



Web-Based Medical Record and Veterinary Clinic Service Information System Using The Waterfall Method at UPTD Veterinary Health Clinic, Medan City

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ABSTRACT

The rapid advancement of information technology in veterinary healthcare has significantly impacted medical data management modernization. The Regional Technical Implementation Unit (UPTD) Veterinary Clinic of Medan City encounters challenges with manual recording systems that result in operational inefficiencies, documentation error risks, and loss of critical animal medical record data. This research develops an integrated Web-Based Veterinary Medical Records and Clinic Services Information System equipped with service-supporting features, enabling clinic staff to manage animal medical data digitally while providing organized and efficient services to pet owners. The development follows waterfall methodology through requirement analysis, system design utilizing Unified Modeling Language (UML), implementation employing PHP and MySQL, Black Box Testing procedures, and maintenance phases. Results demonstrate that the system significantly enhances medical record documentation efficiency, reduces data errors, and provides real-time accessibility to animal medical information. All core features including patient registration, medical record documentation, queue management, vaccination tracking, online consultation, and reporting have been tested and function effectively. The system successfully digitalizes medical documentation workflows and provides clinic staff with enhanced control in data management.

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1. Introduction

The advancement of information technology has significantly impacted data management and healthcare services, including veterinary medicine. Many clinics in Indonesia still rely on manual record-keeping, which is inefficient and prone to errors and data loss. Animal medical records stored on paper require large storage space and are easily damaged, making digital systems a more reliable solution [1-5]. In the digital era,

information technology has become the backbone of healthcare administration, including at regional technical service units. Web- and mobile-based systems provide fast access for pet owners to conduct consultations and obtain real-time information, while also increasing their involvement in pet care. The integration of this technology has proven to enhance service quality by ensuring clinic operations remain efficient even with increasing numbers of patients [6-10].

The theoretical foundation of this system lies in the automation of sensitive medical processes while maintaining confidentiality, integrity, and data availability. However, the UPTD Veterinary Clinic of Medan City still employs manual, paper-based documentation, leading to problems such as data loss, errors, duplication, and delays that hinder optimal services. This condition highlights that digital transformation is an urgent necessity rather than a mere trend.

This study proposes a Web-Based Veterinary Medical Records and Clinic Services Information System using the Waterfall model, supporting systematic record-keeping, reporting, real-time queue management, integrated vaccination scheduling, and online consultations. The system is built with PHP CodeIgniter, MySQL, and XAMPP, proven to accelerate services, minimize data loss, and reduce documentation errors. Unlike previous research, this system offers full integration between medical documentation and supporting services, enabling medical staff to access complete examination histories, manage vaccination schedules, and communicate directly with pet owners [11-18].

With a web-based architecture, the system is accessible via computers, tablets, and smartphones, transforming manual workflows into structured, secure, and reliable digital processes. This study, conducted at the UPTD Veterinary Clinic of Medan City, contributes by designing a web-based medical record system, evaluating the efficiency improvements after digital integration, and providing a digitalization model that can be replicated by other veterinary service units. Thus, the study not only improves technical efficiency but also supports public service digitalization programs and promotes the digital transformation of veterinary healthcare services in Indonesian.

2. Method

In this research, the author employs the Waterfall method as the development approach for the veterinary medical record information system. This methodology was selected because the system requirements have been clearly defined from the outset, featuring two primary actors namely veterinarians and administrators, whilst the business processes remain relatively structured and do not undergo significant changes throughout the development process [19-20]. The complexity of system features such as examination result recording, animal data management, and clinic reporting are still categorised as stable and linear, thus the Waterfall approach is deemed appropriate and effective for implementation. The Waterfall model is recognised for its systematic and layered approach, wherein each phase must be completed before proceeding to the subsequent stage.

Data Collection Techniques

In order to obtain relevant data and support the development of the Veterinary Medical Record Information System at UPTD Animal Clinic Medan City, the author utilises

several systematically designed data collection methods. The methods employed in this research are as follows:

1. The author conducts direct observation at the UPTD Animal Clinic Medan City location to examine the ongoing veterinary service processes. Through this method, the author can comprehend the operational activity flow of the clinic, ranging from animal registration processes, medical record documentation, to manual storage of medical documents. This observation aims to identify problems arising from the absence of a digital system in data management.
2. This method is conducted through face-to-face meetings directly with staff and the clinic head as primary informants. The interviews aim to obtain more detailed information regarding constraints and requirements in the medical record service system. Several questions posed include:
 - a. What problems are currently faced in medical record documentation?
 - b. What types of medical services are available at the clinic?
 - c. How is the examination recording process conducted?
 - d. Does the clinic already possess a web-based information system for medical data management?
3. The author collects several data and documents utilised in the clinic's administrative processes, such as patient examination forms, manual medical record cards, and treatment history records. This data is used to analyse the information structure required and will serve as the foundation for the system's database design.
4. The author also conducts a review of several academic journals, articles, and other academic references related to information system development, particularly in the veterinary field. This study aims to obtain theoretical foundations supporting the research and serves as a reference in selecting appropriate system development methods.

ANALYSIS AND DESIGN

Analysis of Current Running System

The service process begins when a pet owner arrives directly at the clinic with the purpose of obtaining veterinary services. Without needing to make an appointment beforehand, the pet owner proceeds directly to the registration section at the clinic. This represents the starting point of the entire service flow.

Upon arrival at the clinic, the pet owner conducts manual registration. Here, they are requested to complete a form containing personal data as well as information about their animal. The information collected includes the owner's name, contact details, and animal data such as the animal's name, species, age, complaints, and other relevant details. If necessary, clinic staff will provide assistance in completing this data.

After the form is completed, the clinic staff or administrator re-records this data into the clinic's recording system and creates a manual registration card as proof of registration. This is done physically, without the assistance of a computerised system. The registration

card is then returned to the pet owner as evidence that they have been registered and will shortly enter the examination queue.

Subsequently, the pet owner will wait for their examination turn. The queuing system operates based on order of arrival, and staff conduct periodic checks to determine whether the examination turn has arrived for each pet owner. If their turn has not yet arrived, the pet owner continues waiting. When the turn arrives, the veterinarian will call and begin conducting the examination. The examination is conducted comprehensively using anamnesis methods (question and answer regarding complaints), diagnosis, and medical procedures if required. The doctor ensures that each animal case is handled with a professional approach and according to proper procedures.

After the examination is completed, the doctor manually records the examination results on the animal's physical card. This record contains the diagnosis results, types of medical procedures administered, and additional notes if required for follow-up or subsequent monitoring. The physical card document is then handed to the pet owner as a medical record that can be used again during the next check-up or as proof of having received services.

Subsequently, the doctor will evaluate whether the animal requires medication prescriptions or further medical recommendations. If not required, the service process directly approaches the final stage. However, if a prescription is needed, the doctor will manually write the prescription on a special prescription sheet and hand it to the pet owner. After that, the prescription document is given to the pet owner, and staff will provide important information that the clinic does not provide a pharmacy or medications directly. The pet owner is directed to fill the prescription at an external pharmacy according to the medications recommended by the doctor.

With the conclusion of the examination process and prescription provision (if any), the pet owner may leave the clinic. This marks the completion of the entire veterinary service sequence provided by the clinic. Finally, the flow concludes with a "Complete" status, which means the veterinary service business process has been completed from beginning to end for one service session.

Current Business Process Flow

To address various problems faced by UPTD Animal Clinic Medan City due to manual system usage, the development of a web-based veterinary medical record information system is proposed. This system aims to facilitate clinic service digitalisation from registration, examination result recording, medical data management, to reporting, with specific role-based access for pet owners, veterinarians, and administrators. The proposed system is designed to be user-friendly and capable of simplifying time-consuming operational processes whilst supporting digital and centralised medical record management, automatic notifications, quick search capabilities, and data-based reporting. With this information system implementation, all clinic service processes are expected to operate more structurally and professionally in accordance with contemporary demands.

1. Pet Owner System Flow

Pet owners access the system's main page. If they do not have an account, they register by completing personal data, contact information, and pet details. The

system automatically validates the data, and if valid, the account will be registered for login access. After successful login, the main dashboard displays menus for examination schedules, announcements, monitoring, and history. Through the "Schedule" menu, owners can view available examination schedules complete with dates and doctor names. The "Announcements" menu provides the latest information from the clinic such as service holidays or free vaccination programmes.

2. Veterinarian System Flow

The dashboard displays a list of animals scheduled for examination, enabling doctors to efficiently identify their clinical tasks by either adding new patient data or selecting existing patients from the available list. When a patient is selected, the system displays complete medical record history, allowing the doctor to conduct physical examination and record results including symptoms, clinical signs, and diagnosis. The veterinarian then determines whether medical procedures or standard treatment with prescriptions are required, with all examination results and prescription data being stored in the database as part of medical records. Doctors can schedule follow-up visits if needed, with the system automatically sending reminder notifications to pet owners before logging out and terminating the user session.

3. Administrator System Flow

The process begins when admin staff access the veterinary medical record information system and initiate a work session through login using registered credentials, with the system performing automatic validation to verify username and password before displaying the admin dashboard containing various main menus such as Dashboard, User Management, Add User, Doctor Verification, Appointment Management, Queue, View Medical Records, and Reports. Admin can manage user data through search features based on specific criteria, perform actions such as editing or deleting data, add new users including pet owners or veterinarians, and review and verify veterinarian credentials including document completeness and qualification validation with automatic database updates. Additionally, admin can manage various other system features such as patient queue arrangement, viewing medical records that can only be inputted by veterinarians, and accessing monthly reports with filters for vaccination, users, animals, and queues before logging out from the system to safely terminate the work session.

System Overview

The design phase constitutes a crucial component in the development process of web-based information systems. During this stage, system blueprints are crafted to provide a comprehensive overview of how the system will operate, encompassing user interaction flows, data storage architecture, and interface presentation. This system design embraces a modeling approach utilizing the Unified Modeling Language (UML), which incorporates various diagram types such as Use Case Diagrams, Activity Diagrams, Sequence Diagrams,

and Class Diagrams. The objective of this design process is to ensure that the system can be developed in accordance with previously identified requirements, whilst facilitating the implementation process for developers.

The design methodology employed here follows established software engineering principles, wherein each UML diagram serves a specific purpose in documenting different aspects of the system architecture. Use Case Diagrams illustrate the functional requirements and user interactions, Activity Diagrams map out the workflow processes, Sequence Diagrams detail the temporal aspects of object interactions, and Class Diagrams define the structural relationships within the system. This comprehensive modeling approach not only enhances the clarity of system specifications but also serves as a communication bridge between stakeholders and the development team, ultimately contributing to more efficient and accurate system implementation.

Functional Requirements

Functional requirements delineate the functions that must be present within the system :

For Veterinarian Users

The system must be capable of displaying a main dashboard containing summary information of today's patients and clinic statistics. Veterinarians must be able to register new patients by completing comprehensive data entry for both animals and their owners. The system must provide a search feature for patients based on animal name, owner name, or registration number to enable rapid access to medical records. Veterinarians can create new examination records with input fields for symptoms, diagnosis, medical procedures, and medication prescriptions. The system shall store all examination data chronologically and display complete patient medical histories. An automated reminder feature for vaccination schedules and routine check-ups must also be available. Veterinarians can print animal cards and medical certificates as required.

For Admin Users

The system must provide secure login access using authentication with encrypted usernames and passwords. When credentials are incorrect, the system shall display clear error notifications. Administrators can access a control panel to manage veterinarian data, practice schedules, and system configurations. Administrators must be able to manage medication and medical equipment data with add, edit, and delete functionality for inventory items. The system must provide statistical reports on patient visits, frequently encountered disease types, and clinic performance on a periodic basis. All data can be exported in PDF or Excel formats for reporting purposes.

Non-Functional Requirements

Non-functional requirements encompass security and usability aspects:

1. **For Security:** All medical data must be encrypted and stored using high-security protocols. System access must be protected through multi-level authentication systems and robust session management. Automated data backup must be performed periodically to prevent loss of medical information. The system must

comply with data protection regulations and patient privacy standards. User activity logs must be recorded to maintain a comprehensive audit trail.

2. **For Performance:** The system must be responsive with a maximum loading time of 3 seconds per page. The database must be optimised to handle large data volumes without performance degradation. The system must accommodate concurrent access by multiple users without data conflicts.
3. **For Usability:** The interface must be intuitive and easily learnable by users with varying levels of technological expertise. Navigation must be straightforward with logically organised menus. Input forms must be equipped with real-time validation and informative error messages.

System Design

The creation of information system design constitutes a vital stage preceding the implementation process. In this research, the system design is developed based on the Waterfall methodology approach, which represents a sequential software development model commencing from requirements analysis, system design, implementation, testing, through to maintenance phases. This approach is selected due to its systematic development flow, which aligns appropriately with project requirements that possess a clearly defined and stable scope.

The system design is structured with the objective of providing an overview of how the veterinary medical records information system will function both technically and visually. This design encompasses data structure, user interface presentation, and the system architecture to be employed. Through mature design planning, the system implementation process can be executed efficiently and in accordance with end-user requirements, namely veterinarians, administrators, and pet owners.

The system being developed is designed as a web-based application utilising modern programming technologies. This web-based approach facilitates accessibility across multiple platforms whilst ensuring consistency in user experience. The adoption of contemporary programming frameworks and methodologies ensures that the system remains scalable, maintainable, and capable of accommodating future enhancements. Furthermore, the web-based architecture enables seamless integration with existing clinic infrastructure whilst providing the flexibility required for multi-user environments typical of veterinary practice settings.

Database Design

The database is designed to store all necessary data within the system through an interconnected table structure, where each table serves a specific function in supporting the complex operations of the veterinary medical records information system.

The veterinarian table is designed to store veterinarian data with an id field serving as the primary key, an str number for official identification as a veterinarian, the doctor's full name, specialization expertise possessed, practice schedule, and an encrypted password for authentication system security. The patient_hewan table is structured to store patient animal information with an id field as the primary key, pemilik_id as a foreign key

connecting to the animal owner table, animal name, animal type such as dogs, cats, birds and others, breed, gender, body weight, fur colour, sterilization status, and registration date to record when the animal was first registered.

The animal owner table is designed to store owner data with an id field as the primary key, owner's full name, complete address for communication and visits, telephone number for contact, email address, identity card number for official identification, and the owner's occupation. The medical records table serves as the primary medical documentation table with an id field as the primary key, patient_id as a foreign key connecting to the patient animal table, doctor_id as a foreign key connecting to the veterinarian table, examination date, chief complaint presented by the owner, detailed history, clinical symptoms observed by the doctor, animal's body temperature, weight during examination, complete physical examination, primary diagnosis, secondary diagnosis if applicable, medical procedures performed, doctor's notes, and next control date.

The vaccination table is designed for tracking animal immunization with an id field as the primary key, patient_id as a foreign key connecting to the patient animal table, type of vaccine administered, vaccination date, vaccinating doctor, vaccine batch number, vaccine expiry date, and next vaccination schedule for reminder purposes. The appointment table is designed for consultation schedule management with an id field as the primary key, patient_id as a foreign key connecting to the patient animal table, doctor_id as a foreign key connecting to the veterinarian table, consultation appointment date, appointment start time, estimated completion time, type of service requested, appointment status such as scheduled or completed, and special notes for the appointment.

System Implementation

This display represents the initial interface when users (pet owners, veterinarians, administrators) access the website of UPTD Animal Clinic, Department of Food Security, Agriculture and Fisheries, Medan City. The homepage features a welcome message "Welcome to Animal Services and Medical Records" with a description stating that the clinic provides modern and efficient services for beloved pets. The display includes illustrations of the veterinary medical team and various types of animals that can be served, such as dogs, cats, birds, and other pets. A "Get Started" button is available to begin accessing services. This display can be seen in Figure 1 below:



Figure 1. Initial Display of UPT Animal Clinic Website Homepage

This display represents the main dashboard for pet owners, featuring user greetings and system statistics including Total Animals, Consultations, Vaccinations, Active Queue, and Notifications. The dashboard is equipped with information about the latest animals along with their status and recent consultation history with process status to facilitate pet monitoring. This display can be seen in Figure 2 below:

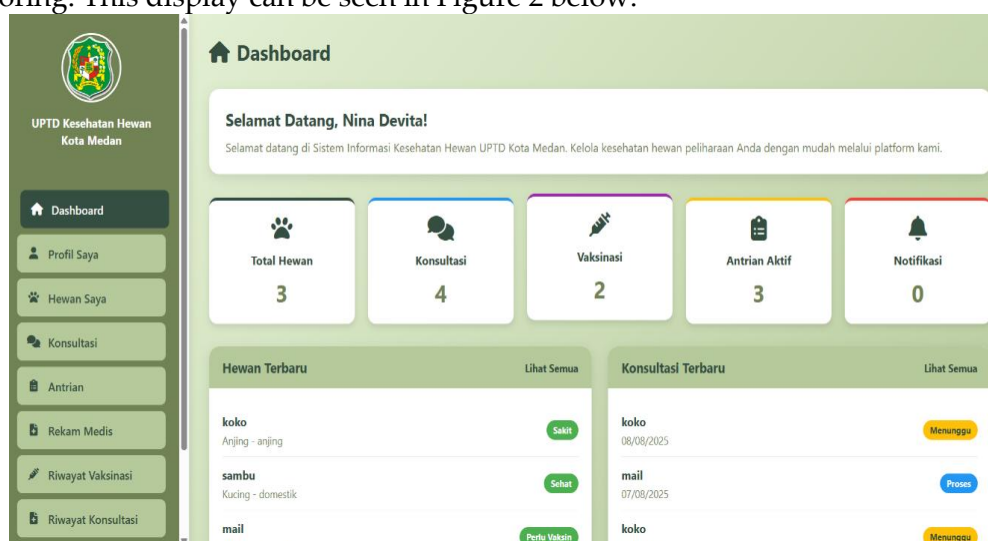


Figure 2. Pet Owner Dashboard Display

This display represents the veterinarian dashboard page showing a summary of activities and animal services. The page contains key statistics such as Total Consultations, Total Vaccinations, Total Patients, and Diagnosis History. The lower section features quick access menus to view various data and information panels for recent consultations and vaccinations. This display can be seen in Figure 3 below:

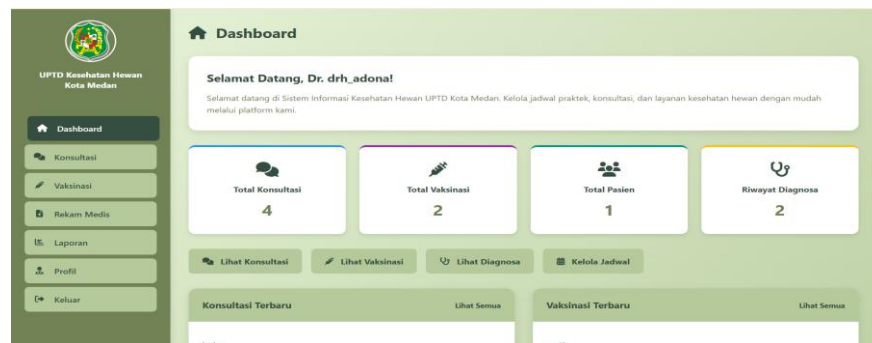


Figure 3. Veterinarian Dashboard Page Display

This display represents the admin dashboard page for managing the UPT Animal system. The dashboard shows system statistics, admin navigation menu, quick action buttons, and security information panel to assist administrators in managing the entire system. This display can be seen in Figure 4 below:

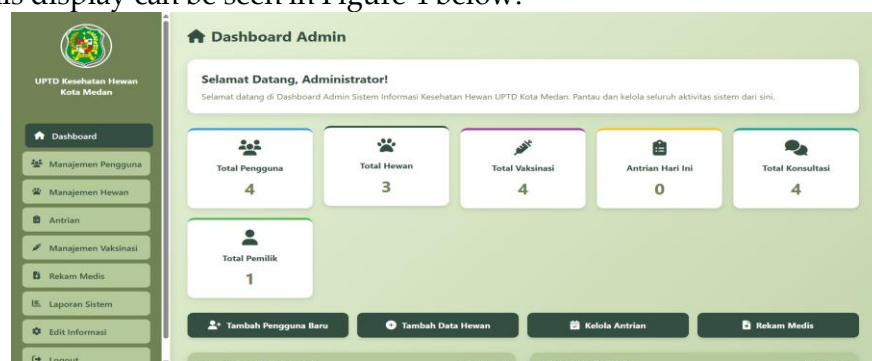


Figure 4. Veterinarian Profile Page Display

Test Scenario

In terms of system testing, a comprehensive black-box testing methodology was implemented to ensure that each functional component operates according to specifications. The testing scenarios encompassed the main website homepage functionality which verified basic loading and navigation capabilities, user role selection that validated proper form rendering for different user types including pet owners and administrators, pet owner registration that ensured form validation and successful account creation processes, authentication systems for all user roles including administrators, veterinarians, and pet owners with proper credential verification and dashboard redirection, pet owner dashboard functionality that confirmed statistical data display and system overview presentation, user profile management that validated profile editing capabilities and data persistence, pet management features that tested animal registration, data modification, and record maintenance, consultation systems that verified messaging functionality between pet owners and veterinarians with proper chat interface operations, veterinarian dashboard that ensured queue management and summary data visualization, vaccination management that validated data input, storage, and tracking capabilities, medical record systems that confirmed comprehensive health record documentation and prescription management, administrative dashboard functionality that verified system

statistics and administrative control panel access, user management systems that tested user registration, modification, and administrative oversight capabilities, animal management features that validated comprehensive pet data handling including deletion operations, queue management systems that ensured proper verification and status update mechanisms, vaccination administration that confirmed scheduling and record-keeping accuracy, and profile configuration systems that validated settings management and data synchronization. This structured testing approach ensures comprehensive validation of system reliability, functionality, and usability across all user roles before deployment, providing confidence in the system's operational readiness for veterinary clinic management.

Test Results

The veterinary medical records information system has been successfully developed and functions effectively according to requirements. The systematic implementation of the Waterfall methodology, progressing through analysis, design, implementation, and testing phases, has enabled the system to store and manage animal medical data more efficiently. Both veterinarians and pet owners can easily access medical information through a user-friendly interface, resulting from the structured design approach that enhances medical data management efficiency.

The integrated system with systematic data storage minimizes recording errors and information loss through comprehensive documentation processes derived from thorough requirements analysis and detailed design phases. The system enables veterinarians to provide faster and more accurate services since animal medical histories can be accessed instantly, supporting more precise medical evaluations. Additionally, administrators can efficiently manage examination schedules, patient data, and clinic reports, with the implementation and testing phases of the Waterfall methodology ensuring that all system functions operate according to design specifications and user requirements, ultimately improving overall veterinary service delivery.

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