

HOSPETAL: VETERINARY MANAGEMENT SYSTEM

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ABSTRACT

In today's fast-paced digital world, the integration of technology into the field of veterinary medicine can be highly beneficial when it comes to providing efficient and comprehensive care to our animal companions. Effectively managing appointments, patient information, billing, and other essential areas of their business can be a problem for veterinary clinics of all sizes. In the development of our veterinary management system, the adoption of the Agile Scrum methodology has significantly elevated our approach to project management. Agile Scrum's iterative and collaborative nature has allowed our development team to seamlessly integrate feedback from veterinary professionals, ensuring that the system aligns closely with their evolving needs. Sprint Planning and weekly meetings keep the team informed and engaged, fostering a culture of open communication and continuous improvement. As a result, our veterinary management system is not only robust and efficient but is continually evolving to meet the dynamic requirements of the veterinary industry.

CSS Concepts

Applied Computing → Life and Medical Sciences → Healthcare Information Systems

Keywords

management; communication; interaction; location; records

1. INTRODUCTION

With the modern advancements in technology, the demands of a rapidly changing society require efficient execution of administrative tasks and medical practices. As of recently, various fields of the industries have embraced the introduction of digitization, digitalization, and telemedicine. Technologies are viewed as possible tools to enhance current healthcare procedures, aiming to introduce fresh approaches to delivering medical treatment. Tools which are created through the modernization of technologies such as the microfluidic tools, digital radiography and imaging systems are continuously used and developed. The modern use of artificial intelligence also has the potential to be integrated into almost every aspect of veterinary practice, including diagnostics, care for animals, and medicines. In veterinary diagnostic imaging, AI is used on the classification of features in the image wherein abnormalities can be identified as well as streamline processes in accessed pet record systems [1].

However, since the lockdowns and the nature of the pandemic occurred, there had been significant increases in the utilization of telemedicine services. The use of telemedicine technology brought essential benefits that improve access to quality and timely care while maintaining physical distance, preventing disease, home COVID-19 screening and monitoring in epidemic conditions [2]. As with telemedicine, healthcare services which involve consultations, diagnostics, and treatments are delivered over distances or time gaps through the use of diverse information and communication technologies [3]. Included in the fields of healthcare that adapted these ways during the pandemic is the veterinary field. Safety protocols such as online appointments and telemedicine were implemented to ensure continued care for pets while minimizing human contact.

The veterinary field has consistently shown its ability to embrace and overcome new challenges and advancements, leading to significant changes in the required expertise. Veterinary professionals in the industry have to persist in advancing and innovating to maintain relevance in a fiercely competitive landscape. This requires veterinarians to offer clients pioneering services that enhance the well-being of their livestock or pets and yield favorable economic outcomes for their operations [4].

As technologies rely on data it can be categorized through three instances for the veterinary use of wireless and mobile technologies employed in animal health monitoring, disease surveillance, reporting, and information exchange; sophisticated data-processing technologies like big data and data analytics utilized to identify patterns, predict outcomes, establish correlations, and extract insights; and emerging technologies like blockchain applications utilized to efficiently manage diverse input supply chains. Recent advancements in information and communication technologies (ICTs) and innovations have generated a great amount of new prospects to enhance veterinary practices. It has improved the speed and precision of gathering and reporting data for disease surveillance and monitoring of animal health as well. This includes the progress in mobile technology which has resulted in a rise in utilizing mobile applications for gathering, analyzing, and sharing real-time data concerning animal health [5].

As a mean to keep up with the continuous adjustments, the implementation of systematized veterinarian management enhances its efficiency and

effectiveness. The effective management of tasks such as managing appointments, patient information, billing, and other essential areas of their business is to be accomplished in convenience.

1.1 Project Objectives

The stated veterinarian management system is to be achieved through the creation of a website that will allow the veterinarians as well as their prospective customers access to pet health care.

Specifically the study aims on the implementation (1) to create an administrator dashboard that provides data statistics for data monitoring, (2) to allow both the veterinarians and clients to track the vaccination schedule of patients; (3) to store and access patient records and scheduling functions to clients from any internet-connected device; (4) to include search features for a clinic's location; (5) to integrate a communication channel between pet owners and veterinarians.

2. LITERATURE REVIEW

The study is in line with the development of information and communication technology (ICT) tools utilized in veterinary management wherein its primary focus is on gathering, analyzing, managing, and sharing data. The study along with these tools facilitate dissemination of information regarding new disease outbreaks and biological emergencies, enabling communication soon after the disease occurrence. This along with the implementation of the study enables pet owners understanding of health issues in regards to their pets, allowing the demand for proper and best quality veterinary services [6].

With continuous changes and growth in pet record management, implementing digital storage of data is required. Pets' healthcare records often become scattered as well which can be due to changes within the system or the data itself. This leads to data redundancy and even potential medical oversights. In a study where publications and data researches that are in concern with databases establishment in veterinary practices are examined, the researcher concluded that its implementation is with great prospect and popularity in the current field of sciences and business expertise [7]. Hence, a key feature which is the pet record storage of which this paper's system shall implement is prospectively beneficial both for the veterinarians and their prospective clients.

Clinical decision-making process is one of the most complex aspects of the veterinarian-client-patient interaction [8]. It refers to how veterinarians' approach to communication in clients in the decision-making process and their ultimate satisfaction. As such, different approaches to the interaction will consequently affect the decision-making process. One of the most common communication approaches used in a clinical setting is paternalism [9], to which the veterinarian would take the lead during the appointment, assuming that his/her values mirror the client's. This has been proven to be ineffective as clients would have an increase in resistance to change or decisions. Instead, a client-centered communication is the suggested optimal approach, wherein the veterinarian will act as an advisor or counselor, allowing shared decision making.

The importance of medical records is in their role in patient care, examination, diagnosis, treatment, research,

and hospital management [10]. It is the basic conditions for a hospital management. Traditional paper records are difficult to keep and query. With the development in the field of Information Technology, it is possible to deposit patient information through information systems. The Electronic Medical Record systems are crucial for the digital management of patient and medical records. With that, it has greatly improved the hospital management's efficiency and the stored electronic medical records can be used for big data analytics.

Modern healthcare settings are dependent on the use of Information Technology (IT) [11], and in some cases, required by the law. Integrating IT into healthcare became an emphasis of the USE Federal Government through the Health Information Technology for Economic and Clinical Health Act of 2009. Since then, four out of five clinics have adopted the use of basic electronic health records. Cloud storage has also been rising in popularity in the healthcare sector over the years and the stigma around it has reduced, recognizing the potential advantages. As more clinics use mobile applications, storing data in the cloud has allowed for more complete access to the information. Scalability of cloud technologies is also an enormous advantage due to the growing number of connected medical devices.

Using an Electronic Veterinary Management (EVM) system has improved the efficiency of accessing pet data compared to traditional methods [12]. Averaging 25.14 seconds for getting data in an EVM while the average time for traditional is 37.09 seconds. He also points out the job description of employees under a veterinary system, namely: employee, veterinarian, and manager. He identified that the employee has only minimum access, while the veterinarian can modify treatment plans, and decide the course of action in pet care. As a veterinarian, they are responsible for treating animals brought to the clinic. Lastly, the manager is the one who can manipulate the data inside the system and view revenue.

Balasooriya [13] developed a web-based application to improve inefficient resource management while saving time. Health care for animals is just as important as health care for a person. The system offers more benefits than the traditional way. With the advancement of technology, he created veterinary software that makes scheduling easy and keeps up with pets' necessary medical appointments and care. It is also capable of storing vaccine records and history records of pets. The said project was created because of the smaller number of online applications for veterinary systems. It does not only address pet owner's problems but it also addresses the management side. The system is not only designed for pet owners but considers orphaned dogs as it provides volunteer services.

Studies show that using MERN technology covers the functionalities of the system, including managing pet users, their boardings, services, and products. It provides interaction for users to perform their pet's activities and accomplish them quickly. It also includes testing of various functionalities and a reflection on the design and implementation process [14].

Using a Geographic Information System (GIS) application for locating veterinary clinics, the application is designed to be user-friendly, with simple buttons for easy navigation. The system should provide information about

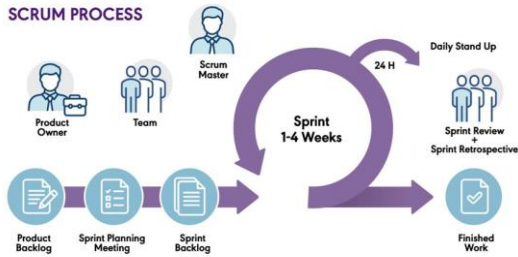
the location of veterinarians and includes features such as map directions and news information about veterinary clinics [15].

3. METHODS and DESIGN

3.1 Methodology

In order to achieve the objectives of the study, quantitative method research was used for the study which was conducted through online survey and face to face interview as well as the utilization of agile scrum framework. Data-driven approaches aid in acquiring insights about the design and implementation of the study while ensuring it addresses prevalent issues and aligns with the needs and preferences of both pet owners and veterinary professionals. Quantitative method evaluates empirical statements through gathering numerical-data [16]. Agile consists of different frameworks one of which is the scrum. Scrum is adaptive, fast and flexible with a main goal of fulfilling the clients' needs through the project development strictly with open communication and shared ownership. As shown in Figure 1 Scrum's development starts with the fundamental requirements of a project followed by the creation of a list of tasks called backlogs which will be categorized by its priority and be called sprints [17].

Figure 1
Agile Scrum Methodology



As shown in Table 1 a total of 7 sprints should be accomplished each week, starting on September 28, 2023, and ending on November 17, 2023. First sprint would cover the account creation and logging in of the veterinarian through the administrator, and the pet owner in the website. Second would be the uploading of the veterinarian and pet owner's information and changing of passwords in case if forgotten. Sprints three and four would be for the vet and client interaction and appointment scheduling. Sprints five and six is accessing and updating information. Lastly, the final part would assist the administrator in the maintenance of the system.

Table 1
Sprint Backlogs Summary

Sprint	Task	Backlog Items
1	Account Creation And Disabling	User Landing Page
		Signing Up
		Uploading of Pet Information

2	Account Management	Veterinarian Register
		Account Disabling
		Upload Vet Credentials
		Log In
		Change Passwords
3	Communication and Location Services	Verify Vet Credentials
		Locate Nearby Clinics
		Communicate via Chat System
		Access Medical Records
4	Appointment Scheduling	See Pet Owner Information
		Schedule an appointment
		Request for rescheduling
		Confirm Appointment
		Confirm Rescheduling
5	Accessing information	Upload/Download Files
		Access Prescription
		See Own Pet's Medical Records
6	Updating information	Vaccination Tracker
		Update Pet Information
		Update Medical Records
7	System Maintenance / Feedback	Disable Files
		Report Bugs
		See Bug Reports
		Backup Existing Data

The context diagram of Hospetal shows how the entities- pet owner, veterinarian, and the system administrator, would interact with the system and its data.

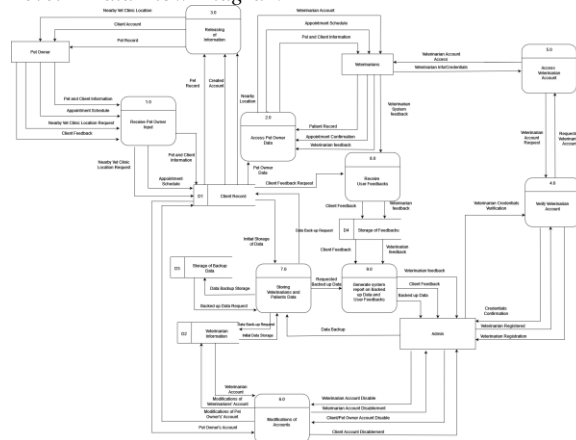
Figure 2
Level 0 or Context Diagram



The Level 1 data flow diagram (DFD) serves as an

intricate and detailed guide, offering a comprehensive overview of the processes involved in the processing, storage, and interaction of data within the system. This diagram represents a critical milestone in systems analysis and design, providing a deeper insight into the flow of information and the dynamic relationships between various entities and the overarching system.

Figure 3
Level 1 Data Flow Diagram



3.2 Research Design

The researchers formulated statements in the form questionnaire aligned with the objectives of the study and the initial identified needs of veterinarians and pet owners. The researchers employed two dissemination methods in which Google Forms was utilized as it offers a convenient digital platform for the respondents, allowing for greater distribution and ease of response collection. These questions were also given through face-to-face meetings with veterinarians and pet owners that provided the opportunity to engage directly, fostering deeper insights. These varied approaches ensured a comprehensive reach, catering to diverse preferences in participation.

3.3 Data Gathering Procedure

The data collection was conducted after the initial presentation of the project's idea. The survey questionnaire was given to people who own animals as pets and veterinarians who own or serve a clinic by distributing or conducting face-to-face interviews to both respondent types.

3.4 Population and Sample

Different Pet Owners and Veterinarians across Bulacan have been selected to give out the survey questionnaires. A total of 13 Pet Owners and 7 Veterinarians have been approached for the development of the Map-Based Veterinary Management System.

3.5 Statistical Treatment

The study used a five point Likert-type scale as a means of data collection. This allows participants to express their responses to a range and scalable degree. Table 1 shows the description, range, and scale of the picked answers.

Table 2

Questionnaire Choices for Veterinarians' and Pet Owners' Insights for Project's Development

Scale	Range	Description
5	4.50 - 5.00	Strongly Agree
4	3.50 - 4.49	Agree
3	2.50 - 3.49	Neutral
2	1.50 - 2.49	Disagree
1	1.00 - 1.49	Strongly Disagree

3.6 Data Analysis

The development of the project was based on the gathered insights of the pet owners and veterinarians about their needs and wants. Shown in Table 3 and 4 were the recorded answers in the survey. Five veterinary clinics were interviewed for the study wherein two were interviewed face to face. Out of the seven veterinarians only one approved of the idea of diagnosing or having checkup for pets online. As online checkups are not advisable in all circumstances wherein basic physical checkups are not to be executed along with laboratory tests for proper and accurate diagnosis and treatment of the patient [18].

Table 3

Sets of Questions for Veterinarians' Insights for Project's Development

Questions	Yes	No
Store and record Patient's records	5	0
Communicate with Patients via the App	4	1
Track Patient's Pet Status	4	1
Bill Clients Online / Send Invoices	4	0

As shown on both Table 3 and 4, it presents a comprehensive overview of users' perceptions and preferences regarding a proposed veterinary management system. The high mean suggests all stated features should be implemented within the system. However, veterinarians from the previous survey did not agree with the effectiveness of online consultation, hence the third statement in the table was not implemented by the researchers.

Table 4
Sets of Questions for Pet Owners' Insights for Project's Development

Statement	Mean	Interpretation
See nearby available vet clinics around me	4.78	Strongly Agree
Schedule an Appointment with Vet Clinic	4.69	Strongly Agree
Communicate with Veterinarians via online consultation	3.92	Agree
See my pet's record	4.92	Strongly Agree
Track my pet's vaccination	4.84	Strongly Agree
Access Treatment Plans for Pets	4.69	Strongly Agree

4. RESULTS AND DISCUSSION

4.1 Admin Dashboard

Figure 4 illustrates the dashboard page for the admin where they can see a summary of appointment schedules, pets registered, and prescriptions uploaded based on a chosen time frame using a filter. In the dashboard, the admin can also view the user's activity and the number of accounts registered. It also provides the user review so that the admin can see user feedback with regards to their experience in using the system and if there is something that needs to be fixed.

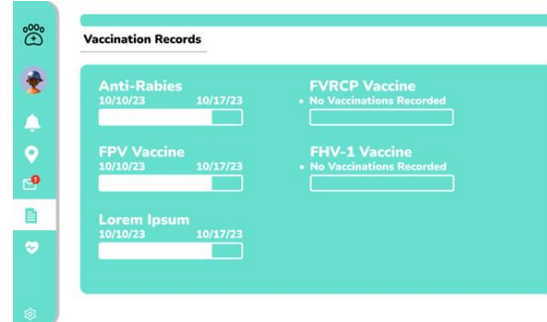
Figure 4
Admin Dashboard



4.2 Track Vaccination of Pets

As shown in Figure 5 it presents a detailed visualization of the vaccination tracking system, a pivotal component in the comprehensive pet care infrastructure. This illustrative representation not only delineates the essential vaccines mandated for your pet but also provides insightful information regarding the recommended intervals for each vaccine. The visualization effectively communicates the duration or frequency for administering each vaccine, offering pet owners a clear and organized overview of their furry companions' immunization schedules. Within this visual representation, users can easily discern the specific vaccines that their pets require, thereby ensuring that they remain up-to-date with their immunizations. The inclusion of the recommended time frames for each vaccine further empowers pet owners to proactively manage their pets' health by adhering to timely vaccination protocols.

Figure 5
Vaccination Tracker

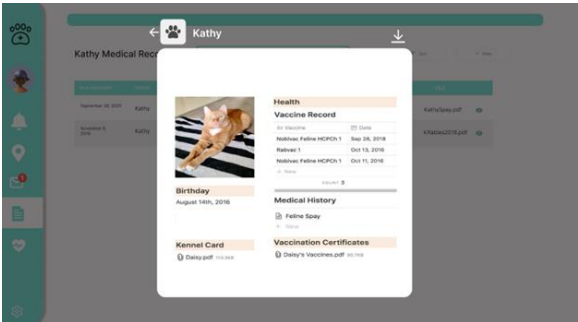


4.3 Access Patient Records

Figure 6 illustrates the functionality of our integrated system, wherein a patient's health records are seamlessly accessible through a comprehensive database. This advanced feature holds significant implications for both veterinarians and pet owners, fostering a streamlined and efficient approach to pet healthcare. For veterinary professionals, this database access translates to an invaluable tool for delivering optimal care. By gaining immediate access to a patient's complete medical history—ranging from past treatments to current health status—veterinarians can make well-informed decisions swiftly, leading to a more rapid and accurate diagnosis. This not only enhances the overall efficiency of veterinary services but also contributes to improved patient outcomes. On the pet owner's side, the accessibility of health records empowers them to actively

participate in their pets' well-being. Through this feature, pet owners can keep a vigilant eye on their pets' health trajectories, facilitating proactive health management.

Figure 6
Patient Records



4.4 Location-based Clinic Searching

Figure 7 shows the integration of location-based searching of nearby partnered pet clinics. The implementation of the map can help the pet owners scan their geographical proximity and identify which pet clinic they should go to. Having a search function for nearby veterinary clinics will give convenience and time efficiency for pet owners. The system also applied a different color and design for the pin so pet owners can easily distinguish partnered veterinary clinics from Hospital. The color blue and paw print will guide the pet owners to the clinic while the red pins are for the ones who are not partnered. The dropdown for province, city, and barangay will further assist the pet owner in easier navigation. For the last function, a “Use location” function will be the one to set your trip for you to head to a partnered clinic without typing or swiping on the screen.

Figure 7
See nearby clinics

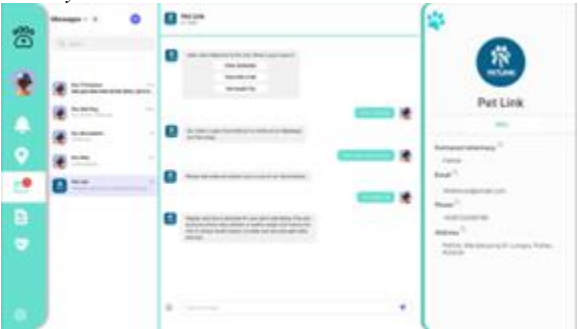


4.5 Chat System

Figure 8 provides a comprehensive depiction of the chat system, showcasing a user-friendly interface that facilitates seamless communication between pet owners and veterinarians. Within this innovative system, pet owners are granted convenient access to engage in meaningful conversations with qualified veterinarians. The interface not only supports real-time communication but also streamlines the process of scheduling appointments, ensuring a hassle-free experience for both users and veterinary professionals. This illustration highlights the user-centric design and functionality of the platform, emphasizing its role in

enhancing the overall pet care experience by fostering efficient communication and prompt appointment management.

Figure 8
Chat System



4.6 Prototype Evaluation Using ISO/IEC 25010 Standard Model

In Table 5, the system received an overall mean of 4.49. The interpretations of each statement all favor “Strongly Agree”. The highest among the statements are its Functional Suitability and Security, both with a mean of 4.53. The second is its Performance Efficiency at 4.51. Third is its Portability with a score of 4.50. Fourth is the Usability at 4.48. Lastly, Maintainability ranks with a mean of 4.41. The scores show that Hospetal provides a Functional and Secure website to both the client and veterinarian, while also having a balanced experience to other statements.

Table 5
Prototype Evaluation

Statement	Mean	Interpretation
Functional Suitability	4.53	Strongly Agree
Performance Efficiency	4.51	Strongly Agree
Usability	4.48	Strongly Agree
Security	4.53	Strongly Agree
Maintainability	4.41	Strongly Agree
Portability	4.50	Strongly Agree
Overall Mean	4.49	Strongly Agree

5. CONCLUSION

The integration of modern technology in veterinary practices has provided an impact in the modern era, not only through the interaction between the professionals and the clients, but also to their own patients -

pets. This study aims to provide an integration of systems that would provide interactions of both entities that allow visible and proper communication. Systematized veterinarian management is crucial for sustaining efficiency. Embracing these advancements positions the veterinary field at the forefront of care for animals and ensuring the success of operations in a rapidly evolving landscape.

6. RECOMMENDATION

The following recommendations are made in light of the study's conclusions and breakdown of its findings. For researchers in the future who are venturing into the development or analysis of a comparable system, it is strongly suggested that they: (1) Utilize artificial intelligence to perform predictive analysis and diagnostic support; (2) Permit users to utilize the system in the form of a mobile application; (3) Allow collaboration between veterinarians of different clinics in order to ensure that the client treatment is consistent throughout partnered clinics; (4) Integration with an API-enabled EHR (Electronic Health Record) ensures that patient data, including medical history, diagnoses, and treatment plans, is consistently updated across systems. The incorporation and refinement of these features will significantly elevate and enrich the overall experience for both pet owners and veterinarians alike and also improve the quality of patient care.

7. RESEARCH IMPLICATIONS

After a careful deliberation of the study, the Veterinary Management System will be used as a point of contact between Pet Owners and Veterinarians. Pet owners may use HosPETal to schedule appointments and search for suitable clinics near them, as well as contact veterinarians with the chat system. Veterinarians may use the system as a means of managing different patients and their respective owners as well as confirm, reschedule, and cancel appointments. Additionally, future pet owners can use the system as a means for finding a future trustworthy veterinarian that can help their pets to be healthy.

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