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2024-2025 Spring Term SE 216 Software Project Management

Project Final Report

PETPAL

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1 - INTRODUCTION

Taking care of stray animals on university campuses in a regular and organized way has always been a challenge. Most of the time, their needs are either noticed too late or completely ignored. The main reason behind this is the lack of a system that could make animal care easier and more efficient. Especially when animals are spread across the campus, manual care and tracking methods are no longer enough.

To address this issue, we developed PetPal, a smart and user-friendly animal tracking system designed specifically for campus life. PetPal includes many useful features such as scanning QR codes to access animal profiles, checking their health and vaccination info, monitoring smart food and water bowls with sensors, sending adoption requests, and managing different user roles like volunteers, veterinarians, and donors.

The system also offers a donation screen, a panic button for emergencies, and a special “I have been bitten” button that allows users to report incidents like animal bites. This way, authorities can be contacted quickly and act immediately if needed.

Students, volunteers, and staff can interact with the system by reporting health issues, updating animal profiles, checking food and water levels, and viewing animal locations on the map.

PetPal aims to improve the living conditions of animals on campus while also creating a safer, more transparent interaction between humans and animals using smart technology. In this way, the system provides a more organized, responsible, and compassionate approach to animal care.

2 - HIGH LEVEL FUNCTIONALITY

2.1. Functional Requirements

1. The system should allow pet food brands, restaurants, and animal lovers to make food and money donations.

2. The system must analyze animal movement patterns and detect signs of illness at an early stage.

3. Administrators should be able to review, then accept or deny adoption requests.

4. Administrators should be able to create and update animal profiles with name, photo, and health status.

5. The system must allow users to make adoption requests from animal profiles.

6. The system must allow veterinarians to mark an animal as healed after responding to reports.

7. The application should be able to list every animal detected by the nearest RFID detector to the user at the push of the panic button.

8. Users should be able to report injured or sick animals through the app.

9. The system should monitor the fill levels of smart food and water bowls in real time and should send notifications and update the map when levels are low.

10. The system should be able to detect the locations of animals in real time and update a heatmap within the app accordingly.

2.2. Non-Functional Requirements

1. The system must support at least 500,000 concurrent users.
2. System updates must be applied without causing any interruptions.
3. The system should be able to run on the specified hardware (servers).
4. The system should update animal locations every 10 seconds.
5. The system must be accessible 24/7.
6. The mobile app should have a user-friendly interface.
7. The app should support Android and IOS as well as web browsers.
8. The system must comply with any relevant laws.
9. User data must be encrypted to protect sensitive information.
10. The app should be optimized to support older or weaker devices.

3 - STAKEHOLDERS

There are several key stakeholders in this project, each with specific roles and impacts on the project's success or failure:

Students and Campus Community

Students and the wider campus community benefit from improved engagement with animal welfare through the PetPal project. They gain the ability to report sick and injured animals, check vaccination statuses, and submit adoption requests, empowering them to actively contribute to animal wellbeing. Their feedback also influences the ongoing development of the system.

Animal Welfare Organizations

Animal welfare organisations are positively impacted by the project's digital infrastructure, which supports their mission of animal care. PetPal helps them coordinate vaccinations,streamline adoptions, and mobilise volunteers more efficiently, improving their overall outreach and impact.

Pet Food Brands

Pet food brands benefit from the opportunity to contribute to a socially impactful initiative, improving their public image and corporate social responsibility. By donating food, they help reduce operational costs for the project while promoting their products to an engaged audience.

Health Workers And Animal Attack Victims

In the event of an animal attack, knowing the types of vaccinations an animal has, and even its medical history will help narrow down the infections health workers need to treat for. This both saves the vital time of health workers, and prevents animal attack victims from undergoing unnecessary treatments.

Stray Animals

Stray animals stand to gain food, water, and potentially homes from the PetPal project, and thus are affected by the outcomes of the project. Their health and wellbeing should not be omitted in any phase of the project.

Cafes, Restaurants, and Butchers

These businesses stand to gain time thanks to the option to have a volunteer pick up leftovers that would normally go to waste, to feed to stray animals. Instead of having to take out their own leftovers to the bin, or for some bigger businesses, hiring a waste disposal service, businesses can save time, and even money with the mentioned option.

City Councils

City councils stand to gain time and resources normally spent on gathering stray animals. With the implementation of PetPal, animal disturbances will become less frequent and the need for council intervention will lessen, freeing up council resources for essential city services.

Smart Device Manufacturers

Smart device manufacturers are key stakeholders affected by the performance and longevity of the devices they provide—such as RFID sensors, QR code tags, and feeding stations. The success of the PetPal system reflects on their technology's durability and innovation, potentially influencing future partnerships and product demand.

Campus Administration

Campus administration is affected through their involvement in enabling the project's infrastructure, granting permissions, and potentially allocating budget. Their support not only ensures the system runs smoothly but also reflects the university's commitment to social and environmental responsibility. In return for this support they get good media coverage, and improved satisfaction among students.

Animal Rights Clubs

Animal rights clubs benefit from the PetPal system by having a centralised platform to help advocate for animal welfare, run awareness campaigns, and report sickly animals. Their visibility and influence within the campus community are strengthened as a result.

Potential Adopters

Potential adopters, including residents in and around the university area, are directly impacted by the PetPal project through greater access to adoption opportunities. The system simplifies how they discover, learn about, and apply for pets, encouraging responsible ownership. Their engagement also supports the project's mission by increasing adoption rates and improving animal welfare outcomes.

Vets

Veterinarians benefit from having easier access to animal health and vaccination records via the platform. This helps them deliver more effective care, monitor animal activity, and support adoption procedures with accurate medical checks.

4 - SOFTWARE PROCESS MODEL

Software Process Name: SCRUM

Scrum is an agile project management framework emphasizing flexibility, teamwork, and iterative progress. It involves three key roles: the Product Owner, who prioritizes work and manages the backlog; the Scrum Master, who ensures the team adheres to Scrum practices and facilitates problem resolution; and the Development Team, which delivers increments of the product. Scrum employs artifacts like the Product Backlog and Sprint Backlog to track work and uses events such as Sprint Planning, Daily Scrum, Sprint Review, and Sprint Retrospective to facilitate communication and continuous improvement. The primary goal of Scrum is to deliver value to customers efficiently while promoting transparency and continuous development.

Sprint 1: Project Initiation and Planning(13 days)

- Database Planning
- UI / UX Planning & Preparation of UI Templates for Design Purposes
- Layout Planning for RFID Sensor Locations
- Outlining any laws the system must comply with
- Layout Planning for Smart Feeding Stations

Sprint 2:Core Mobile Development(9 days)

- Starting Development of the Mobile App
- Development of Animal Profiles for the Mobile App
- Adding Adoption and Report Illness Menus to Animal Profiles
- Implementing the Heatmap UI Within the Mobile App
- Implementing the Panic Button
- Implementing Notifications
- Implementing the Offline Mode for the Mobile App
- Legacy Support

Sprint 3:Database Integration & Admin Tools(7 days)

- Database Integration
- Animal Profile Storage
- Location Tracking

- Adoption Requests and Reports
- Admin Dashboard
- Database Backup

Sprint 4:Finalization & Deployment(13 days)

- Implement QR Scanning
- Smart Feeding Stations Database Integration
- Testing
- Security Enhancements
- Bug Fixes and UI & UX Enhancements
- Mounting Feeding Stations and RFID Sensors in Planned Locations
- User Guide Preparation
- Launching the System

5 - SCHEDULE AND EFFORT

The Gantt chart and project schedule provide a detailed timeline for our project. Our schedule shows all project activities with days and dependencies, which can be easily understood by looking at the Gantt chart. The project is expected to take 42 business days to complete. And it was supposed to start in May and end in July, but these dates can be changed if needed.

gantter™

Project Name **PetPal Gantt Chart & Project Schedule**

	Name	Duration	Start	Finish	Predecessors	Resources
1	**Sprint 1**	**13days**	**05/19/2025**	**06/04/2025**		
2	Outlining any laws the system must comply with	3days	05/19/2025	05/21/2025		
3	Layout Planning for Smart Feeding Stations	1day	05/22/2025	05/22/2025	2	
4	Layout Planning for RFID Sensor Locations	10days	05/22/2025	06/04/2025	2	
5	Database Planning	1day	05/22/2025	05/22/2025	2	
6	UI / UX Planning & Preparation of UI Templates for Design Purpose	3days	05/22/2025	05/26/2025	2	
7	**Sprint 2**	**9days**	**06/05/2025**	**06/17/2025**	**1**	
8	**Development of the Mobile App**	**4days**	**06/05/2025**	**06/10/2025**		
9	Initial UI Development	1day	06/05/2025	06/05/2025		
10	Development of Animal Profiles for the Mobile App	1day	06/06/2025	06/06/2025	9	
11	Adding Adoption and Report Illness Menus to Animal Profiles	2days	06/09/2025	06/10/2025	10	
12	Implementing the Panic Button	2days	06/06/2025	06/09/2025	9	
13	Implementing the Heatmap UI Within the Mobile App	1day	06/06/2025	06/06/2025	9	
14	Implementing Notifications	1day	06/06/2025	06/06/2025	9	
15	**Finishing Up the Mobile App**	**4days**	**06/11/2025**	**06/16/2025**	**8**	
16	Implementing the Offline Mode for the Mobile App	2days	06/11/2025	06/12/2025		
17	Legacy Support	2days	06/13/2025	06/16/2025	16	
18	Testing the Mobile App	1day	06/17/2025	06/17/2025	15	
19	**Sprint 3**	**7days**	**06/18/2025**	**06/26/2025**	**7**	
20	**Database Integration**	**6days**	**06/18/2025**	**06/25/2025**		
21	Database Initialization	2days	06/18/2025	06/19/2025		
22	Animal Profile Storage	1day	06/20/2025	06/20/2025	21	
23	Adoption Requests and Reports	2days	06/23/2025	06/24/2025	22	
24	Admin Dashboard	1day	06/25/2025	06/25/2025	23	
25	Location Tracking	2days	06/18/2025	06/19/2025		
26	Testing the Database	1day	06/26/2025	06/26/2025	20	
27	**Sprint 4**	**13days**	**06/27/2025**	**07/15/2025**	**19**	
28	**IoT Device Implementation**	**1day**	**06/27/2025**	**06/27/2025**		
29	Implementation of QR Scanning	1day	06/27/2025	06/27/2025		
30	Smart Feeding Stations Database Integration	1day	06/27/2025	06/27/2025		
31	Sensor Database Integration	1day	06/27/2025	06/27/2025		
32	Testing IoT Devices	1day	06/30/2025	06/30/2025	28	
33	**Final Checks and Tests**	**9days**	**06/27/2025**	**07/09/2025**		
34	Testing All Systems	2days	06/27/2025	06/30/2025		
35	Security Enhancements	7days	07/01/2025	07/09/2025	34	
36	Bug Fixes and UI&UX Enhancements	7days	07/01/2025	07/09/2025	34	
37	**Finishing The Project**	**3days**	**07/10/2025**	**07/14/2025**	**33**	
38	Sensor & Feeding Station Placement in Planned Locations	2days	07/10/2025	07/11/2025		
39	Live Testing All Devices	1day	07/14/2025	07/14/2025	38	
40	User Guide Preparation	1day	07/10/2025	07/10/2025		
41	Launching the System	1day	07/15/2025	07/15/2025	37	

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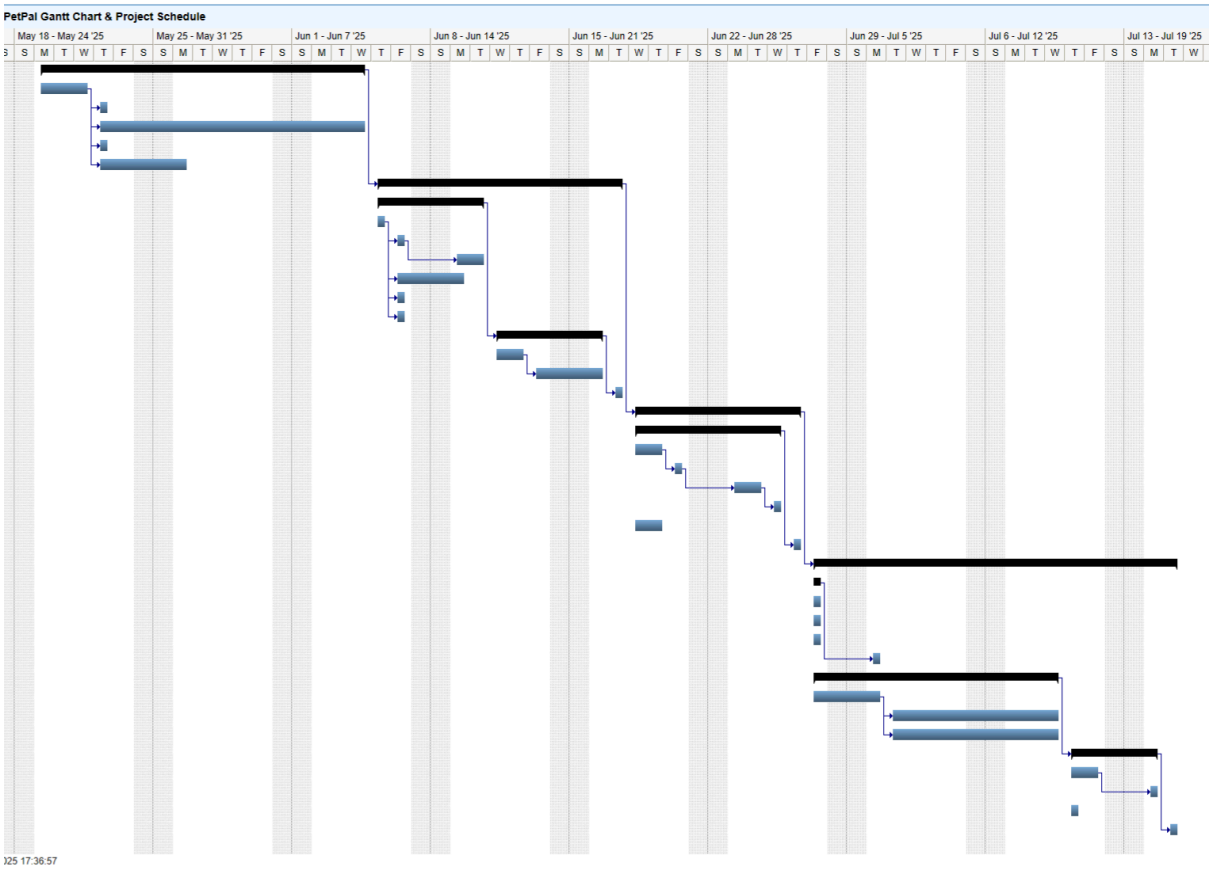

PetPal Gantt Chart & Project Schedule
May 18 - May 24 '25
May 25 - May 31 '25
Jun 1 - Jun 7 '25
Jun 8 - Jun 14 '25
Jun 15 - Jun 21 '25
Jun 22 - Jun 28 '25
Jun 29 - Jul 5 '25
Jul 6 - Jul 12 '25
Jul 13 - Jul 19 '25
S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W
025 17:36:57

6 - PROJECT RISKS

Within the scope of the PetPal project, various risks have been identified in terms of technical infrastructure, user interaction, and external factors. These risks may directly or indirectly impact the success of the project. Each has been analyzed based on its likelihood and potential impact. The risks are prioritized according to a combined risk ranking that considers both probability and severity.

1. **Removal or Relocation of RFID Sensors**: Deployed sensors may be stolen or damaged, significantly reducing the system's ability to track animals effectively. This would lead to inaccurate data and compromise the system's overall functionality.

2. **Animals Refusing to Wear Sensor Collars**: Some animals may refuse to wear collars or may lose them while roaming. This would decrease tracking accuracy and hinder the monitoring of vaccination status.

3. **System Integration Failures**: Integration issues between RFID sensors, smart food bowls, and other components may lead to data loss, malfunctioning alert systems, or inefficient resource distribution.

4. **Device Failures**: Technical malfunctions in smart collars, sensor-equipped food bowls, or QR code systems may affect the reliability and sustainability of the system.

5. **Overpopulation at Feeding Stations**: Large numbers of animals gathering in the same feeding areas could cause territorial aggression, conflicts, or imbalanced food distribution, undermining the project's goal of fair resource allocation.

6. **Power Outages**: Devices that are not powered by alternative energy sources (e.g., solar panels) may become non-operational during power outages. Although rare, such events can cause major disruptions.

7. **Data Overload and System Lag**: The app and tracking infrastructure may struggle to process large volumes of real-time data from RFID sensors, GPS trackers, and user

reports, resulting in slow performance or crashes.

8. **Cyber Attacks**: Although unlikely, malicious individuals may attempt to disrupt the system through DDoS or similar attacks. Despite the low potential for profit or notoriety, the impact on the project could still be serious.

9. **Animal Abuse Risks**: App data could be misused by illegal animal traders or dogfighters. High-value animals may be targeted for adoption and exploitation. Admins must monitor suspicious activity and involve authorities when necessary.

10. **Panic Button in Animal-Dense Areas**: In regions with a high animal population, pressing the panic button may result in several similar-looking animals being flagged, reducing the accuracy of the feature.

11. **Internet or Network Failure**: Unstable Wi-Fi or lack of internet access may interrupt real-time alerts and system synchronization, affecting usability and responsiveness.

12. **Trolls and Fake Users**: Individuals may create fake profiles during the adoption process, wasting administrators' time and creating additional management overhead.

Each of these risks should be considered throughout the project's lifecycle. High-likelihood and high-impact risks must be addressed with priority, while emergency response plans should be prepared for low-likelihood but high-impact scenarios. Proactive strategies and continuous monitoring are essential to minimize potential disruptions and ensure long-term success.

7 - SOFTWARE TOOLS

In the development of the PetPal system, various software tools were evaluated and selected for the development, database management and UI/UX design tasks of the project; taking into consideration the cost, training days and functionality.

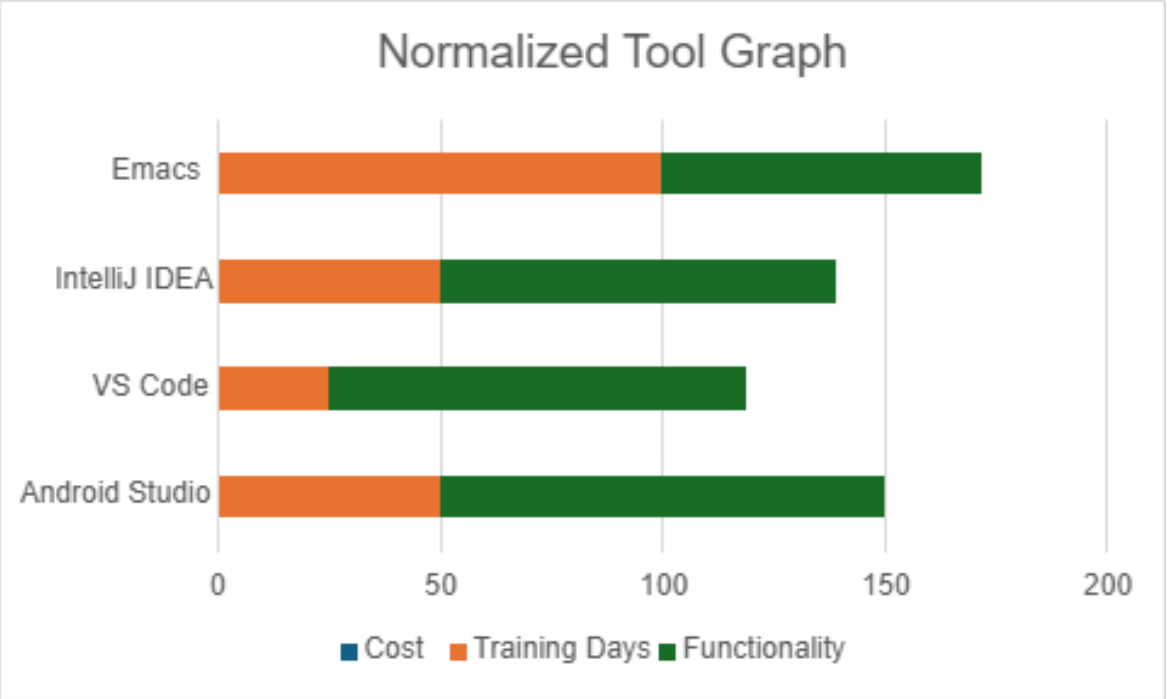
Task 1: Development of the Mobile Application:

Tool Cost/Training/Functionality Data

Tools	Android Studio	VS Code	IntelliJ IDEA	Emacs
Cost	Free	Free	Free	Free
Training Days	10	5	10	20
Functionality	90	85	80	65

Normalized Cost/Training/Functionality Data

Tools	Android Studio	VS Code	IntelliJ IDEA	Emacs
Cost	0	0	0	0
Training Days	50	25	50	100
Functionality	100	94	89	72



As a result of comparing Android Studio, VS Code, IntelliJ IDEA and Emacs; Android Studio has been chosen because of it providing the most comprehensive and stable support for Flutter development environment. It also offers seamless integration with the Android SDK, built-in emulators and advanced debugging tools which ensures a smooth development process as it is the official IDE endorsed by Google.

Despite the learning curve being slightly higher, its robust performance for monitoring tools and deep platform integration makes it the best choice for building high-quality Flutter applications. Additionally, Android Studio's extensive documentation and strong developer community provide valuable support, which helps to resolve technical challenges efficiently and streamline development.

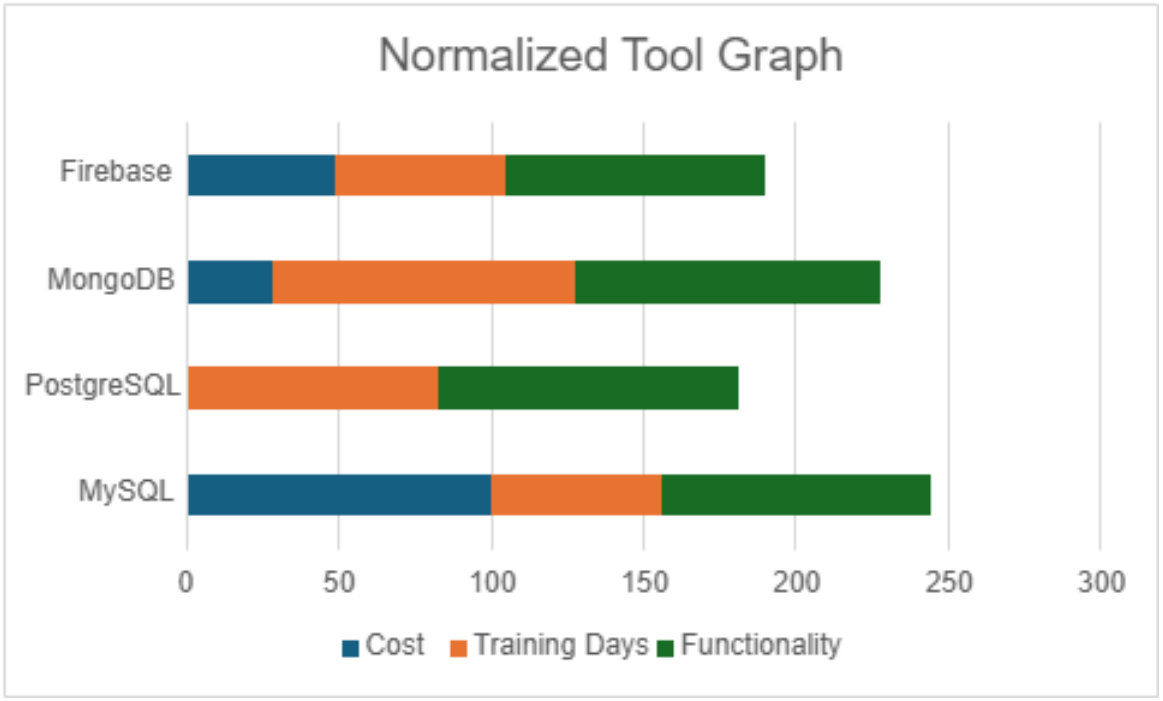
Task 2: Database Management System:

Tool Cost/Training/Functionality Data

Tools	MySQL	PostgreSQL	MongoDB	Firebase
Cost	$2,140/y	$0	$684/y	$1,000/y
Training Days	10	15	18	10
Functionality	76	85	86	72

Normalized Cost/Training/Functionality Data

Tools	MySQL	PostgreSQL	MongoDB	Firebase
Cost	100	0	28,27	49,30
Training Days	56	83	100	56
Functionality	88,4	98,8	100	84,6



Given the system's requirement for real-time data synchronization, Firebase was chosen as the backend database solution among MySQL, PostgreSQL, MongoDB and Firebase. Additionally, Firebase is designed to work seamlessly with Flutter which makes it the best backend solution for the mobile application. Flutter's official Firebase plugins allow for fast and efficient integration of critical features such as real-time database updates, cloud storage, authentication and push notifications, which are essential for functionalities like live animal location updates, vaccination status tracking and volunteer alerting systems.

By using Firebase and Flutter together, building a scalable, responsive and easily maintainable application is possible.

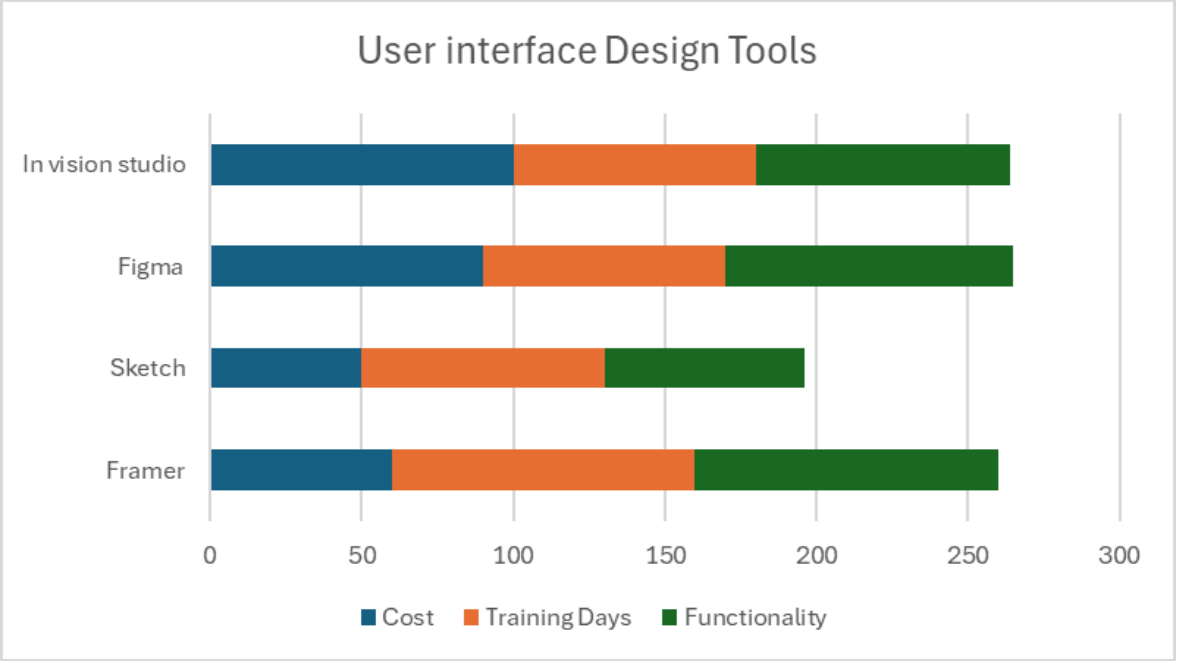
Task 3: User Interface Design:

Tool Cost/Training/Functionality Data

Tools	Framer	Sketch	Figma	inVision Studio
Cost	$300/y	$250/y	$450/y	$500/y
Training Days	10	8	8	8
Functionality	90	60	85	75

Normalized Cost/Training/Functionality Data

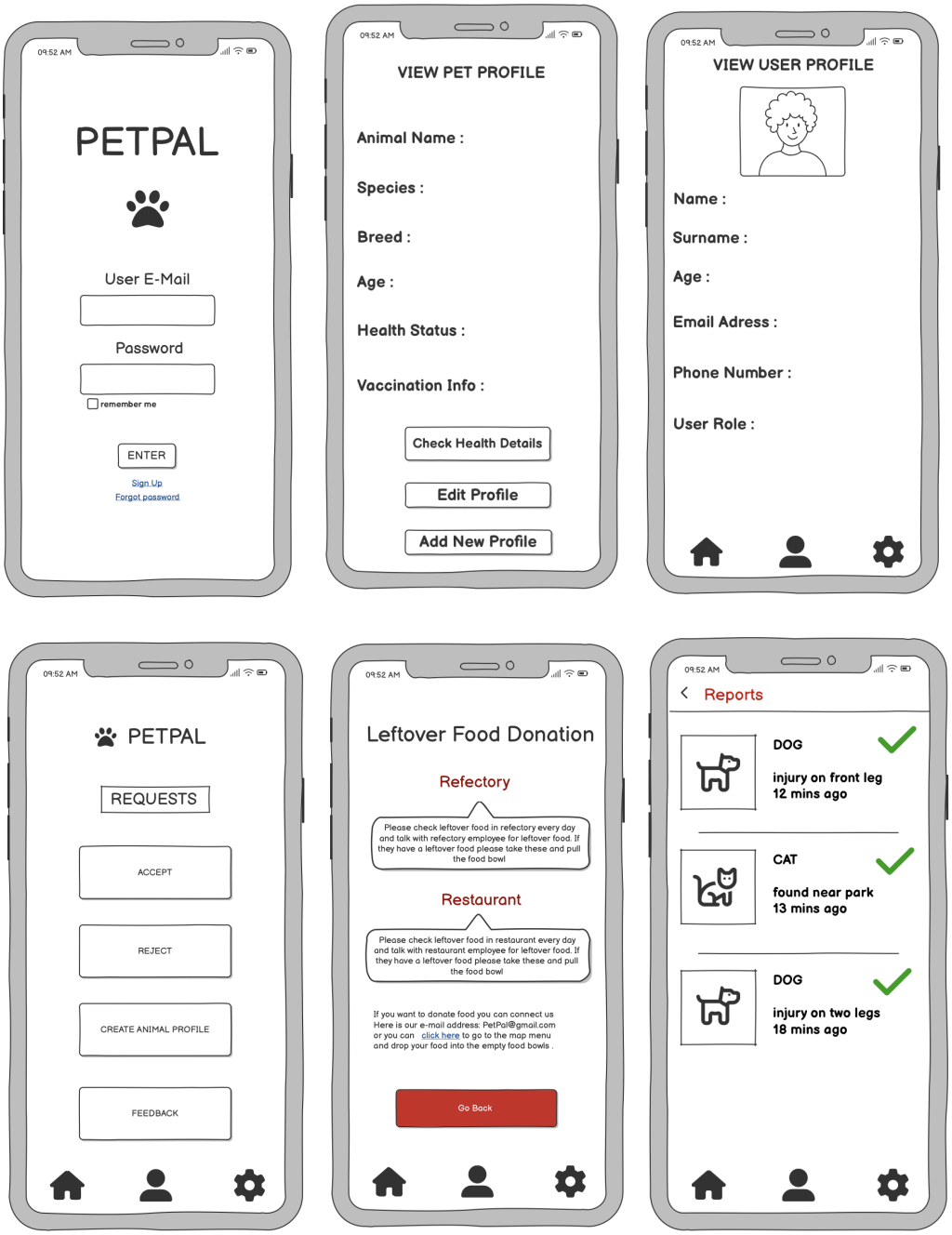
Tools	Framer	Sketch	Figma	inVision Studio
Cost	60	50	90	100
Training Days	100	80	80	80
Functionality	100	66	95	84



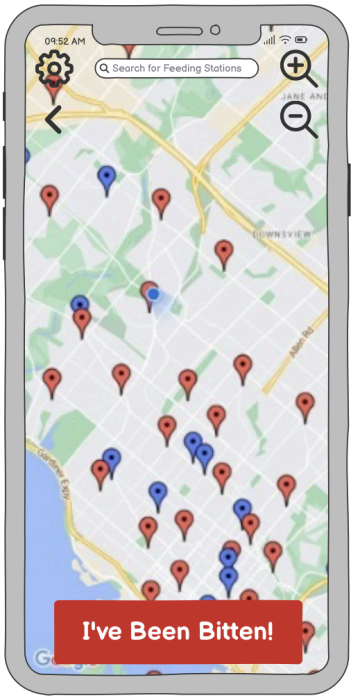
Checking against Framer, Sketch, Figma, inVision Studio; Figma was selected due to its powerful collaboration features, cloud-based accessibility and interactive prototyping capabilities for UI/UX design. Its cloud-based structure makes it platform-independent and accessible from any device, allowing for a quick start without complex setups.

Figma is possible to be used to design critical components of the PetPal application, including real-time animal activity maps, animal profiles, adoption forms, emergency alert interfaces and refill notifications for smart bowls. With extensive plugin support, tasks such as creating color palettes, adding icons and exporting assets are streamlined which optimizes the design process.

8 - GRAPHICAL USER INTERFACES




09:52 AM
ADOPTION REQUEST
Ralph
Cat, 2 years
Full Name:
Phone Number:
Email:
Address:
Animal Name:
RALPH
CANCEL
NEXT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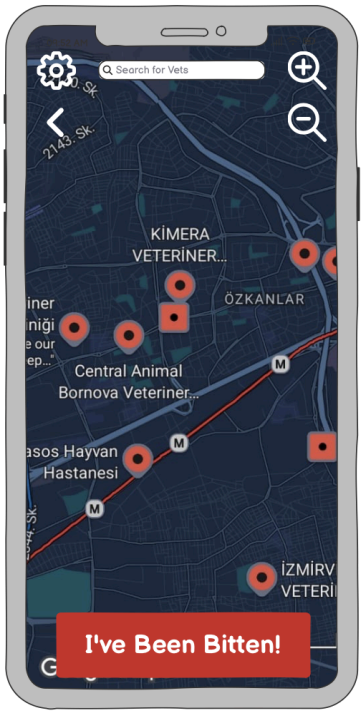
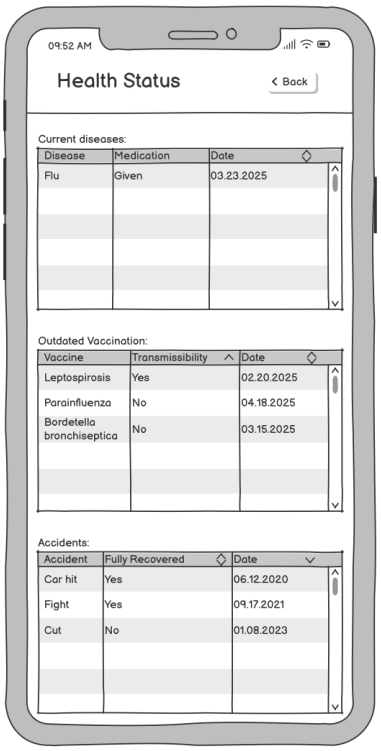
Search for Feeding Stations
I've Been Bitten!


Search for Vets
KİMERA VETERİNER...
ÖZKANLAR
Central Animal
Bornova Veteriner...
İZMİRV
VETERİ
I've Been Bitten!


09:52 AM
Celal
Back
Has Rabies Vaccination
Has Tetanus Vaccination
Warning: Aggressive
Distance: 12m
Call An Ambulance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Health Status
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Current diseases:
Disease
Medication
Date
Flu
Given
03.23.2025
Outdated Vaccination:
Vaccine
Transmissibility
Date
Leptospirosis
Yes
02.20.2025
Parainfluenza
No
04.18.2025
Bordetella bronchiseptica
No
03.15.2025
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Fight
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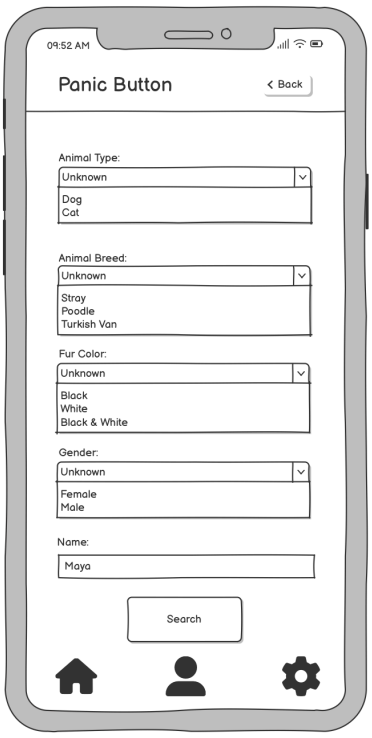
09.17.2021
Cut
No
01.08.2023


09:52 AM
Panic Button
Back
Animal Type:
Unknown
Dog
Cat
Animal Breed:
Unknown
Stray
Poodle
Turkish Van
Fur Color:
Unknown
Black
White
Black & White
Gender:
Unknown
Female
Male
Name:
Maya
Search

9 - CONCLUSION

This document provides a complete and organized overview of the PetPal project, covering key areas such as system features, stakeholder analysis, functional and non-functional requirements, risk assessment, software tools, and the project schedule. Each section is designed to give a clear understanding of how the system will operate and what is needed for its success.

It will serve as a valuable guide for the project team and the project manager during the development and implementation phases. From technical planning to stakeholder coordination, this documentation supports informed decision-making and effective execution.

In short, PetPal is not just a system to monitor animals, it is a step toward more compassionate, responsible, and technology-assisted animal care in campus environments.