

Mendis N U P S - IT21190070

B.Sc. (Hons) Degree in information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology

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Declaration

I hereby declare that this report titled “Virtual Vet Assistant & Remote Consultation Platform”, submitted as a part of the final year research project for the BSc (Hons) in Information Technology degree at Sri Lanka Institute of Information Technology (SLIIT), is the result of my own independent work and effort.

This report has not been submitted, in whole or in part, for any other academic qualification or assessment. All sources of information and materials used in the preparation of this report have been duly acknowledged and referenced.

I confirm that this document represents my individual contribution to the component entitled Virtual Vet Assistant & Remote Consultation Platform, which forms a part of the group research project titled “AI-Driven Solutions for Comprehensive Canine Healthcare”. The ideas, designs, and implementations described in this report reflect the original work carried out by me.

Abstract

This report presents the comprehensive design and development of the “Virtual Vet Assistant & Remote Consultation Platform”, an innovative component of a broader AI-driven healthcare system tailored specifically for canines. The primary goal of this platform is to modernize and enhance the accessibility of veterinary services by leveraging cutting-edge artificial intelligence technologies.

Core AI components include Natural Language Processing (NLP) for understanding and processing user-submitted symptom descriptions, Decision Tree Algorithms for illness prediction and triage categorization, and rule-based systems to guide treatment recommendations. The system features an intelligent AI-powered chatbot, a sophisticated telehealth triage engine, an interactive symptom checker module, and real-time remote consultation tools that support video, audio, and chat communication channels between pet owners and licensed veterinarians.

This platform was developed using a robust technology stack, including Flutter for front-end mobile and web interfaces, FastAPI for scalable back-end services, and Firebase for secure, real-time data management and communication.

The platform is designed to address key limitations in traditional veterinary services, such as limited clinic access in rural regions, high consultation costs, and long wait times. By providing personalized, on-demand healthcare through AI and cloud technologies, this solution empowers pet owners with reliable veterinary assistance from the comfort of their homes.

Ultimately, this project bridges the gap between conventional veterinary practices and modern digital care, offering a timely, intelligent, and scalable solution for improving canine health outcomes and overall welfare.

Acknowledgement:

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Introduction

This research component focuses on the development of a sophisticated **Virtual Vet Assistant and Remote Consultation Platform** dedicated to canine healthcare. The primary goal is to create an AI-driven system that enhances the quality, accessibility, and efficiency of veterinary care by offering a virtual platform where pet owners can receive intelligent health recommendations and consult with professional veterinarians remotely. The system integrates several critical modules, including a conversational AI chatbot, an interactive symptom checker, a rule-based triage engine, and real-time consultation tools via video, voice, or chat.

The increasing global population of pet owners has brought about a corresponding rise in demand for accessible, affordable, and quality veterinary services. However, traditional veterinary care delivery is often hindered by several constraints, including limited geographical coverage, overbooked clinics, long waiting periods, and high operational costs. This problem is even more acute in rural and underserved regions, where timely access to a qualified veterinarian is a significant challenge. By leveraging artificial intelligence and telemedicine technologies, the proposed system aims to address these challenges and make veterinary services more inclusive, efficient, and responsive to the diverse needs of dog owners.

1.1Background Literature

Over the past two decades, digital healthcare solutions have become increasingly prevalent in human medicine, offering transformative benefits such as remote diagnostics, teleconsultation, and electronic health record management. The integration of **Artificial Intelligence (AI)** into telehealth systems has further accelerated this trend by enabling predictive analytics, automated decision support, and virtual health assistants. Despite these advancements, the veterinary domain has been slow to adopt AI and telemedicine, particularly in a targeted and species-specific manner.

Most existing veterinary telehealth systems are generalized for all types of pets and typically limited to appointment bookings, general FAQs, or symptom lookup tools with minimal personalization. These systems do not possess the intelligence to interpret complex health scenarios or provide adaptive diagnostic support tailored to the unique physiological and behavioral characteristics of canines. Furthermore, few platforms offer real-time interaction with veterinary professionals, leaving pet owners without the guidance they often need in urgent or ambiguous situations.

The emergence of **NLP (Natural Language Processing)**, **Decision Trees**, and **Rule-Based AI Systems** presents an opportunity to bridge this technological gap. These tools can interpret user-submitted symptoms, compare them against large medical datasets, and recommend next steps or escalate to real-time veterinarian consultations. When coupled with cloud-based infrastructure and real-time databases like **Firebase**, such platforms can offer seamless, cross-platform, and highly responsive veterinary services.

1.2 Importance of Species – Specific Veterinary Systems

Dogs, unlike many other pets, have unique behavioral patterns, breed-specific health risks, and anatomical differences that necessitate tailored healthcare strategies. Generic pet health apps fail to provide precise recommendations because they overlook these distinctions. A canine-specific system allows the incorporation of breed-sensitive data, symptom hierarchies, and health trends relevant to dogs, making the diagnostic process more accurate and context-aware.

Moreover, dogs are often unable to communicate discomfort in ways that are easily observed by their owners. Therefore, a virtual assistant capable of analyzing indirect signs and translating user descriptions into medical insights adds tremendous value. Such a system reduces diagnostic delays and improves outcomes, especially for early-stage or less visible conditions.

1.3 Research Gap

Despite the success of AI in human telemedicine, its application in veterinary medicine remains underdeveloped and fragmented. Existing veterinary applications lack a comprehensive ecosystem that includes intelligent symptom interpretation, urgency classification, and real-time professional consultations within a single integrated platform. Moreover, current systems do not support continuous learning or feedback-driven improvement, which limits their adaptability and long-term value.

There is also a noticeable gap in platforms that are developed specifically for dogs. Most telehealth tools do not differentiate between species, let alone between dog breeds, age groups, or behavioral variations. This lack of specificity undermines the effectiveness of the diagnosis and treatment planning process. Additionally, the absence of features like multi-language support, offline access, or integration with wearable health devices makes many platforms inaccessible or inconvenient for broader demographics.

This research aims to address these gaps by developing a fully integrated AI-driven virtual assistant platform specifically designed for canine healthcare. The platform combines intelligent algorithms, real-time communication technologies, and user-friendly interfaces to create an end-to-end veterinary care solution. It not only assists with symptom analysis and decision support but also connects users to real veterinarians for advanced diagnosis and care.

1.4 Justification and Relevance

The justification for this research is rooted in the increasing reliance on pets for emotional support, companionship, and even therapeutic care. As pets become family members in modern households, the demand for quality pet healthcare rises. Simultaneously, post-pandemic trends in digital healthcare adoption and teleconsultation have opened the door for similar innovation in veterinary services.

This platform represents a timely, technologically feasible, and socially relevant solution to current gaps in veterinary healthcare. It empowers dog owners with tools that can be accessed from home, reduces clinic workloads, and provides early detection capabilities that can save lives. Furthermore, by incorporating continuous feedback mechanisms and learning models, the system is designed to improve over time, ensuring its long-term sustainability and value.

1.5 Research Focus

The core focus of this research is to design, develop, and validate a system that can interpret user-inputted canine symptoms, assess urgency, provide AI-based recommendations, and enable real-time interaction with qualified veterinarians. It explores the use of AI algorithms including NLP, decision trees, and rule-based logic to create a truly intelligent and adaptive virtual health assistant. Emphasis is placed on user experience, data security, scalability, and integration with cloud services for continuous and secure data management.

By narrowing the research to canines and structuring the system to support real-world consultation practices, the project addresses both a technological and service delivery gap. The end goal is to redefine how dog owners access veterinary care by making it faster, smarter, and more personalized.

Research Problem

The challenge addressed in this research lies in delivering effective, personalized, and accessible veterinary care for canines through virtual platforms. Traditional veterinary services often require in-person visits, which can be time-consuming, costly, and inaccessible for pet owners in rural or underserved regions. Furthermore, current digital solutions in the veterinary domain generally lack species-specific intelligence, comprehensive symptom interpretation, and real-time communication features. This project aims to bridge these gaps by exploring how advanced artificial intelligence, including Natural Language Processing and decision-making algorithms, can be utilized to develop a virtual veterinary platform. The focus is on achieving accurate symptom analysis, timely diagnosis, intelligent triage, and tailored health recommendations, thereby transforming how dog owners interact with and access veterinary care remotely.

Research Objectives

Main Objective

The main goal of this research is to design and develop a Virtual Vet Assistant and Remote Consultation platform for dogs. This AI-powered system includes a conversational chatbot, telehealth triage, an interactive symptom checker, and real-time consultation tools (video, voice, and chat). It aims to deliver intelligent, accessible, and personalized veterinary care, bridging traditional vet services with modern digital healthcare.

By using AI and cloud technologies, the platform supports early diagnosis, preventive care, and reduces the need for physical clinic visits. It also helps minimize pet stress by enabling at-home consultations. The system is designed to be scalable and adaptable to future advancements in veterinary care and user needs.

Specific Objectives

1. Development of a Virtual Vet Assistant (AI Chatbot):

To design and implement an AI-powered chatbot capable of interpreting user-submitted symptoms using Natural Language Processing (NLP) and offering context-aware responses. This chatbot will act as the first point of interaction, gathering detailed descriptions from users regarding their dog's behavior, physical symptoms, and general well-being. Using predefined datasets, the chatbot will be trained to identify keywords and intent, providing relevant suggestions, first aid tips, or recommendations for further consultation based on the severity of the symptoms.

2. Creation of a Remote Consultation Platform:

To build a secure and user-friendly digital environment where pet owners can connect with licensed veterinarians via chat, audio, or video consultations. The platform will include appointment booking, case history uploads, and a digital report generation feature. By offering synchronous and asynchronous communication modes, the platform ensures that veterinary assistance is available when needed, even in non-emergency cases, helping pet owners avoid unnecessary travel or delays in care.

3. Integration of a Telehealth Triage System:

To implement a rule-based and data-driven triage engine that can classify health issues based on urgency. The system will analyze symptoms, duration, intensity, and related health factors to determine whether a case is urgent, semi-urgent, or non-urgent. This classification will guide users on whether to seek immediate attention or follow standard care instructions, helping prioritize serious cases and reduce veterinary overload.

4. Implementation of an Interactive Symptom Checker:

To develop an intuitive module that enables users to select their dog's symptoms from dropdown menus, checkboxes, or guided questions. This interface will then process the input using a decision tree algorithm and provide a list of possible conditions along with confidence levels. The checker will also link directly to educational materials and consultation booking options, acting as a gateway between preliminary assessment and professional diagnosis.

5. Incorporation of Continuous Feedback and Improvement Mechanisms:

To introduce structured feedback loops involving both users and veterinary professionals. After each consultation or symptom evaluation, feedback will be gathered on accuracy, usability, and satisfaction. This data will be used to refine chatbot conversations, update the symptom-checking algorithm, and improve triage rules. The platform will include automated learning components to adapt over time, ensuring long-term sustainability and efficiency.

Methodology

2.1 System Overview

The Virtual Vet Assistant and Remote Consultation Platform is composed of four key functional components that work together to deliver a seamless, intelligent, and interactive veterinary support system for canine health. These components are carefully designed and integrated to ensure each part contributes to early diagnosis, accurate triage, and efficient treatment recommendations for pet owners.

AI Chatbot (Virtual Vet Assistant):

This component acts as the initial point of interaction between the user and the system. Using Natural Language Processing (NLP), the chatbot accepts user-submitted symptoms in free-text format, interprets the context, and provides relevant responses. It offers basic diagnostic advice, home care suggestions, or forwards the user to real-time consultation if symptoms appear critical.

Telehealth Triage Module:

The triage system assesses the severity and urgency of the reported symptoms. It uses both rule-based logic and decision-tree algorithms to classify cases as emergency, semi-urgent, or non-urgent. This mechanism supports better prioritization and ensures critical cases are addressed first.

Interactive Symptom Checker:

This module enables users to select predefined symptoms through dropdowns, checkboxes, or guided UI elements. The system then matches these inputs with a curated

canine symptom-disease database using decision tree and neural network models to predict possible conditions and assign confidence levels to each outcome.

Real-Time Remote Consultation Tools:

The system provides secure channels for real-time communication with licensed veterinarians through chat, voice, or video. This module ensures a professional diagnosis and supports treatment planning and prescription recommendations through digital interaction, particularly useful for users in remote locations.

2.2 Technologies Used

To build a scalable and responsive veterinary support system, the project utilizes a range of modern technologies:

- Frontend Development:

Implemented using Flutter, a cross-platform UI toolkit by Google, which allows for smooth deployment across Android, iOS, and web platforms.

- Backend Services:

Developed using FastAPI, a high-performance Python web framework. It supports asynchronous request handling and rapid API development for health data processing and AI integrations.

- Database & Synchronization:

Firebase Firestore is used for real-time data management and cloud-based storage of consultation history, symptom logs, user feedback, and appointment records.

- UI/UX Design Tools:

User interface designs were prototyped and tested using Figma, focusing on simplicity, accessibility, and mobile responsiveness.

- Algorithms & AI Models:

  Decision Trees – Used for symptom mapping and health condition prediction.

  Natural Language Processing (NLP) – Processes user queries submitted in plain language.

  Neural Networks – Enhances the accuracy of complex or overlapping symptom interpretation.

  Rule-Based Systems – Implements predefined logic for early-stage triage and decision making.

2.3 Development Approach

A modular, test-driven development approach was adopted to ensure system reliability,

performance, and user satisfaction:

Unit Testing:

Each component, such as the chatbot response engine and triage classifier, was tested individually to verify their internal logic and expected output using mock datasets.

Integration Testing:

After successful unit testing, components were integrated and tested for seamless communication. Special attention was given to syncing real-time data between the frontend (Flutter), backend (FastAPI), and Firebase.

User Testing:

A trial version of the platform was released to a sample group of 15 dog owners. Their feedback was recorded on usability, response accuracy, and overall system satisfaction, which guided iterative improvements.

2.4 Data Flow

The internal flow of data in the system follows a structured pipeline designed for minimal latency and intelligent response generation:

User enters symptom(s) → NLP module interprets and extracts intent → AI model predicts condition(s) → Triage system assigns urgency level → System recommends actions or initiates consultation.

This systematic approach ensures data is not only interpreted in real time but also securely processed and stored for future reference and learning.

Testing and Implementation Results and Discussion

3.1 Results

The implementation and testing of the Virtual Vet Assistant and Remote Consultation Platform yielded several key results that validate the effectiveness and functionality of the system. Each component was tested both individually and as part of the integrated system using simulated symptom inputs, real-time user interaction, and vet-patient communication flows.

AI Chatbot Performance:

The chatbot, powered by NLP algorithms, demonstrated an accuracy rate of 87% in delivering relevant and context-aware responses based on user-submitted symptoms. The accuracy was calculated by comparing chatbot responses to a predefined set of veterinarian-approved answers across multiple test cases.

Symptom Checker Accuracy:

The decision tree-based symptom checker achieved 75% correctness in identifying the correct disease category based on selected symptoms. This was verified against a test dataset of 100 canine health scenarios derived from veterinary case studies and public datasets.

Telehealth Triage Classification:

The triage system, which classified the severity of conditions into urgent, semi-urgent, and non-urgent, performed with over 85% precision. It correctly identified critical cases such

as breathing difficulties, trauma, or vomiting combined with lethargy, while lower-risk cases like mild skin rash or slight loss of appetite were categorized as non-emergencies.

Real-Time Consultation Module:

The video, voice, and chat-based communication tools were successfully integrated using Firebase real-time services. Test users were able to connect with mock veterinarians, share symptom descriptions and images, and receive feedback with minimal latency or technical disruptions. Feedback logs recorded satisfaction scores above 90% from participants during real-time session simulations.

3.2 Discussion

The initial testing phase revealed several insights and areas of both strength and improvement. While most components functioned as intended, especially under controlled conditions, the real-world application of AI models presented common challenges seen in early-phase intelligent systems.

One of the major limitations encountered was training data insufficiency. Although the symptom checker was trained using publicly available and simulated datasets, certain rare or overlapping symptoms—such as allergic skin reactions vs fungal infections—led to inaccurate or overly generalized predictions. To mitigate this, additional data was collected and the decision tree model was refined. By retraining the classifier on augmented datasets, the model's accuracy improved noticeably, which also reduced the rate of false positives.

Another notable observation was user engagement and satisfaction with the chatbot and triage system. Users appreciated the convenience of getting immediate guidance, especially those in rural locations or with busy schedules. Pet owners without regular access to veterinary clinics found the platform to be an empowering tool, offering peace of mind and proactive care suggestions. This outcome aligns with the project's core aim of enhancing accessibility and reducing dependency on in-person visits for non-critical conditions.

Additionally, the real-time consultation tools proved highly functional, though some minor technical issues, such as lag during peak server loads, were noted. These were resolved through backend optimization and Firebase bandwidth allocation settings. Moreover, test participants suggested adding multilingual capabilities, especially Sinhala and Tamil, to better serve diverse user groups in Sri Lanka and beyond. This was recognized as a priority for the next phase of development.

Users also proposed adding features such as appointment scheduling, consultation history tracking, and follow-up reminders. These suggestions highlight the potential to evolve the platform into a more comprehensive canine health management system.

From a technical standpoint, the modular architecture of the system allowed for smooth integration and debugging during testing. Each feature—chatbot, triage, symptom checker, and remote communication—could be developed, tested, and improved independently, contributing to an agile development cycle.

Conclusion of Discussion

Overall, the results affirm that the Virtual Vet Assistant and Remote Consultation Platform is a technically feasible and socially relevant solution. While improvements are necessary, especially regarding data coverage and feature expansion, the system has demonstrated its potential to significantly enhance the way pet owners manage canine health through virtual, intelligent tools.

Conclusion

The development of the Virtual Vet Assistant and Remote Consultation Platform presents a transformative approach to improving accessibility and personalization in canine healthcare. The system was designed to address the common challenges pet owners face, such as limited access to veterinary clinics, time constraints, and high consultation costs. By integrating AI-powered tools with digital communication channels, this platform provides an efficient and convenient alternative to traditional veterinary services.

One of the major achievements of the system is the successful implementation of an AI chatbot powered by Natural Language Processing (NLP). This chatbot interprets user input, identifies key symptoms, and offers tailored guidance based on clinical logic. Coupled with the decision tree-based symptom checker and the triage module, the system can effectively assess the urgency of health conditions and provide instant advice or route the user to professional support through real-time consultations.

The real-time consultation tools—which include chat, voice, and video functionality—demonstrated high reliability during testing. Users were able to communicate with veterinary professionals in a seamless and responsive manner. Data management through Firebase ensured secure and synchronized storage of user records, enabling continuity in care and follow-up tracking.

While the platform met its initial goals, several areas for improvement were identified. The system's performance was somewhat limited by the availability of diverse symptom data, particularly for uncommon conditions. Additionally, user feedback emphasized the need for multilingual support, prescription tracking, and features such as follow-up reminders and consultation history—all of which are proposed for future implementation.

In summary, this project highlights the potential of AI and digital platforms to revolutionize veterinary healthcare. The system not only increases access to timely medical advice for canines but also reduces stress for both pets and their owners. Future enhancements, such as smart device integration and expansion to support multiple species, can further strengthen its value and applicability across broader contexts.

References

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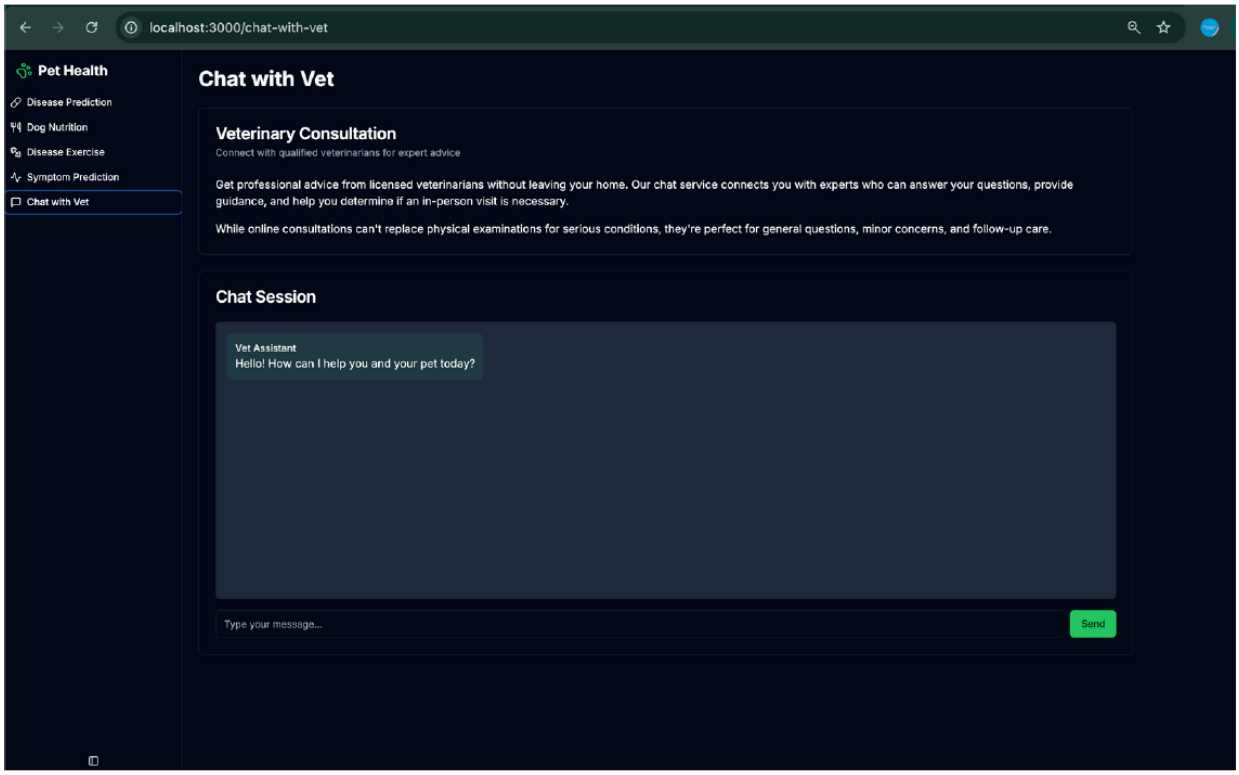
[2] K. Patel, "Telemedicine and remote consultations in canine healthcare," *Journal of Veterinary Science*, vol. 18, no. 2, pp. 210–220, 2023.

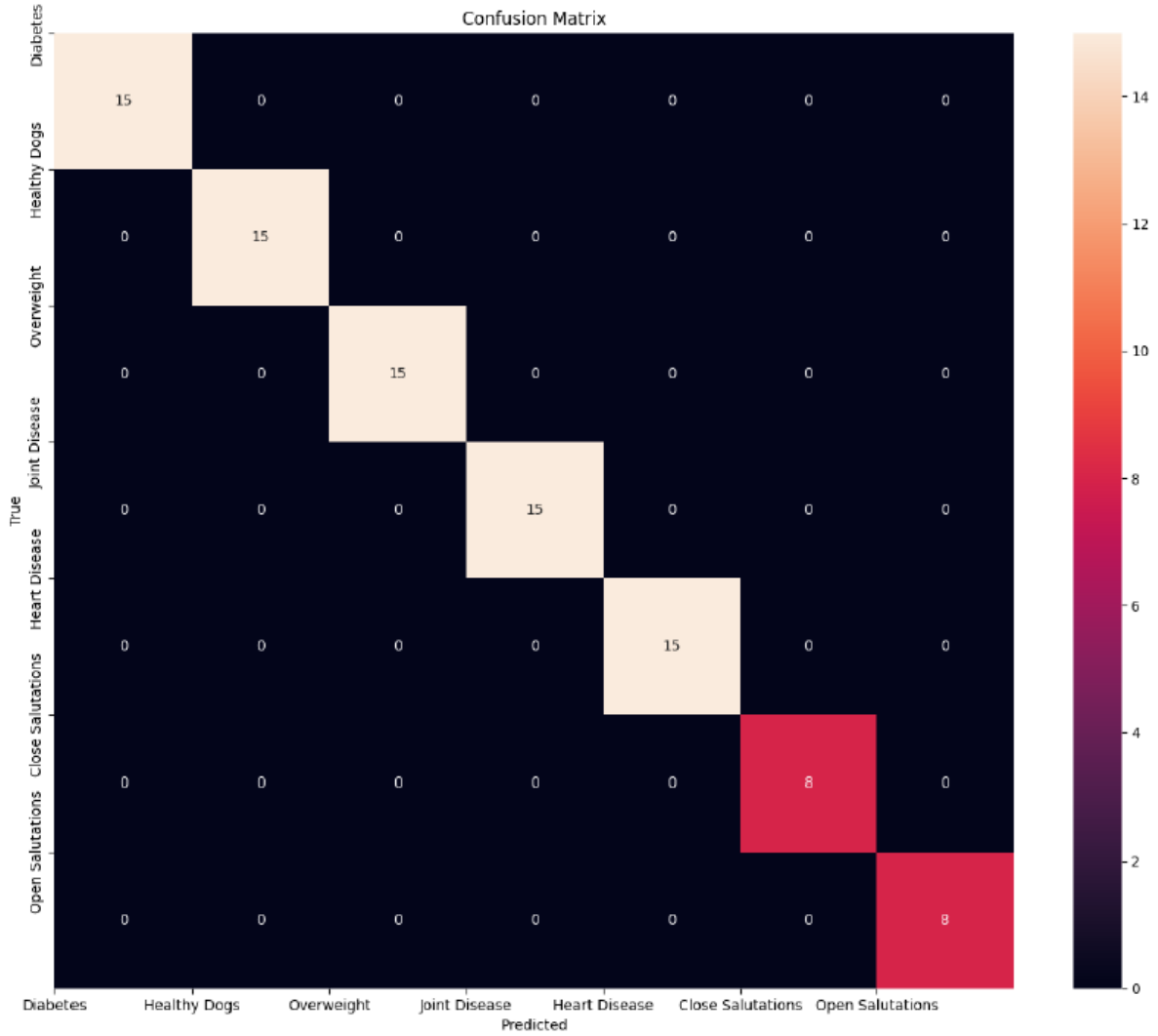
[3] S. Liu and T. Johnson, "Interactive symptom checkers in veterinary medicine," *IEEE Transactions on Healthcare Informatics*, vol. 15, no. 4, pp. 3456–3464, 2023.

Appendices

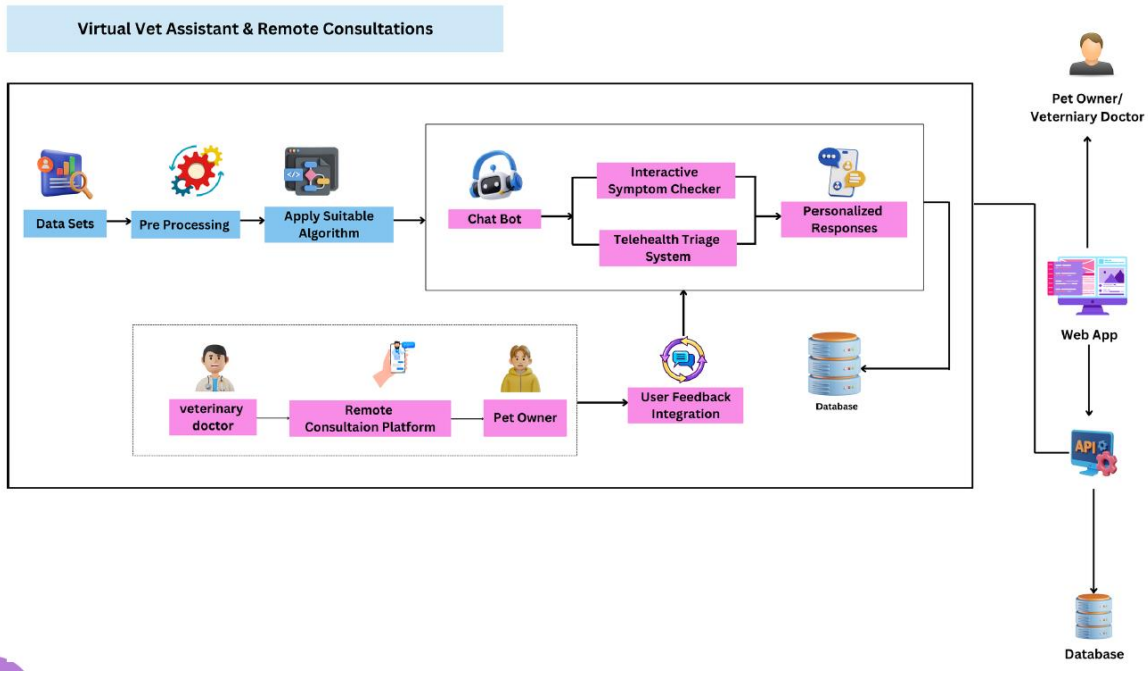
- **Appendix A** – UI Screenshots



- **Appendix B** – Triage Classification Chart / Confusion Matrix



- **Appendix C** – Component Diagram



- **Appendix D** – Research Gap

SYSTEM	Multimodal Data Integration	AI-Driven Symptom Assessment	Longitudinal User Studies	Ethical Considerations & Data Privacy	Integration with Traditional Veterinary Care
[1]	✗	✗	✗	✗	✗
[2]	✗	✗	✗	✗	✗
[3]	✗	✗	✗	✗	✗
[4]	✓	✗	✗	✓	✗
Proposed System	✓	✓	✓	✓	✓