Sri Lanka Institute of Information Technology

IT2080 - Information Technology Project

Year 2 Semester 2 - 2025

Activity 02

[Requirements Engineering]

ITP25_B7.2_168

Project Title: Veterinary Management System
(PetIQ.lk)

B.Sc. (Hons) in Information Technology
IT2080 - IT Project
Activity 02 - Requirements Engineering Activity

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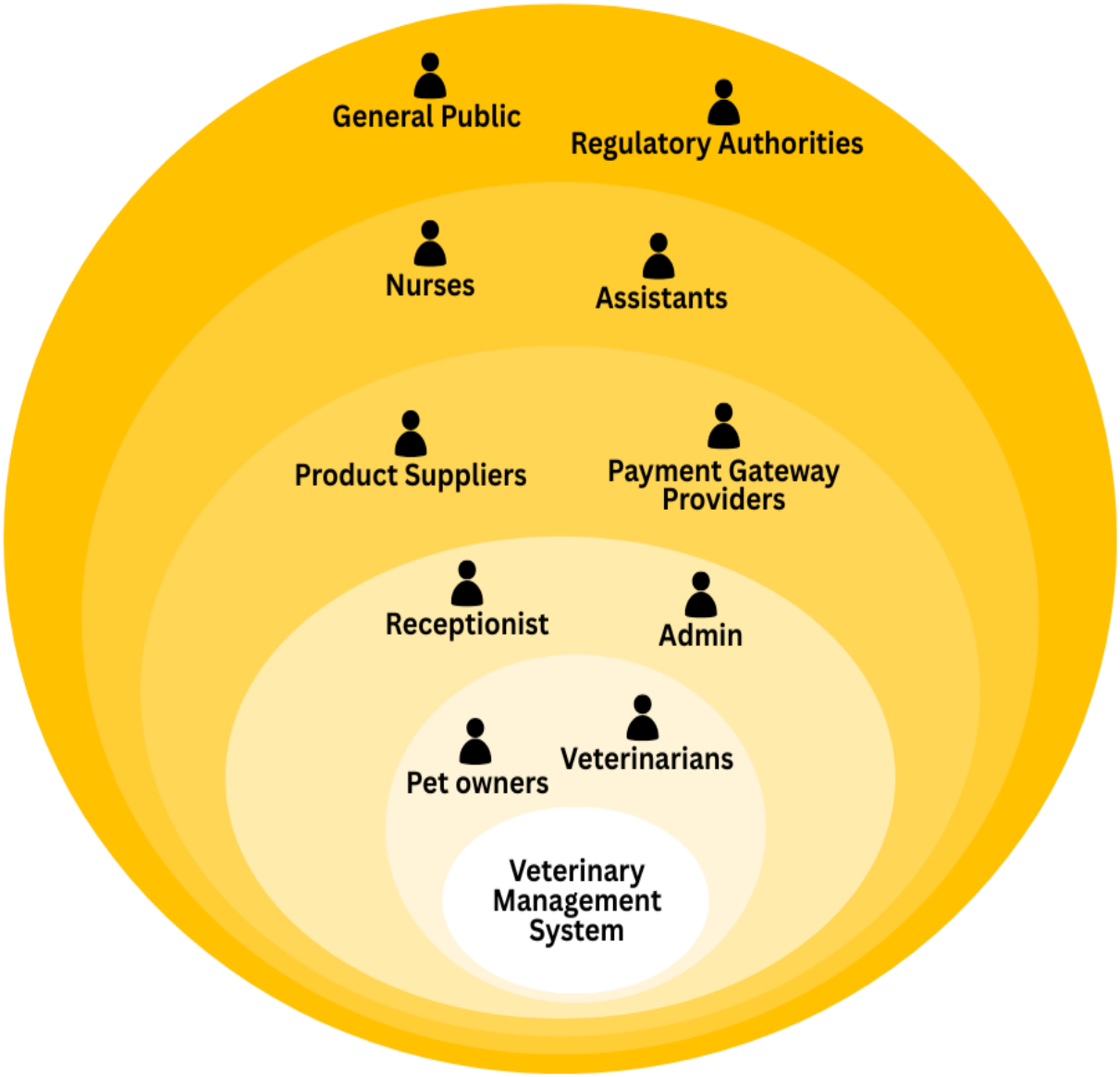
Objective: Identify the requirements of your system

1. Identify the stakeholders in your system and analyze them using an onion diagram.
2. List the Functional Requirements for the direct system users (in the innermost layer of the Onion diagram or main stakeholders).
3. List the related NFRs and analyze them user wise.
4. State the Technical requirements for the system
5. Model the requirements using a use case diagram
6. Write down the use case descriptions for 5 main use cases in the diagram
7. Develop suitable diagrams to show visual presentation of data flow, **the process Flow and Data Connections** to support the above (eg: system diagram, Flow chart, DFD)
8. Create a suitable plan to develop the project as a team.

Question 01 – Answers

Onion Diagram



Core Layer (Innermost): Pet Owners & Veterinarians

- **Role:**
  - **Pet owners** use the system to register pets, book appointments, view medical history, and purchase products.
  - **Veterinarians** use it to diagnose, prescribe, and manage treatment records.

- **Responsibilities:**
  - **Pet Owners:** Provide accurate pet data, make payments, and follow treatment advice.
  - **Veterinarians:** Record diagnoses, update medical records, prescribe treatments, and ensure correct data entry.

Second Layer: Receptionist & Admin

- **Role:** Manage clinic operations, appointments, pet product inventory, and system functions.

- **Responsibilities:**
  - **Receptionist:** Schedule and reschedule appointments, update veterinarian availability, and assist pet owners.
  - **Admin:** Manage system database, verify user profiles, generate reports, and oversee product management.

Third Layer: Pharmacy / Product Suppliers & Payment Gateway Providers

- **Role:** Provide medical supplies, pet products, and enable secure transactions.

- **Responsibilities:**
  - **Suppliers:** Ensure product stock, pricing accuracy, and timely updates.
  - **Payment Gateway:** Process online transactions, ensure secure and reliable payment methods.

Fourth Layer: Clinic Staff (Nurses, Assistants)

- **Role:** Support veterinarians in treatments and assist in day-to-day operations.

- **Responsibilities:** Help during examinations, prepare animals for treatment, and update minor records.

Outer Layer: External Stakeholders

- **Role:** Influence or benefit from the system without direct use.

- **Responsibilities:**
    - **Regulatory Authorities:** Ensure compliance with animal health and veterinary standards.
    - **General Public:** Benefit indirectly through better veterinary services and healthy animals.
    - **System Developers / Maintenance Team:** Build, update, and maintain the system.

Question 02 – Answers

Functional Requirements (FRs)

1. **User Management**
   - Ability for users to register with their personal details (e.g., name, contact, role).
   - User authentication through login (email/username and password).
   - Password recovery and reset options.
   - Role based access control (different permissions for each user roles)

2. **Appointment Management**
   - Pet owners can book, reschedule, or cancel appointments.
   - Receptionists can manage appointments for multiple clients.
   - Veterinarians and nurses can view real time schedules.
   - Appointment status tracking (upcoming, completed, canceled).

3. **Medical Records Management**
   - Veterinarians can access, create, and update pet medical records.
   - Nurses can update vaccination and treatment details.
   - Pet owners can view their pets' medical history.
   - System generates treatment history reports for reference.

4. **Payment Management**
   - Receptionists can generate invoices for appointments and treatments.
   - Pet owners can make payments through integrated payment options.
   - System maintains records of past payments and bills.
   - Admins can generate financial reports for analysis.

5. **Pet Product Management**
   - Admins or staff can add, update, and remove pet products (e.g., food, medicine, accessories).
   - Pet owners can browse available products.
   - Option to place orders for pet products.
   - Inventory tracking and low-stock notifications for admins.

6. **Treatment and Prescription Management**
   - Veterinarians can record diagnoses, prescriptions, and treatment notes.
   - Nurses can monitor ongoing treatments and assist in procedures.
   - System maintains a record of past treatments and prescriptions.

7. **Notification System**
   - Pet owners receive reminders for upcoming appointments, vaccinations, and treatments.
   - Staff members get alerts for new or rescheduled appointments.
   - Notifications sent via email, SMS, or mobile app.

8. **Profile Management**
   - Users can view and update their personal details (address, role specific info).
   - Pet owners can manage pet profiles (name, breed, vaccination details).

9. **Reporting and Analytics**
   - Veterinarians and admins can generate reports on appointments, treatments, and finances.
   - Receptionists can track daily appointments and billing summaries.
   - Analytics dashboard for monitoring system usage, revenue, and treatment statistics.

Question 03 – Answers

Non-Functional Requirements (NFRs) – User Wise Analysis

1. **Performance and Scalability**
   - **Pet Owners:** The system should load product catalogs, medical records, and appointment schedules quickly (within 2-3 seconds).
   - **Veterinarians, Nurses:** Real time access to medical records and updates without delays during diagnosis or treatment.
   - **Receptionists:** Must be able to handle concurrent bookings and cancellations smoothly.
   - **Admins:** System must scale to support multiple clinics, thousands of pets, and reporting without affecting speed.

2. **Performance and Scalability**
   - **Pet Owners:** Access to booking appointments, payments, and pet profiles anytime (24/7).
   - **Veterinarians, Nurses:** Reliable access to treatment history and prescriptions during consultations.
   - **Receptionists:** Continuous system access for managing schedules and product sales during working hours.
   - **Admins:** Automatic backup and recovery to prevent data loss in case of server downtime.

3. **Security and Data Protection**
   - **Pet Owners:** Personal data and payment information must be encrypted.
   - **Veterinarians**, **Nurses:** Role-based access to only their patients' records.
   - **Receptionists**: Restricted access (appointments & billing only, no medical data).
   - Admins: Full control over data protection policies, user account management, and audit logs.

4. **Performance Monitoring**
   - The system must support monitoring tools for uptime, errors, and usage analytics.

5. **Usability and User Experience (UX)**
   - **Pet Owners:** Simple and responsive UI for mobile/web, with easy navigation to book, pay, and view reports.
   - **Veterinarians, Nurses:** User-friendly dashboard for quick access to patient history and prescriptions.
   - **Receptionists:** Easy appointment management screen with daily/weekly calendar view.
   - **Admins:** Dashboard for monitoring system performance, reports, and security alerts.

6. **Audit and Logging**
   - **Pet Owners:** View transaction history (appointments, payments, product orders) but cannot modify it.
   - **Veterinarians, Nurses:** Logs of treatments and prescriptions must be stored for future reference.
   - **Receptionists:** System should record booking and payment handling activities.
   - **Admins**: Access to full system logs (logins, data access, modifications) for troubleshooting and compliance.

7. **Compatibility**
   - The system should be compatible with major browsers (Chrome, Firefox, Edge).
   - Mobile responsiveness for Android and iOS users.

8. **Maintainability & Extensibility**
   - The system must support modular updates (e.g., adding new features like online consultations).
   - Source code should be well-documented for future developers.

Question 04 – Answers

Technical Requirements

1. **Technology Stack**

   - To guarantee flexibility and performance for the Veterinary Management System (VMS) we use scalable technology like the **MERN stack** (**MongoDB, Express.js, React.js, and Node.js**).

   - This ensures smooth handling of appointments, medical records, billing, pet profiles, and multi role access (Admin, Veterinarian, Receptionist, Pet Owner).

2. **Database Management**

   - **MongoDB** will serve as the primary database to store veterinary related information, including pet profiles, owners details, appointments, prescriptions, treatments, billing records, and medical history.

   - Proper indexing and query optimization should be applied for fast searching of pets, medical records, and appointment schedules.

3. **API Development**

   - **Express.js** should be used to develop **RESTful APIs** for communication between frontend (**React**) and backend (**Node.js**).

   - APIs will handle modules such as User Management, Appointments, Pet Records, Billing, Inventory (medicines, vaccines), and Notifications.

   - API endpoints must follow industry best practices with consistent naming, validation, and error handling.

4. **Authentication and Authorization**

   - **JWT** (JSON Web Tokens) should be used for secure login authentication.

   - **Role Based Access Control** should be enforced to grant specific permissions:
     - Admin – Full system access
     - Veterinarian – Access to appointments, treatments, medical records
     - Receptionist – Manage appointments, billing, and customer inquiries
     - Pet Owner – Access to pet profiles, view medical history, book appointments

5. **Data Encryption**
    - Sensitive data like user credentials, payment details, and medical records should be encrypted with strong algorithms (e.g., bcrypt for passwords, AES for sensitive info).
    - Encryption keys should be securely managed and rotated regularly
6. **Caching**
    - Use caching mechanisms such as Redis or Memcached for frequently accessed data (e.g., available appointment slots, veterinarian schedules, pet medical history).
    - Implement proper cache invalidation strategies to ensure up to date information.
7. **Monitoring and Logging**
    - Use Winston or Bunyan for structured logging of system events, errors, and user activities.
    - Implement Prometheus or Grafana to monitor real-time performance, server health, appointment traffic, and database load.
8. **Deployment and Scalability**
    - Use **Docker** for containerization of backend, frontend, and database services for easy deployment.
    - Utilize **Kubernetes** for orchestration, auto-scaling (e.g., handling peak appointment booking times), and fault tolerance.
9. **Testing**
    - Frontend: Use **React** Testing Library for UI component testing (appointment booking forms, dashboards, pet profile pages).
    - Backend: Use Jest and **Supertest** for API and logic testing.
    - Run **integration tests** to ensure smooth operation across appointments, billing, and medical record modules.

10. **Documentation**

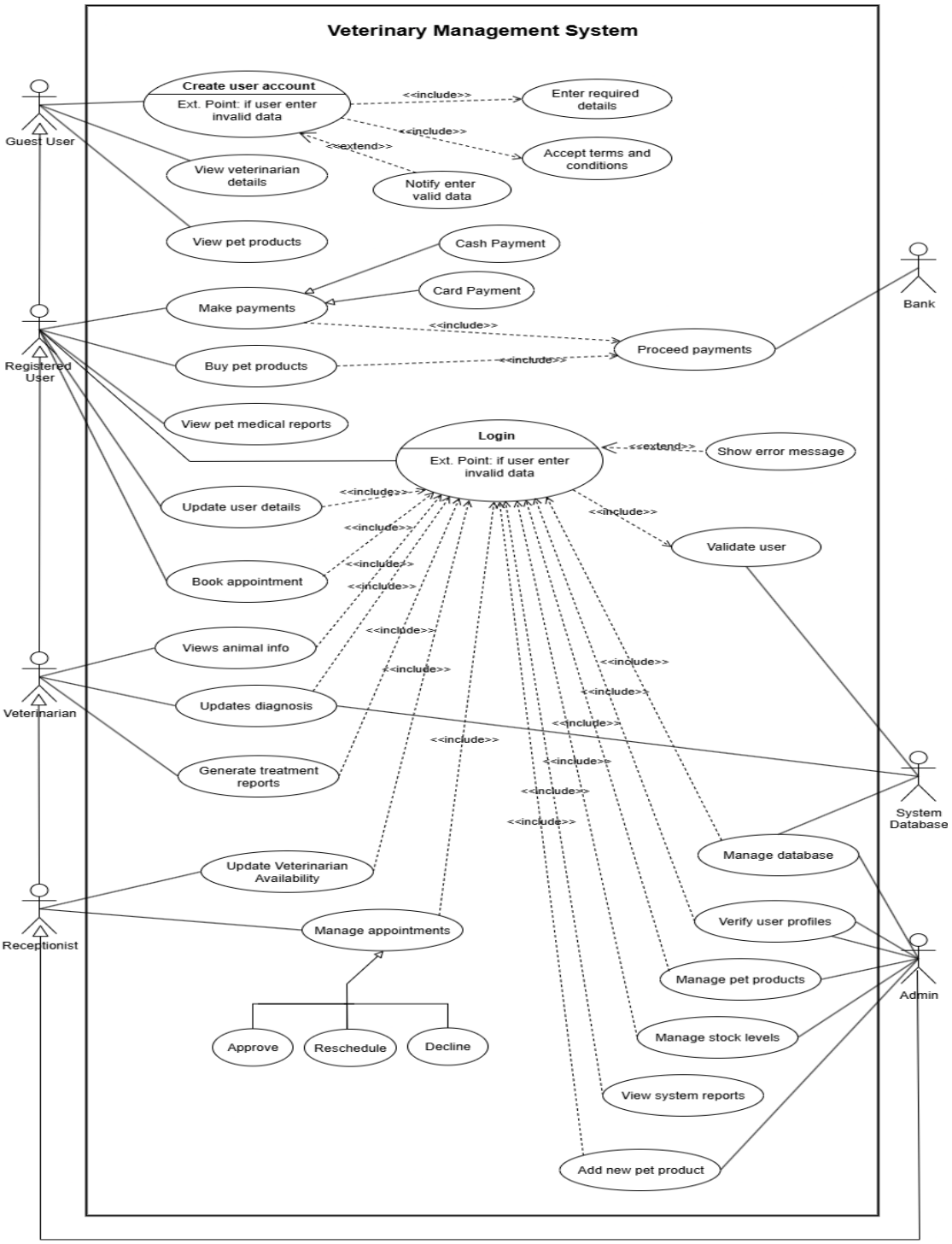
- Maintain comprehensive documentation covering:
  - System architecture
  - Data models (Pet, Owner, Veterinarian, Appointment, Medical Record, Billing, Inventory)
  - API endpoints with request/response examples
  - Deployment protocols for developers and system administrators

- Include Data Validation & Input Sanitization to prevent SQL Injection, XSS, and CSRF attacks.

- Ensure **regular backups** of pet medical records, billing data, and appointments.

Question 05 – Answers

Use Case Diagram



Question 06 – Answers

Use Case descriptions

1. **Student ID: IT23640948**

Number	1	
Name	Book an Appointment	
Summary	Allows pet owners to book an appointment with a veterinarian by selecting date, time, and reason for visit.	
Priority	5	
Pre-Condition	Pet owner must be registered and logged in. Veterinarian schedules must already be defined in the system.	
Post-Condition	Appointment is successfully created and stored in the system. Notifications are sent to both pet owners and veterinarian.	
Primary Actor(s)	Pet Owner	
Trigger	Pet owner selects the "Book Appointment" option from the dashboard.	
	Step	Action
	1	Pet owner logs in by using username and password.
	2	Navigates to "Appointments" section.
	3	Views available to veterinarians and their schedules.
	4	Select a veterinarian and preferred date/time.
	5	Inputs appointment details (reason for visit, pet information).
	6	Confirms the appointment request.
	7	System checks veterinarian availability
	8	Appointment is confirmed and saved in the system.
	9	Customer receives confirmation notification (email/SMS/system alert).

	10	Appointment details are displayed on the customer dashboard.
Extensions	7a	If selected slot becomes unavailable during booking, system displays “Selected slot is no longer available, please choose another.”
	9a	If confirmation fails, system shows error message and sends follow-up instructions to the customer.
	10a	Customer can reschedule cancel appointment before due date; system update records and notify veterinarian.

2. **Student ID: IT23631106**

Number	2	
Name	Add new user	
Summary	Allow Pet Owners and Staff (Receptionist, Nurse, Veterinarian) to create, view, update, or delete their accounts while ensuring secure authentication and role-based access control.	
Priority	5	
Pre-Condition	Users must be registered and logged in (except during account creation).	
Post-Condition	Deleted users lose access, but linked records (appointments, medical history, billing) remain stored.	
Primary Actor(s)	Pet Owner, Staff (Receptionist, Nurse, Veterinarian)	
Trigger	Users select **"User Profile"** option from the system dashboard/menu.	
	Step	Action
	1	User (Pet Owner or Staff) opens the system and logs in (except for first-time registration).
	2	User navigates to the User P**rofile** section.
	3	Creates a new account by entering details (name, email, phone, address, username, password).
	4	Views their existing profile information
	5	Updates profile details if needed
	6	Requests to delete/deactivate the account if they no longer want access
	7	System validates the action (checks data, uniqueness, rules).
	8	Saves changes to the database.
	9	Confirmation message is displayed.
	10	Updated account details appear on the user profile dashboard page

Extensions	3a	If required fields are missing/invalid, the system prompts the user to correct them.
	3b	If email/username already exists, system shows "Email/Username already in use."
	5a	If password update is attempted, system enforces strong password rules (minimum length, characters, etc.).
	6a	If user deletes account, login is disabled but past records remain in the system

3. Student ID: IT23594722

Number	3	
Name	Add medical record details	
Summary	Allow veterinarians and nurses to add, update, and view pets' medical records, including diagnoses, treatments, vaccinations, and prescriptions.	
Priority	5	
Pre-Condition	Veterinarian/nurse must be logged in with appropriate access rights. Pet profile must exist in the system.	
Post-Condition	Updated medical records are securely stored and accessible for future appointments.	
Primary Actor(s)	Veterinarian / Nurse	
Trigger	User selects "Medical Records" option from the system dashboard.	
	Step	Action
	1	Veterinarian/nurse logs in by using username and password.
	2	Navigates to "Medical Records" section.
	3	Selects a pet from the system database.
	4	Views existing medical history of the pet.
	5	Adds new details (diagnosis, treatment, vaccination, prescription).
	6	Updates or edits existing records if required.
	7	Saves changes to the database.
	8	System validates and stores the updated record.
	9	Confirmation message is displayed.
	10	Pet owners can view non-restricted parts of the medical record from their account.

Extensions	5a	If required fields (e.g., diagnosis or treatment) are missing, system highlights them.
	7a	If saving fails due to system error, system displays error message and prompts retry.
	10a	If pet owner access is restricted for sensitive notes, only veterinarian can view them.

4. Student ID: IT23413474

Number	4	
Name	Add new pet product	
Summary	This describes how an admin adds new pet products (e.g., food, medicine, accessories) to the Veterinary Management System.	
Priority	4	
Pre-Condition	Admin must be logged into the system.	
Post-Condition	The new product is successfully added to the catalog and Pet owners can view the new product on the product list.	
Primary Actor(s)	Admin	
Trigger	The admin wants to add a new product to the system.	
Main Scenario	**Step**	**Action**
	1	Admin logs into the Veterinary Management System.
	2	System validates credentials
	3	System navigates to the admin dashboard.
	4	Admin clicks on “Manage Products” section.
	5	System displays product management options (Add, Update, Delete, View).
	6	Admin clicks “Add Product.”
	7	System displays a product entry form.
	8	Admin enters required product details (name, description, category, price, stock quantity, and image).
	9	Admin clicks “Submit.”
	10	System validates inputs.
	11	System saves the product details in the database.

	12	System shows a success message "Product added successfully."
Extensions	**Branching Actions**	
	2a	If credentials are invalid, system prompts "Invalid username or password."
	8a	If required fields are missing, system prompts "Please fill all mandatory fields."
	8b	If price or stock is invalid (e.g., negative numbers), system prompts error message.
	11a	If database error occurs, system displays "Unable to save product, try again later."

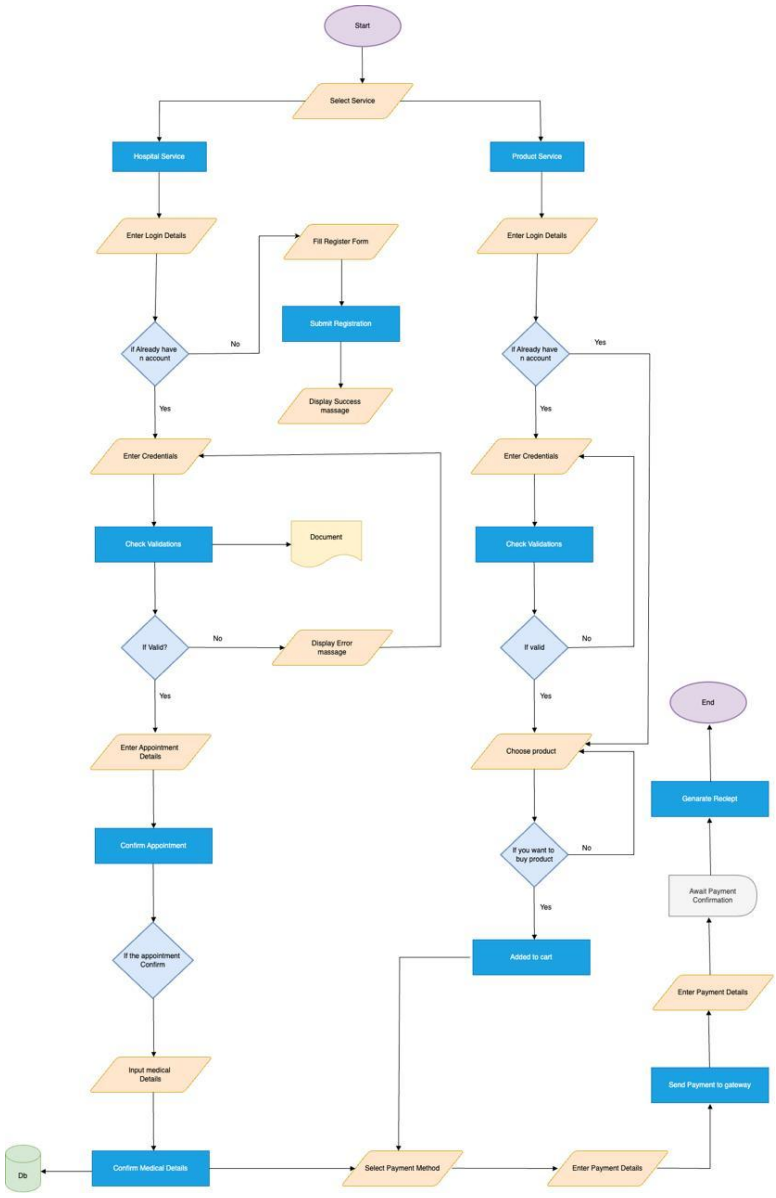
5. Student ID: IT23631274

Number	5	
Name	Payment process	
Summary	Registered users make payments for either hospital services or pet mart orders by providing relevant details, proceeding to check out and completing secure payment through the system.	
Priority	05	
Preconditions	Users must be registered and logged into the system and users must have at least one payable thing (appointment, treatment or mart cart order).	
Postconditions	Payment is recorded in the system and receipt is generated and linked to the correct service (hospital or mart).	
Primary actor	Pet Owner	
Trigger	The user decides to pay for hospital services or pet mart purchases.	
	Step	**Action**
	1.	User logs in to the system using his username and password.
	2.	System verifies credentials.
	3.	User successfully logged into his account.
	4.	User selects a service to pay (hospital service or pet mart order.)
	5.	System shows the service/order details.
	6.	User confirms the details of the service/order.
	7.	If mart order: system displays delivery details (prefilled if those details are saved before)
	8.	User confirms or edits delivery details.
	9.	System navigates the user to the checkout page.
	10.	User selects a saved card or enters new card details
	11.	System validates card details
	12.	If valid, user confirms payment.
	13.	Payment gateway processes the transaction.
	14.	On success, system updates the database with payment status.

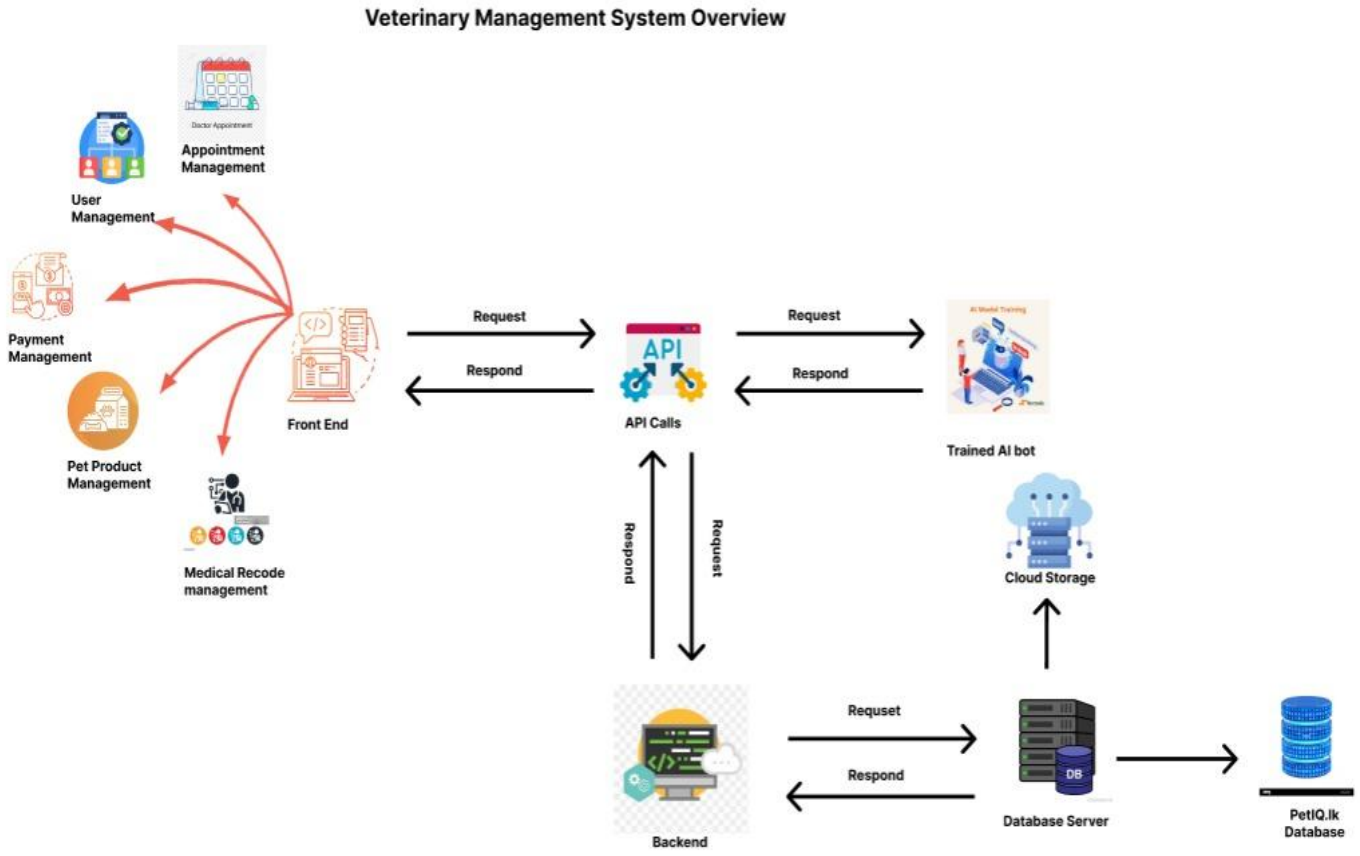
	15.	System generates a receipt and links it to the relevant service.
	16.	System shows confirmation message as “Payment completed successfully.”
Extensions	**Step**	**Branching Action**
	2a.	Get an error message for wrong username or password.
	8a.	Missing or invalid delivery details: System asks user to correct before proceeding.
	13a.	Payment gateway timeout/failure: System shows “Transaction failed, please try again later.”
	15a.	If payment fails, system does not generate a receipt and logs error for audit.
	16a.	If payment fails, system shows a message as “Payment Failed.”

Question 07 – Answers

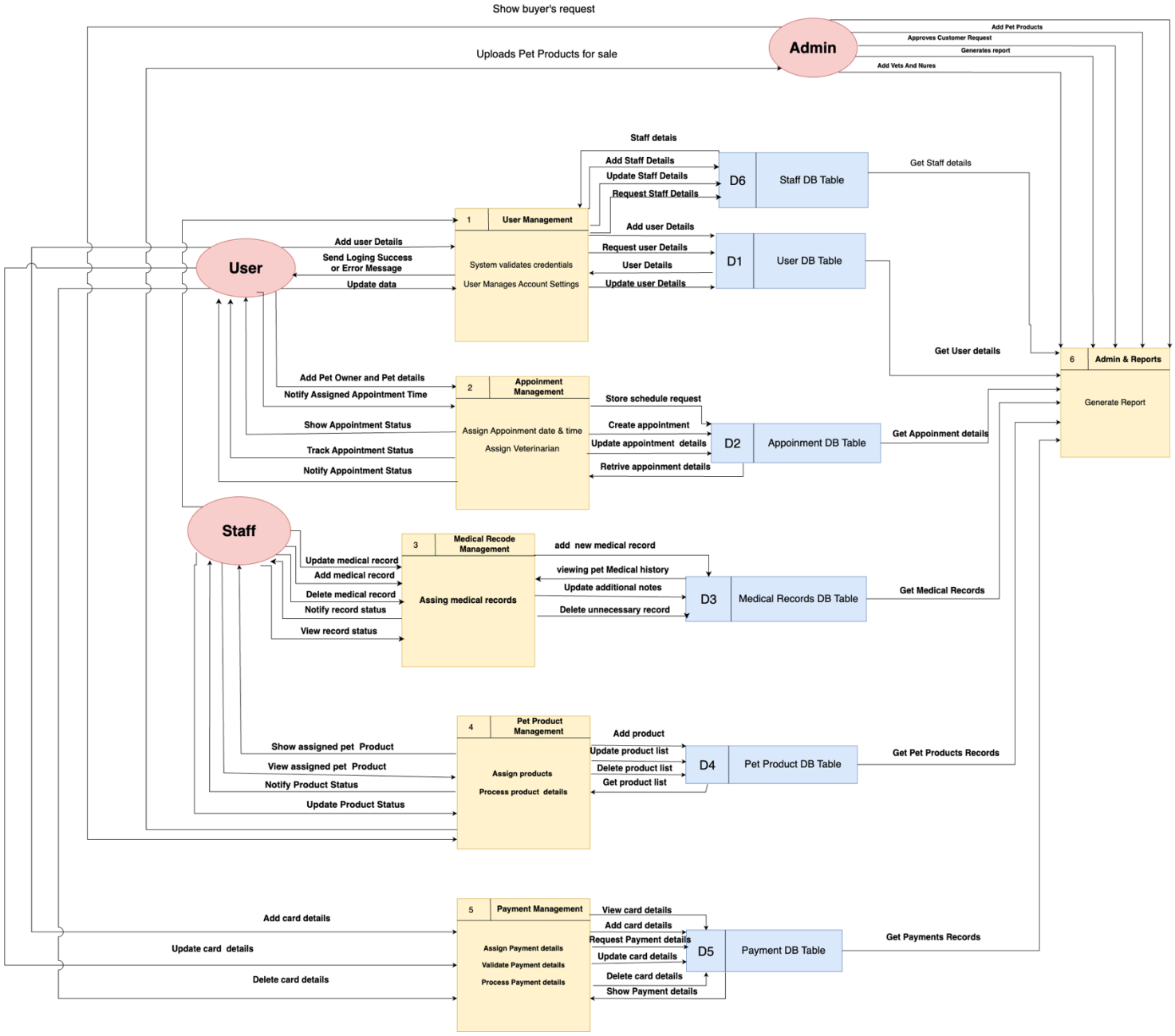
Flow Chart Diagram



System Diagram



Data Flow Diagram



Question 08 – Answers

Suitable Plan to Develop the project

Process	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12
Requirement Analysis & Documentation												
Planning												
Page UI Design												
Database Designing												
Coding the Structure												
Development												
Testing												
Launching the web application												

Figure - Grantt Chart

Project Timeline – PetIQ.lk

We started gathering information for PetIQ.lk from the beginning of the semester. It took us approximately two weeks from the start of the semester to complete the requirement analysis and documentation phase. We were able to gather all the information required within this time, setting a solid base for our project without any major problems.

In the second week, we focused on planning the project, defining milestones, and structuring our development process. In the third week, we began designing the UI/UX with Figma, ensuring that our platform is user-friendly and aligns with the major functionalities of PetIQ.

During the fourth week, we were working on the database design phase that took approximately three weeks. While doing this, we felt the need to implement additional features to make it more effective. We were able to create the basic database layers, but additional complexity in the second layer is required to achieve optimum data handling for user roles, transactions, and tracking waste.

Starting from the fifth week, we will begin building the platform, aiming for both backend and frontend development. This will consume approximately six weeks, and during this time, all the features required, such as user authentication, waste collection scheduling, and admin features, will be successfully developed.

Going into the ninth week, we will intensify our development process, refine the code and integrate the various tools and frameworks required for PetIQ We will focus on optimizing performance, security, and usability without compromising the smooth user experience.

From week twelve, we will enter the testing phase, during which we will conduct unit testing, integration testing, and user acceptance testing to verify the functionality and performance of the platform. With the end of the testing phase, PetIQ will live as a complete web application, and our project will be successfully concluded.

This structured timeline ensures that each component of the platform requirement gathering, UI/UX designing, database structuring, development, and testing will be executed in a proper way, resulting in a high-quality and user-friendly web solution for recycling and waste management.