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PAW Healer: Towards an Intelligent and Autonomous Pet Health Management System

Mubashir K C[1], Nandana K P[2], Neha Ramesh[3], Shahanas C P[4], Ms. Vismaya Vijayan[5]
[1, 2, 3, 4]*Department of Computer Science and Engineering(CSE), Sree Narayana Guru College of Engineering and Technology Korom, Payyanur, Kannur*
[5]*Assistant Professor Department of Computer Science and Engineering(CSE), Sree Narayana Guru College of Engineering and Technology Korom, Payyanur, Kannur*

Abstract: ***Pets are vital to human lives, and their wellbeing depends on prompt medical attention. However, early disease detection and effective management of vaccination schedules and veterinary consultations are frequently challenges for pet owners. This paper introduces Paw Healer, an AI-driven pet care support system that uses pet owners' symptoms to forecast pet illnesses. In order to categorize disease severity into mild, moderate, and severe groups, machine learning models are utilized to examine symptom patterns. The system offers advice on grooming and at- home care or, if required, suggests veterinary consultation based on the prediction results. In order to avoid missed immunizations, the system also creates timely reminders and keeps digital vaccination records. Additionally, in order to detect possible disease outbreaks, area-based disease forecasting is carried out by examining symptom patterns in various locations. All pet health information is safely kept on a cloud platform, and both pet owners and veterinarians can access it via an easy-to-use web interface. The suggested system facilitates informed veterinary care decision-making, enhances early disease detection, and improves pet health management.***

I. INTRODUCTION

The need for effective and easily accessible pet healthcare services has increased dramatically due to the growing adop- tion of companion animals. To maintain their general health, pets need constant observation, prompt immunizations, and early illness diagnosis. Unfortunately, many pet owners lack the medical knowledge necessary to recognize early disease symptoms, which frequently results in treatment delays and serious health issues. Furthermore, vaccination schedules, grooming regimens, and pet health records are traditionally kept mostly by hand, which makes them ineffective and challenging to administer.By enabling automated diagnosis, predictive analytics, and decision support systems, develop- ments in artificial intelligence (AI) and machine learning (ML) have revolutionized a number of healthcare domains. AI-driven solutions in the veterinary field can help with disease pre- diction, symptom pattern analysis, and better preventive care. Despite this potential, the majority of pet care applications currently in use only offer simple features like scheduling appointments or storing medical records; they do not include sophisticated disease prediction or extensive health data analysis. The absence of regional systems for early disease outbreak detection is another significant obstacle in pet healthcare. Pet- related illnesses can spread quickly within certain regions, endangering not only animals but also, in certain situations, the general public's health. Preventive measures are limited because current solutions seldom use aggregated symptom data to predict outbreaks and identify disease trends.In order to get around these restrictions, this paper suggests Paw Healer, an AI-powered pet care and health management system that combines outbreak forecasting, disease prediction, severity classification, and preventive care advice into a single plat- form. Through an easy-to-use web interface, the system lets pet owners enter their pet's symptoms, which are then analyzed using machine learning models to identify possible illnesses and classify their severity. The system recommends grooming and at-home care or prompt veterinary consultation based on the findings.

Additionally, Paw Healer creates automated reminders to guarantee timely immunization and maintains cloud-based digital health records, including vaccination his- tory. By examining symptom patterns in various locations, the system also carries out area-based disease forecasting, which enables early warnings and better preventive care.

The proposed system aims to improve early intervention, decrease treatment delays, and support informed decision-making for both pet owners and veterinary professionals by integrating AI-driven diagnosis, comprehensive pet health management, and regional disease forecasting.

II. RELATED WORKS

A. *Artificial Intelligence in Veterinary Imaging: An Overview*

Pereira and Leite provided a thorough analysis of AI applica- tions in veterinary imaging, emphasizing the efficiency of deep learning methods in identifying illnesses from radiographic and imaging data. Although this work shows how AI can be used for diagnosis, it mainly concentrates on image-based analysis and does not support integrated pet care management or symptom-driven disease prediction.

B. *PulseNet:Deep Learning ECG-Signal Classification Using Random Augmentation Policy and Continuous Wavelet Trans- form for Canines*

A proposal by Dourson and Santilli, uses deep learning models to classify dog ECG signals. Although it is restricted to cardiac monitoring and does not address general disease prediction or recommendations for preventive care, this study highlights the importance of physiological signal analysis in veterinary diagnostics.

C. *Companion Animal Disease Diagnostics Based on Literal- Aware Medical Knowledge Graph Representation Learning*

Lee and Hoang presented a method for modeling intricate rela- tionships in veterinary medical records using knowledge graph techniques. This method improves diagnostic reasoning, but it lacks direct interaction with pet owners through symptom- based inputs and relies on structured clinical data.

D. *The Potential Application of Artificial Intelligence in Veterinary Clinical Practice and Biomedical Research*

Idris and Samuel covered a variety of AI applications, such as decision support, surveillance, and diagnosis. The need for integrated systems like the suggested solution was highlighted by the authors' identification of the lack of unified platforms that integrate prediction, care guidance, and health management.

E. *PETIS: Intent Classification and Slot Filling for Pet Care Services*

Zaman and Won proposed automates interactions with pet care services using natural language processing. The system works well for handling services, but it lacks features for health forecasting, severity assessment, and disease prediction.

F. *The Digital Revolution in Veterinary Pathology*

Pinho and Williams looked at how data-driven technologies and digital transformation are changing veterinary pathology. Their research emphasizes how crucial digital records and AI-assisted analysis are to enhancing diagnostic processes. But rather than real-time, owner-driven pet health monitoring systems, it primarily concentrates on pathology labs.

G. *Advancing Pet Biometric Identification: A State-of-the-Art Unified Framework for Dogs and Cats*

The paper proposed by Lim and Pak focuses on computer vision methods for pet biometric identification. While this work improves pet identification and traceability, it has no direct impact on health forecasting or disease diagnosis.

III. SYSTEM ARCHITECTURE

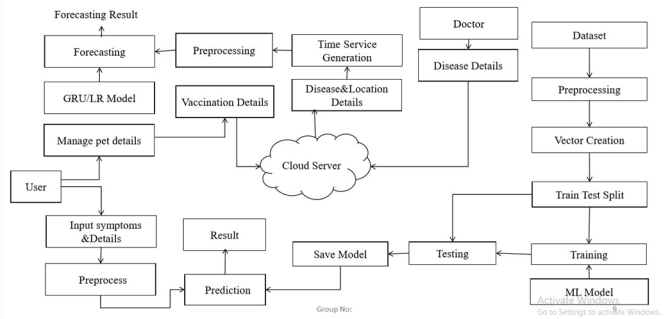


Fig. 1.

The system is built to handle pet health data, forecast long- term trends, and offer real-time disease forecasts based on symptoms. It is divided into three main modules:

A. User& Pet Management Module

Pet owners and caretakers use this module as their main interface to communicate with the system.

- Pet Profile Management: Users are able to track vaccina- tion information and manage particular pet facts that are synchronized with a central cloud server.
- Symptom Input& Diagnostic Flow: Users enter their current health information and symptoms. Before being transmitted to the trained prediction model, this input passes through a preprocessing step.
- Real-time Prediction: Based on the symptoms supplied, the system creates a diagnostic result for the user using the previously saved machine learning model.

B. Data Processing & Forecasting Module

With a focus on 'Time service generation'to forecast future outbreaks or health trends,this component manages the ana- lytical aspects of the system.

- Cloud Integration: To comprehend regional health trends, the system retrieves Disease & Location Details from the cloud server.
- Time-Series Analysis: A Time Service Generation and Preprocessing pipeline is used to process the data.
- Forecasting Models: The system analyzes temporal data using GRU (Gated Recurrent Unit) or LR (Linear Re- gression) models, producing a forecasting result that aids in proactive health planning.

C. Machine Learning Pipeline & Admin (Doctor) Module

This is the backend where the system's intelligence is devel- oped and validated.

- Model Training Pipeline: A rigorous pipeline that in- cludes preprocessing, vector creation, and a train/test split is applied to a raw dataset. After training and accuracy testing, the machine learning model is deployed (Save Model) for user predictions.
- Medical Validation: Medical practitioners can enter or confirm Disease Details using a Doctor interface. The Cloud Server stores this expert data, guaranteeing that the prediction algorithms are based on validated method.

IV. METHODOLOGY

The Paw Healer system combines web and mobile technology with machine learning and forecasting models to create an intelligent, role-based pet healthcare platform. The approach emphasizes proactive illness trend analysis, scalable system design, and precise disease prediction.

A. System Design

The four main modules of the suggested system—Admin, Doctor, Shop, and User—follow a role-based modular architecture. To guarantee safe access and effective workflow management, each module has distinct roles. A mobile application created with Flutter, which offers a user-friendly interface and cross-platform deployment, allows pet owners to communicate with the system. Users can register, add pet profiles, enter symptoms, see prediction results, and get care advice with this application. The Django framework is used to create the Admin, Doctor, and Shop modules as online portals. Data monitoring, system configuration, and user authentication are all handled by the Admin module. Veterinarians can view anticipated cases, verify diagnoses, and upload verified disease records using the Doctor module. The Shop module enhances the ecosystem of pet care support by supporting product management and pet care services. Scalability, maintainability, and system reliability are all enhanced by this hybrid mobile-web design.

B. Data Collection and Preprocessing

A dataset of pet diseases from Kaggle, which contains symp- tom characteristics, disease labels, and past case records, is used to train the disease prediction model. The basis for supervised learning is this dataset, which depicts frequent pet illnesses. The dataset goes through preprocessing procedures such data cleansing, addressing missing values, symptom encoding, and normalization prior to model training.

By en- suring interoperability with machine learning algorithms and improving data quality, these procedures increase prediction accuracy.

C. Disease Prediction Module

Pet owners use the mobile application to enter visible symp- toms. The disease prediction engine receives these symptoms after they have been transformed into numerical feature vec- tors. Because of its ease of use, interpretability, and efficacy in medical decision support systems, a Logistic Regression (LR) model is employed for disease classification. Based on symptom patterns, the LR model calculates the likelihood of each disease class and outputs the most likely illness. This probabilistic method facilitates severity-based recommenda- tions and transparent decision-making.

D. Disease Trend Forecasting

The system includes a forecasting module to examine disease trends over time, in addition to individual diagnosis. Vet- erinarians provide clinical validation and data dependability by adding confirmed disease cases via the Doctor portal.A Gated Recurrent Unit (GRU) model, which can learn temporal dependencies from sequential health data, is used to forecast time series. In order to forecast future trends and spot possible outbreak patterns in particular areas, the GRU model examines past disease occurrences in conjunction with temporal data. Preventive and early warning veterinary care are supported by this feature.

E. Model Integration and Usage

To meet the needs of forecasting and diagnostics, the system uses a dual-model approach. The GRU model is used to predict disease cases over time, whereas logistic regression is used for real-time disease classification based on symptoms. Both population-level illness monitoring and individual-level health- care support are made possible by the integration of these models.All forecasting and prediction findings are kept in a cloud-based database and presented to users and veterinarians via user-friendly dashboards. Scalability, dependability, and efficient decision support are guaranteed by this integrated strategy.

V. RESULTS AND DISCUSSIONS

A multi-module platform with mobile and online interfaces for many stakeholders was used to successfully implement and assess the suggested Paw Healer system.

The outcomes show how well the system manages pet healthcare services, forecasts illnesses, and uses analytics and forecasting to help decision- making.

The login interface was used to verify the authentication and role-based access control, guaranteeing safe access for various users, including shopkeepers, administrators, and vet- erinarians.

The robustness of the role-based system design is confirmed by the system's accurate redirection of users to their corresponding dashboards based on assigned roles.

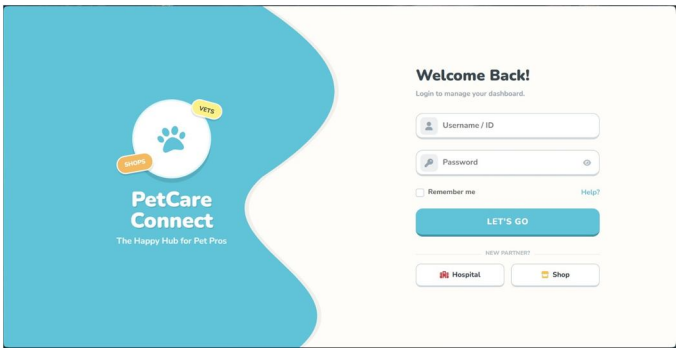
A thorough summary of platform activities, including the total number of registered users, hospitals, pet stores, and user complaints, is given by the admin dashboard. Administrators can effectively handle registrations, feedback, and system alarms thanks to the dashboard's centralized monitoring and administration capabilities. This outcome demonstrates that the system facilitates orderly and scalable data management.

The Pet Shop module shows client data, daily sales figures, and order details in real time. With an easy-to-use interface, shopkeepers can monitor sales success, track orders, and manage product listings. This module shows how the system may assist auxiliary stakeholders other than medical experts and improves the integration of pet care services.

Clinical validation and disease monitoring depend heavily on the Doctor portal. Veterinarians can start forecasting opera- tions, view confirmed illness cases, and track current disease trends. The "Clinic Health Monitor" interface validates the efficacy of the data aggregation and visualization techniques by displaying disease identity, total case records, and trend status.

The forecasting tool effectively analyzes past disease data and produces trend indicators (such as steady or growing) when it is activated by verified clinical inputs. This outcome shows that proactive disease surveillance and early warning systems can be supported by the GRU-based time-series model.

Overall, the system findings show that Paw Healer suc- cessfully combines forecasting, service administration, health monitoring, and disease prediction on a single platform.



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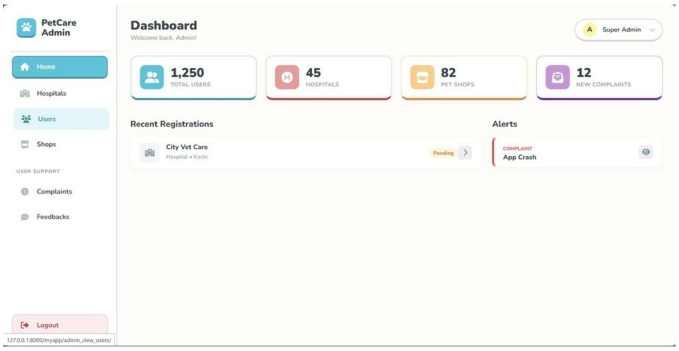

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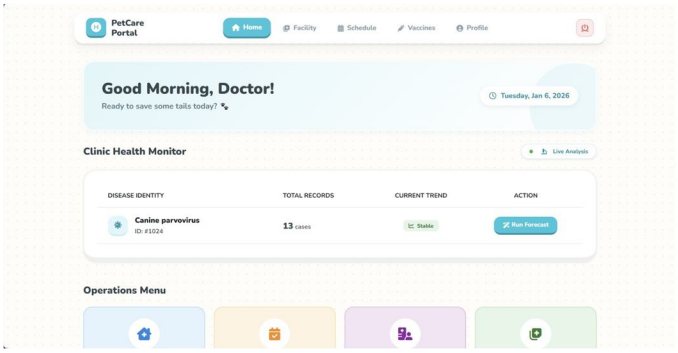

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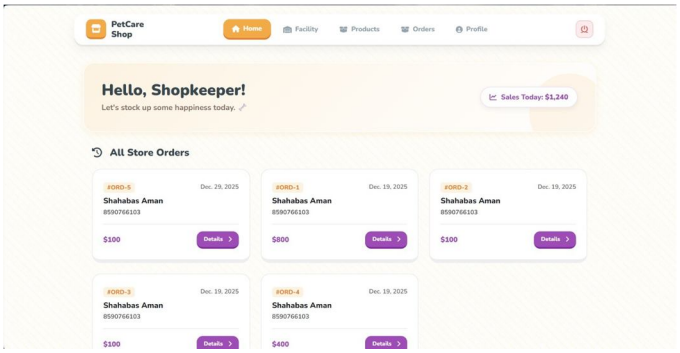

Fig. 5.

VI. CONCLUSION

In order to meet the increasing demand for intelligent, easily accessible, and preventive pet healthcare solutions, this work detailed the design and development of an AI-based Pet Care Assistance System. To assist both pet owners and veterinary professionals, the suggested solution combines machine learning-based disease prediction with severity classification, home care advice, and veterinary service administration. Veterinarians and administrators may effectively manage clinical data through web-based portals, while pet owners can easily input symptoms and receive healthcare services through mobile applications. For the purpose of classifying diseases, the system uses Logistic Regression, which offers a clear and computationally effective baseline model. Furthermore, the basis for predicting future illness patterns is established by time-series analysis of confirmed disease cases. The system's overall usefulness and practicality are improved by supporting features including appointment scheduling, vaccine tracking, cloud-based data storage, and user-friendly interfaces. The outcomes of the trial show that the suggested strategy can successfully support early disease detection and well-informed decision-making. All things considered, the suggested AI- driven framework shows great promise for enhancing preventive pet healthcare and lessening the effects of delayed diagno- sis. The system provides a scalable and expandable platform for intelligent veterinary support by fusing real-time service integration with predictive analytics. Future improvements are made possible by the modular architecture, which makes the solution appropriate for practical implementation and ongoing research in AI-based animal healthcare systems.

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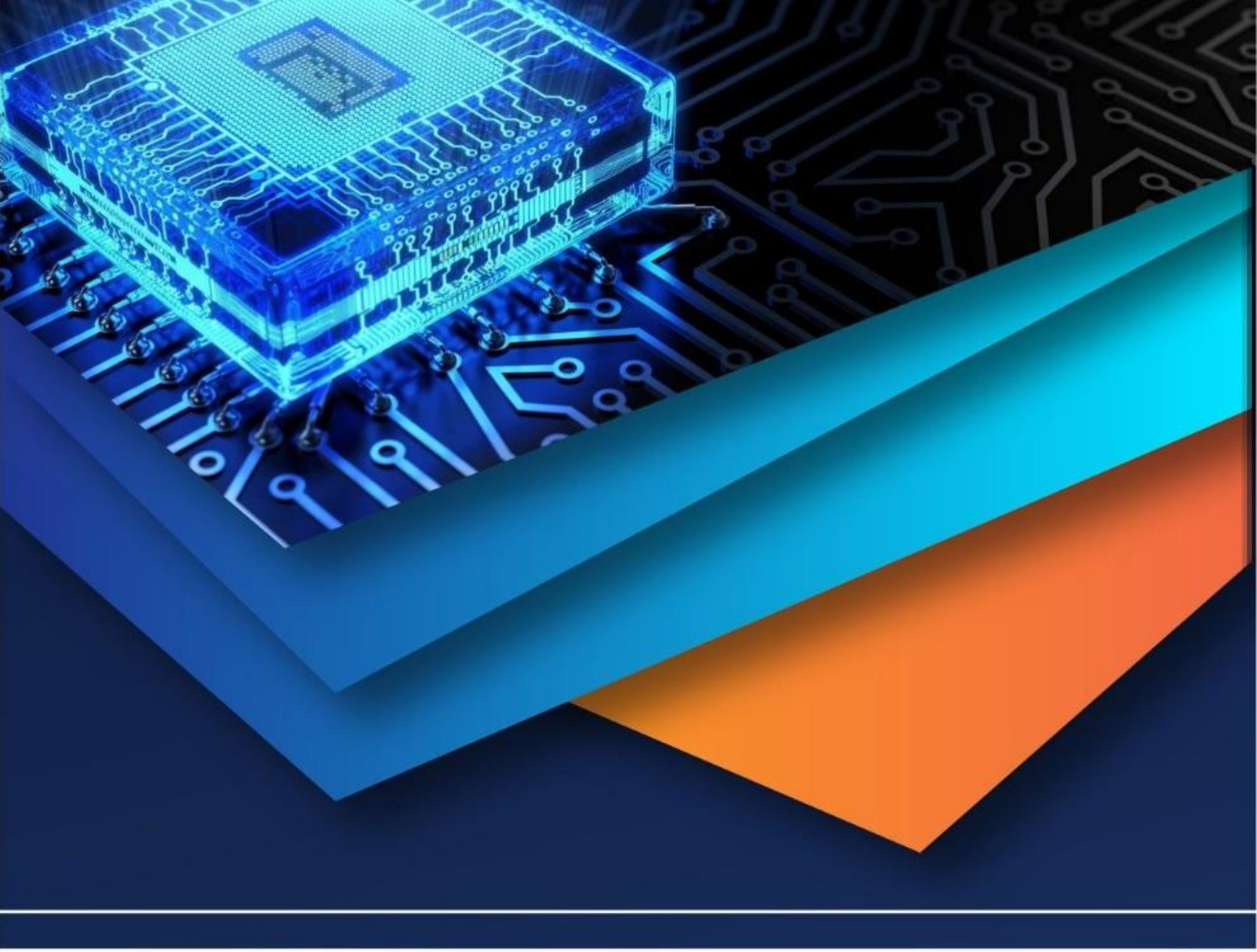

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