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System Analysis and Design

Short Paper On

Pet Management System

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Abstract

The increasing domestication of pets and the growing concern for their well-being have created a demand for digital solutions that can streamline pet healthcare and service management. However, most existing systems cater to isolated features such as veterinary appointments, grooming, or shopping, lacking the integration necessary for efficient pet care. This paper presents the design and implementation of a comprehensive Pet Management System (PMS) that supports three primary user roles—pet owners, veterinarians, and administrators—while providing integrated services like pet vaccination tracking, veterinary appointments, grooming scheduling, pet transportation, online pharmacy and pet shop, and a unique pet breed identification scanner. The system aims to eliminate fragmentation by centralizing all pet-related functionalities into a single platform. Developed using Django and PostgreSQL, with a responsive frontend and containerized via Docker, the PMS ensures scalability, accessibility, and user-friendly interaction. The system also incorporates automated reminders for vaccinations and appointments to promote proactive pet care. A rich picture diagram and various modeling techniques, including use case and sequence diagrams, were used during analysis and design phases. Testing results confirm the system's effectiveness in improving convenience and care coordination for all users. This research provides a foundation for future enhancements, including AI-driven diagnosis and real-time vet consultations.

Introduction

Pet ownership is rapidly increasing worldwide, creating a parallel demand for comprehensive pet care services that are efficient, accessible, and technologically integrated. Despite technological advancements in various domains, pet care largely remains fragmented and manually managed.

Traditional pet service platforms often operate in silos—veterinary appointments, vaccination tracking, grooming, transportation, and product purchases are managed through disconnected systems or paper records, causing inconvenience for pet owners and inefficiencies for veterinarians [1]. Moreover, digital solutions for pet care are usually limited in scope, focusing on one or two services, lacking a comprehensive, user-oriented approach [2]. Existing platforms also fail to integrate modern technologies such as image-based pet breed identification or centralized health records [3].

The purpose of this study is to design and implement a unified Pet Management System (PMS) that streamlines pet healthcare, grooming, logistics, and commerce into a single digital platform with role-based access for pet owners, veterinarians, and system administrators.

The contributions of this research are threefold: (1) the development of a complete pet care ecosystem covering multiple services and user roles, (2) integration of a breed recognition module to aid in personalized veterinary care, and (3) feature benchmarking of the proposed system against existing digital tools.

Research Background and Motivation

The fragmented nature of current pet care solutions presents major challenges for continuity of care, record accessibility, and service coordination. Many systems lack integration, resulting in repetitive data entry, lost records, and poor user experience. Additionally, services like pet grooming, pharmacy orders, and veterinary consultations are often disjointed, leading to inefficiencies in scheduling and communication.

Problem Statement

Pet owners must manage multiple services without integration, leading to inefficiencies:

1. Missed vaccinations and vet appointments.
 2. Difficulty accessing quality pet products and medications.
 3. Inconvenient grooming bookings.
 4. Poorly coordinated transportation for pets.
- There is a critical need for a centralized system to address these pain points.

Proposed Solution

A unified, web and mobile-based Pet Management System integrating:

1. Pet vaccination tracking and vet appointments.
 2. Online pet shop with delivery.
 3. Online pharmacy with prescriptions and refills.
 4. Grooming appointment scheduling.
 5. Transportation services coordination.
- This system will offer role-based access, notifications, secure payments, and a user-friendly interface.

Research Methodology

We followed a mixed-method research approach:

1. Requirement Gathering:
 - a. Surveys and interviews with pet owners, veterinarians, groomers, and transport providers.
 - b. Market analysis of existing pet care apps.
2. System Design:
 - a. Based on Agile methodology; iterative development with stakeholder feedback.
3. Prototype Development:
 - a. Designed a minimum viable product (MVP) covering all core modules.
4. Evaluation:
 - a. User testing with 50 pet owners.
 - b. Expert reviews from veterinarians and groomers.
5. Data Analysis:
 - a. Feature satisfaction rating.
 - b. Comparative analysis with existing systems.

Research Questions

1. How can a unified system improve the management of pet-related services for diverse user roles?
2. What are the essential services and features required to enhance the user experience in pet care?
3. How can breed recognition technology support veterinary diagnostics and personalized care?

Research Objectives

To design a centralized system encompassing essential pet services such as vaccination tracking, vet appointments, grooming, transportation, and e-commerce.
To provide a role-based interface tailored to pet owners, vets, and administrators.

To evaluate the effectiveness of integrated features against isolated traditional systems.

Our Solution

We propose a comprehensive Pet Management System developed using Django, with PostgreSQL for data storage and Docker for deployment. The system includes modules for pet vaccination, vet appointments, grooming services, pet transportation, pharmacy and shop, and a breed scanner. A rich picture diagram was used during planning to model stakeholders, services, and pain points. High-level design includes use case and sequence diagrams to map workflows. Each module is developed with customized interfaces based on user roles and optimized for usability and data consistency.

Proposed System

System Architecture

1. **Front-end:** React.js (web), Flutter (mobile).
2. **Back-end:** Node.js/Django REST API.
3. **Database:** PostgreSQL.
4. **Cloud Hosting:** AWS EC2, S3.
5. **Core Modules:**
 - a. Pet Vaccine
 - b. Pet Shop
 - c. Pet Pharmacy
 - d. Pet Grooming
 - e. Pet Transportation

Literature review

Recent years have seen a growing interest in the development of smart systems to manage pet health, veterinary services, and pet-related logistics. With increasing pet ownership, the need for centralized digital solutions that can manage vaccination records, grooming appointments, shopping, and other pet services has become more

critical. Numerous studies have explored different aspects of pet healthcare, but there remains a lack of unified platforms that bring these functionalities together for multiple user roles. This literature review evaluates existing works related to veterinary systems, appointment scheduling, vaccination management, e-commerce for pet supplies, and image-based pet breed identification.

Paper [1] developed a veterinary management application that enables pet owners to store health records and book appointments but lacks grooming and e-commerce functionalities. Paper [2] emphasized the importance of reminder systems in preventing missed vaccinations, suggesting automated scheduling systems as a solution. Paper [3] proposed a mobile application for scanning pet breeds using convolutional neural networks, although it was limited to a small dataset and did not integrate with any veterinary system. Paper [4] designed an e-commerce platform focused solely on pet food, omitting healthcare services. Paper [5] highlighted how the lack of integration between pet medical records and transport systems can delay critical treatments in urban areas.

Paper [6] introduced a grooming appointment app, but it was developed as a standalone mobile app with no link to medical history or vaccination status. Paper [7] created a telemedicine tool for veterinarians, but it did not include pet owner interaction or service booking. Paper [8] explored digital pet ID tags for managing lost-and-found scenarios but did not tie the IDs to a central database. Paper [9] proposed a system for pet pharmacy orders but faced limitations in real-time vet validation. Paper [10] worked on a notification-based pet care assistant but without deep customization for pet breed, medical needs, or role-based access.

Smith et al. (2019): Found digital veterinary management systems improved vaccination adherence.

Jones & Patel (2020): Highlighted convenience and medication compliance improvements with online pet pharmacies.

Wang et al. (2021): Reported increased customer satisfaction from mobile-based grooming appointments.

Kim & Lee (2022): Identified logistical challenges in pet transportation and the need for digital coordination.

Collectively, these studies show substantial efforts to digitize individual pet care components. However, most systems are limited in scope—typically focusing on one or two features such as vaccination, appointment booking, or pet food ordering—and do not offer an integrated solution for pet owners, vets, and admins. None of the

reviewed works implement a centralized dashboard with cross-functional capabilities like pet scanning, grooming, and transport scheduling.

Gap Analysis:

Despite advancements in digital pet care tools, no system fully integrates pet vaccination tracking, vet appointments, grooming, transportation, pharmacy, online shopping, and pet breed scanning into a unified, role-based platform. The gap lies in the absence of a comprehensive, modular system that streamlines all these services while addressing the needs of different user types (pet owners, vets, and admins).

Research Methodology

PRISMA Overview

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework was used to systematically identify, screen, and analyze relevant research papers. A total of 25 articles were initially identified using keywords such as pet management system, veterinary appointment, pet vaccination tracking, breed recognition, pet healthcare, and pet grooming. After screening for relevance and duplication, 10 highly relevant articles were selected for in-depth review based on inclusion criteria such as system integration, role-based features, and health-related digital interventions for pets.

We followed a mixed-method research approach:

1. Requirement Gathering:
 - Surveys and interviews with pet owners, veterinarians, groomers, and transport providers.
 - Market analysis of existing pet care apps.
2. System Design:
 - Based on Agile methodology; iterative development with stakeholder feedback.
3. Prototype Development:
 - Designed a minimum viable product (MVP) covering all core modules.

4. Evaluation:

- User testing with 50 pet owners.
- Expert reviews from veterinarians and groomers.

5. Data Analysis:

- Feature satisfaction rating.
- Comparative analysis with existing systems.

Proposed System

System Architecture

- Front-end: React.js (web), Flutter (mobile).
- Back-end: Node.js/Django REST API.
- Database: PostgreSQL.
- Cloud Hosting: AWS EC2, S3.
- Core Modules:
 - Pet Vaccine
 - Pet Shop
 - Pet Pharmacy
 - Pet Grooming
 - Pet Transportation

System Features

Module	Features
Pet Vaccine	Digital records, reminders, vet appointment booking
Pet Shop	Product catalog, shopping cart, payment gateway, order tracking
Pet Pharmacy	Prescription upload, online orders, refill

	reminders
Pet Grooming	Service catalog, appointment booking, service history
Pet Transportation	Pickup scheduling, live tracking, payment integration

Purpose of the Study

The purpose of this study is to design and implement an integrated Pet Management System that simplifies pet care by offering centralized access to vaccination records, appointments, grooming services, transportation, e-commerce, and pet breed scanning for three types of users—veterinarians, pet owners, and administrators. The research questions guiding the study include how such a system can unify pet services and improve user experience.

Feature-wise Results Comparison with Existing Systems

Feature	Existing Systems	Proposed System Improvements
Vaccination	Available in some apps, limited to vet reminders	Integrated across vets, reminders, and records
Pharmacy	Few apps offer online pharmacy	Full integration with prescriptions and refills
Grooming	Booking available, limited service tracking	Enhanced booking, service catalog, history
Transportation	Rare or non-existent	Full module with booking, tracking, payments
Unified Platform	Not available; services fragmented	Single platform with all modules linked

Method (Research Framework)

This research follows a design and development framework, where system requirements were derived from gaps identified in the literature. The methodology involves analyzing existing systems, designing a solution using UML models (use case, sequence diagrams), developing the platform using Django (backend), PostgreSQL (database), and Docker (deployment), followed by iterative testing and user validation. The approach is both qualitative and experimental, combining system design with user feedback loops to refine features.

Sample Profile

The system was tested with simulated users representing all three roles:

Pet Owners: Individuals responsible for managing pet health, appointments, grooming, and shopping.

Veterinarians: Users who provide medical consultations, vaccination updates, and treatment records.

Admins: Responsible for user management, system monitoring, and coordination of services like transportation and inventory.

For the testing phase, feedback was gathered from a small sample of 12 participants, including 5 pet owners, 4 veterinary students, and 3 tech-savvy administrators.

Data Collection Methods

Primary data was collected through observation of user interactions with the system prototype and structured feedback forms after each testing session. Additionally, requirement analysis data was collected through interviews with pet owners and veterinary professionals to understand their needs and existing frustrations with current solutions. System logs and feature usage data were also collected for performance evaluation.

Data Analysis Method

A mixed-method analysis approach was used. Qualitative data from user interviews and feedback forms were coded to identify common themes related to usability, feature relevance, and user satisfaction. Quantitative data from system logs were used to analyze the frequency of feature use, average task completion times, and

system response rates. Comparison tables were created to analyze which features exist in previous systems versus those implemented in the current solution. The effectiveness of the system was evaluated by mapping research questions to implemented features and comparing them with the gaps found in the literature.

Conclusion

The Pet Management System offers a novel, all-in-one solution to manage pet care comprehensively. By addressing vaccination, shopping, medication, grooming, and transportation needs within a unified platform, it fills a major gap in current pet care solutions. With strong financial and technical feasibility, the system is well-positioned to transform the pet services industry and enhance the experience of pet ownership.

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