International Journal of Research in Engineering and Modern Technology (IJREMTE)
Volume 2, No 1, April 2025, Pages 39-48
ISSN 3089-4077

Design and Development of an Android-Based Veterinary Appointment Application Using Nearest-Location Detection

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***Abstract*— Information for Veterinary service locations currently still uses a manual system by searching for information on Veterinary services via the internet or word of mouth. There is a complete information application platform regarding the nearest Veterinary clinic or practice along with information about the specialist from the Veterinarian himself. Veterinarians can register their services in the application.**
This application uses the Rapid Application Development (RAD) software development method. The system was built using Visual Studio Code as the IDE then SQL as the database, and the server side. In functionality testing using the black box method. In the list, Veterinarians are sorted based on the closest location to the patient's location by comparing the latitude and longitude coordinates of the Veterinarian and the patient.
***Keywords*— Veterinary Appointment; Veterinarian; Android Application;**

I. INTRODUCTION

A veterinarian, or veterinary doctor, is a healthcare professional dedicated to diagnosing and treating animal diseases, while also promoting animal welfare and safeguarding public health in the veterinary field [1]. Appointment services with veterinarians serve as a healthcare facility that enables pet owners to arrange consultations with veterinary practitioners. Such services are increasingly important in daily life; nonetheless, locating veterinary service providers often remains a manual process, typically involving internet searches or personal referrals, which can hinder timely access to animal healthcare.

To address this challenge, it is essential to establish a unified platform offering detailed information about nearby veterinary clinics, including the expertise and specialization of each veterinarian. This solution would help the public more easily identify and reach suitable veterinary services tailored to their needs. In light of the growing adoption of internet-based services and the limited availability of integrated information on veterinary practices, this study proposes the development of an Android-based system entitled “Design and Development of a Veterinary Appointment Scheduling Application.”

II. LITERATURE REVIEW

Appointment

An appointment refers to a scheduled arrangement in which a visitor books a service at a specific time and place. Through appointments, users can make online reservations without physically visiting the clinic. This system reduces waiting times, minimizes queues, and prevents congestion within healthcare facilities [2].

Android

Android is a mobile operating system that treats core applications and third-party apps equally. Its Application Programming Interface (API) provides developers with access to device hardware, phone data, and system resources [3].
As a Linux-based operating system, Android encompasses the OS, middleware, and application layer. Its key characteristics include:

1. An open-source platform enabling developers to create mobile applications.
2. An operating system acquired by Google Inc. from Android Inc.

3. A runtime environment (Dalvik Virtual Machine) optimized for devices with limited memory rather than a programming language.

Today, Android dominates the mobile OS market worldwide, thanks to Google's strong support. Initially founded in 2003 by Andy Rubin, Rich Minner, Nick Sears, and Chris White, Android has evolved into the most widely adopted mobile platform.

The foundation of an Android application lies in Java programming, which is compiled with resource files into an APK (Android Package). This APK can then be installed and executed on mobile devices. Four primary components define Android applications:

1. Activities – providing user interface screens.
2. Services – running tasks in the background without a UI.
3. Broadcast Receivers – handling events and notifications.
4. Content Providers – managing structured data accessible to other apps [4].

Development Tools for Android are free and compatible with Mac, Windows, or Linux. Commonly used tools include:

1. Java Development Kit (JDK)
2. Android SDK
3. Android Development Tools (ADT) [5]

Database

A database can be understood as a structured collection of data that represents real-world entities. It is designed for organization, interconnection, and efficient retrieval to meet the information needs of an organization [6]. Another perspective defines "database" as a combination of "basis" (repository) and "data" (facts or objects from the real world). These objects may be expressed as text, numbers, symbols, audio, images, or their combinations. Thus, a database is essentially a systematic repository of real-world information [7].

Object-Oriented Analysis (OOA)

OOA is a methodology that systematically approaches the analysis process [8]. Key activities include:

- Identifying actors and their interactions with the system.
- Developing diagrams such as Use Case and Activity Diagrams.

Use Case

Use cases model system behavior by outlining how actors (users or external systems) interact with the system. They specify available functions and user access rights, focusing on functionality rather than implementation. Typical examples include logging in or creating records. Use case diagrams are effective tools for defining requirements, facilitating communication with stakeholders, and preparing test cases [9][10].

Kotlin

Kotlin is a JVM-based programming language that combines object-oriented and functional paradigms. Its interoperability allows seamless integration with Java in the same project. Beyond Android, Kotlin can also be used for desktop, web, and backend development [11]. JetBrains initially created Kotlin, which was later open-sourced and officially endorsed by Google for Android development [12].

PostgreSQL

PostgreSQL is a highly capable open-source relational database system. With its comprehensive set of features, it supports both medium- and large-scale applications and is often considered superior to many other database solutions [13].

Rapid Application Development (RAD)

RAD emphasizes iterative and accelerated development cycles. It is particularly advantageous for projects requiring quick delivery or facing strict deadlines, as it significantly shortens development time compared to conventional approaches [14].

Object-Oriented Analysis and Design

Unified Modeling Language (UML) serves as a standard for representing object-oriented system design. Frequently used diagrams include use case diagrams, activity diagrams, and class diagrams. Additionally, input-output form design is often added to facilitate programmer understanding [14].

Class Diagram

A class diagram provides a static representation of a system's structure. It outlines classes, their attributes, and methods, while also showing the relationships among them [14].

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Activity Diagram

An activity diagram visualizes the flow of processes within a system. It highlights starting and ending points, activity sequences, and parallel workflows, making it a powerful tool for analyzing system functionality and modeling concurrent processes [14].

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III. METHODS

This section describes the methods applied in the design and development of the Android-based veterinary appointment application. The research methodology consists of several stages, including problem identification, requirements analysis, system design, and implementation.

A. Research Stages

The following are the research stages in the design and development of the Android-based Veterinary Appointment Application:

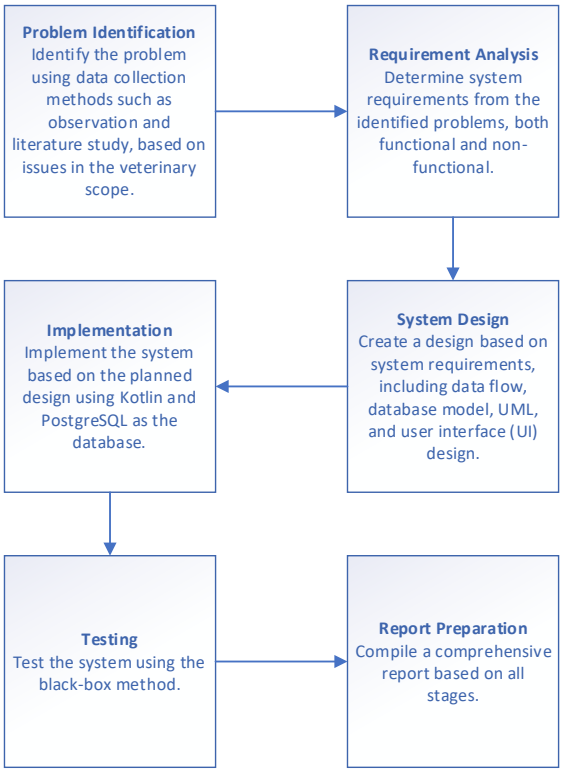

Figure 1. Registration Page

The explanation of the stages carried out in the design and development of this system is as follows:

1) Problem Identification

The first step carried out was problem identification, an activity aimed at understanding the issues that served as the basis for developing the system. This stage was conducted at the research sites, namely within the scope of veterinary hospitals/clinics/practices in the areas of Surabaya, Gresik, and Sidoarjo. The data collection methods used were observation and interviews with relevant parties as data sources.

The problems identified from this stage are as follows:

(1) *Registration at most veterinary hospitals/clinics/practices is still done manually by coming directly to the* location and waiting in line.
(2) Many veterinary clinics or practices are still not well known by the surrounding community.

2) General Description of Business Process

In this study, a general design was carried out related to the overall business process that occurs in veterinary practices. This general description of the business process is used as the basis for designing the system to be developed. The general business process design in this research is illustrated in the business process diagram shown in Figure 2.

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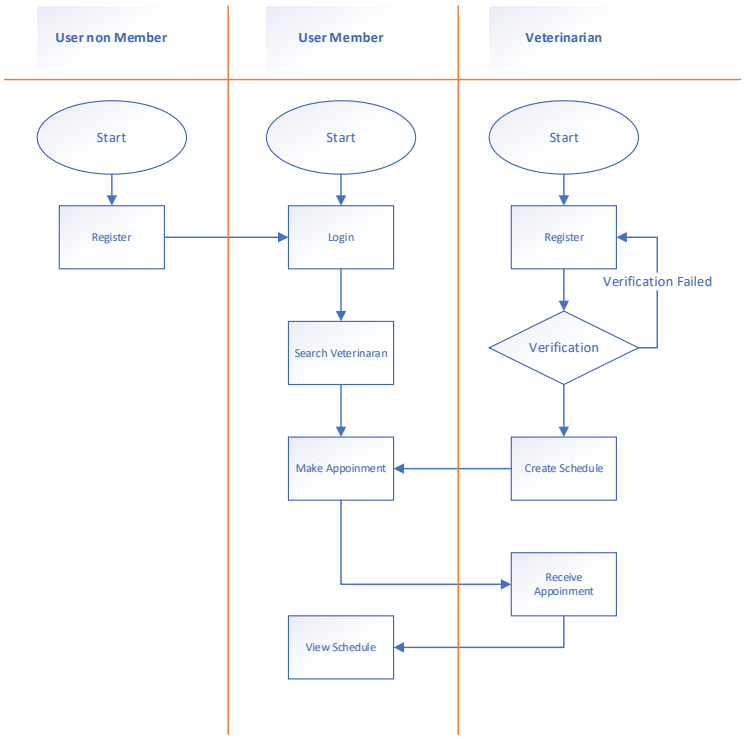

Figure 2. General Description of Business Process

a. Non-Member User

Non-member users are required to register first before proceeding to the login stage.

b. Member User

Member users log in first, and if the input data entered is valid, they are directed to the main page. At this stage, users can perform transactions available in the application.

c. Veterinarian

Veterinarians must register their practice location manually through the administrator. The administrator will then verify the registration, and once successfully verified, the veterinarian can create a schedule, which will be entered into the system by the administrator.

3) Requirements Analysis

After completing the problem identification stage, the next step conducted by the researcher is to determine or analyze the system requirements. The input for this requirements analysis consists of data collection from references available in books and journals, as well as site observations and interviews.

a. User Requirements

User satisfaction is the main objective in developing an application product; therefore, it is necessary to identify the general specifications of user requirements. These requirements include:

1. Patient Requirements:
   (a) Patients can view a list of veterinarians along with their specialization and location distance.
   (b) Patients can view the available schedule of veterinarians.
   (c) Patients can register or book a veterinarian appointment.
2. Administrator Requirements:
   (a) Administrators can validate veterinarian registrations.
   (b) Administrators can view booking orders for veterinarian appointments.
   (c) Administrators can modify patient booking invoices that have already been approved by the veterinarian.

b. System Requirements

System requirements analysis is essential to support the performance of the application system as it contributes to achieving the objectives of the application. The system requirements are as follows:

1. System users are divided into two categories: administrators and patients. Administrators have features to manage transactions within the application, while patients have features to view available veterinarians and book appointments.
2. Administrators will validate veterinarians who have registered and submitted verification.
3. Verified veterinarians can create practice schedules.
4. Veterinarians will receive booking requests that have been verified by the system.
5. Patients can view a list of veterinarians based on specialization and the nearest distance, calculated using latitude and longitude from the patient's location and the veterinarian's location.
6. The system will send booking invoices approved by veterinarians to patients.
7. The system must support data processing operations, namely create, read, update, and delete (CRUD).

c. Non-Functional Requirements

Non-functional requirements refer to aspects that are not directly related to the main system functionalities but are crucial for ensuring the overall quality and performance of the system. These include:

1. The system must respond to user requests within less than 2 seconds.
2. The system must be capable of handling at least 100 appointment bookings per hour during peak usage.
3. Sensitive information such as patient data and transactions must be encrypted during storage and transmission.
4. The system must be available to users at least 99% of the time within a month, with minimal maintenance downtime.
5. All system components, APIs, and databases must be properly documented to facilitate maintenance and continuous development.

d. Hardware Requirements

The hardware requirements for the veterinary appointment application system are as follows:

1. Smartphone
2. 4 GB RAM
3. Internet network

e. Software Requirements

The software requirements for the veterinary appointment application system are as follows:

1. Android operating system version 12
2. Internet connection

4) System Analysis

Based on the analysis conducted in the previous stages, the next step is system analysis. The output of this stage consists of a use case diagram, activity diagram, and class diagram, which are developed using StarUML software, as well as the design of the system's user interface (UI) created with Figma.

Use Case Diagram

A Use Case Diagram is a diagram that describes the interactions between actors and the system. In this study, the diagram illustrates the Android-based Veterinary Appointment Application. Figure 3 presents the use case diagram, which depicts the functionalities of the system.

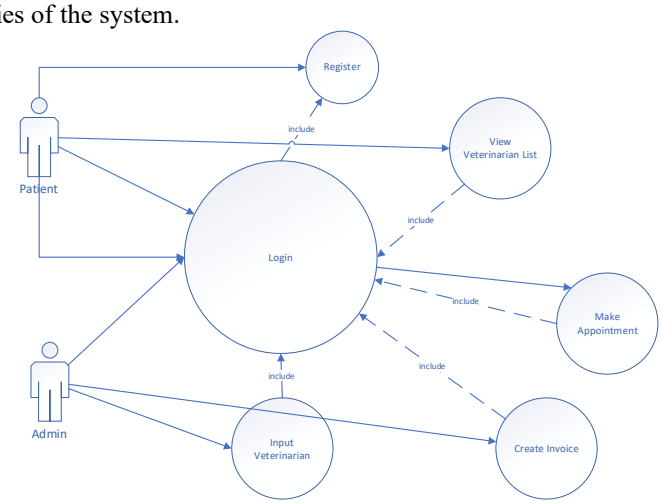

Figure 3. Use Case Diagram

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IV. Result and Discussion

This section presents the results of the system implementation along with a discussion of each developed feature. The discussion highlights the main interfaces and functionalities of the Android-based veterinary appointment application.

A. Registration Page

On this page, users who wish to access the system must register an account by entering their name, email, password, password confirmation, and phone number in order to gain access to the system.

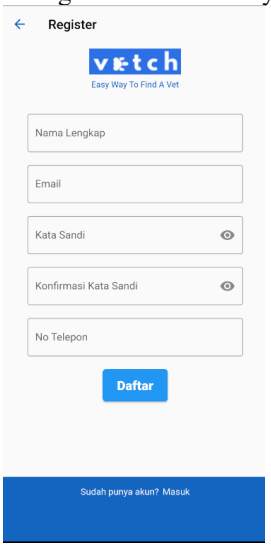

Figure 4. Registration Page

B. Login Page

On this page, users are required to enter the registered email and password. Once the system successfully verifies the provided credentials, the user is granted access to the main page of the application.

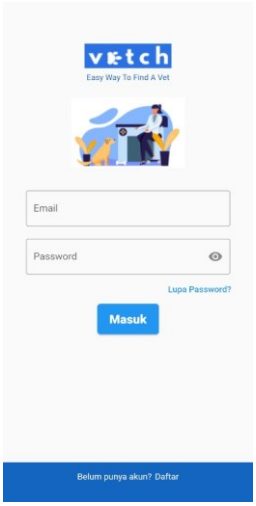

Figure 5. Login Page

C. MainPage

On this page, users are presented with several categories of veterinary specialties. At the top section, an app bar displays the user's profile picture, full name, and current location, which is automatically retrieved when the user enables GPS within the application.

Figure 6. Main Page

D. Veterinarian Detail Page

This page displays detailed information about the veterinarian selected by the user from the veterinarian list page. The information includes the veterinarian's profile photo, full name, workplace, and address.

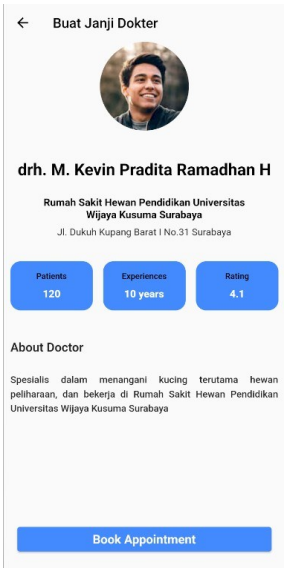

Figure 7. Veterinarian Detail Page

E. Date and Time Input Page

On this page, users can select and enter the desired date and time for a consultation with a veterinarian. The input data will then be saved and sent to the database in the appointments table as the basis for scheduling the consultation.

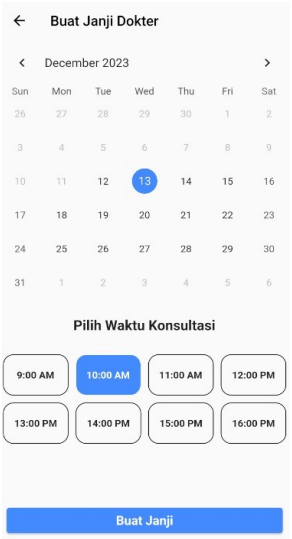

Figure 8. Date and Time Input Page

F. Appointment Schedule Page

On this page, the appointment schedule will be displayed if the user has booked a consultation with a veterinarian. The data shown on this page is retrieved from the appointments table in the database.

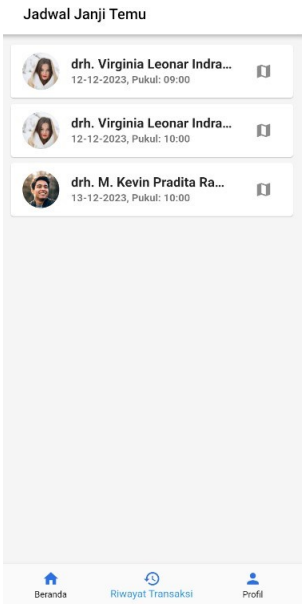

Figure 9. Appointment Schedule Page

G. Testing

At this stage, the researcher conducts testing on the system to ensure that it functions as expected. The testing process applies the black-box method to evaluate the performance of the system's functionality.

1) User Registration

The testing results for the user registration page are presented in Table 1.

Table 1. User Registration Testing Results

No.	Test Scenario	Expected Result	Conclusion
1	Press the register button after filling in all the required data correctly	The data is saved into the database and the display is redirected to the login page	Valid
2	Do not fill in all the required data correctly	No data is saved into the database and the display remains on the register page	Valid

2) Displaying User Location

The testing results for displaying the user's location are valid, as shown in Table 2.

Table 2. User Location Testing Results

No.	Test Scenario	Expected Result	Conclusion
1	When entering the main page	The app bar will display the location of the user who is currently logged in	Valid
2	The system retrieves the user's coordinate points	The coordinate data is captured with latitude and longitude values	Valid

3) Retrieving the List of Veterinarians

The test results show that when the user clicks on a veterinarian specialist button, a list of veterinarians with the selected specialty is displayed. The results are presented in Table 3.

Table 3. Veterinarian List Testing Results

No.	Test Scenario	Expected Result	Conclusion
1	When clicking the specialist category	The system will display a list of veterinarians according to the selected category	Valid
2	When accessing the veterinarian list page	The system will display a list of veterinarians with profile photos, full names, and the distance between the veterinarian and the user. Then, the system will show the nearest veterinarian and their available time slots when the user accesses the system	Valid

4) Testing on the Veterinarian Detail Page

The testing conducted on the Veterinarian Detail Page produced results as shown in Table 4.

Table 4. Testing Results of the Veterinarian Detail Page

No.	Test Scenario	Expected Result	Conclusion
1	When entering the veterinarian detail page	The system will display data retrieved from the database such as the veterinarian's name, clinic address, and detailed information about the selected veterinarian	Valid
2	When pressing the appointment button	The system will redirect to the date and time input page for the consultation	Valid

5) Appointment Schedule Page

This testing was conducted when the user wanted to view the appointment schedule that had already been created. The results of this test are shown in Table 5.

Table 5. Appointment Schedule Page

No.	Test Scenario	Expected Result	Conclusion
1	When the user clicks the bottom navigation on the main page	The system will display a list of veterinary appointment bookings that have been made	Valid

6) Results of Nearest Veterinarian Location Retrieval

The result of this test is obtaining the nearest veterinarian's location by comparing the latitude and longitude coordinates of both the veterinarian and the user. The outcome can be seen in Table 6.

Table 6. Results of Nearest Veterinarian Location Retrieval

No.	Test Scenario	Expected Result	Conclusion
1	When the user clicks the Veterinary Specialist option	The display will automatically be sorted by the nearest location	Valid
2	When the user clicks the Veterinary Specialist option	The system will compare the user's location with the veterinarian's location managed in the backend	Valid

V. CONCLUSION

In the design and development of the Android-based veterinary appointment application based on the nearest location, it can be concluded that:

1. The system assists patients in searching for information and making appointments with the nearest veterinarian based on the latitude and longitude coordinates of the user's location.
2. The system facilitates patient services by making it easier to find veterinarians closest to their location.
3. The system displays the location of the nearest veterinarians based on the latitude and longitude coordinates of both the veterinarians and the patients.

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