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OptiVet: A User-Centered Approach to Veterinary Clinic Management

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Mohammad Sweiti	1202366
Osaid J. Baba	1203115
Mohammad Murar	1200698

Supervisor: Dr. Samer Zein

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Abstract

Mobile applications, also known as apps, are pervasive and currently utilized in every aspect of our modern life. When developing such apps, traditional software development models such as Waterfall and Agile are usually applied, were software analysts and app user's work together to build the analysis and design models. However, due to the peculiarities of mobile apps usage, personalization, and high-demand of improved user experience (UX), traditional software development models often struggle in delivering mobile apps that correctly answer real needs and expectations of users.

Here is where User-Centered Design (UCD) can become helpful. UCD is a thoroughly modern approach to analyze, design, implement, and evaluate mobile apps that puts the end-users in the center of the whole development process. In this development model, users are involved throughout the analysis and design process from the very beginning (User-Based Design) and to the end of the development with their presence in a beta-testing of the app software. They are asked to collaborate in an initial premise of what they want in the system or the application even before a prototype is given to them. The literature has a plethora of studies that prove the effectiveness of applying UCD in developing mobile apps in various domains, especially the mHealth sector. The primary aim of this project is to employ the principles of UCD in order to develop a new mobile app for real veterinary clinic in Palestine. By applying UCD model, we intend to deeply understand, design, and implement real needs, information architecture, daily tasks, and real expectations of veterinary professionals. This should be achieved via iterative feedback and involvement provided by the real users where they become the center of the development process.

The analysis and design activities were planned as follows: in the first stage, we applied focus group methods for situation analysis and information architecture gathering; in second stage we conducted wireframe (prototype) design, in third stage we conducted wireframe testing. In second semester, we will proceed with actual implementation and evaluation of the mobile app. During all these stages, veterinarians are put in the center were collected information precisely reflects real aspects of their work and most need services. Their answers derive the design and development of that application, emphasizing iterative improvements rather than rushing towards a final version. Ultimately, the goal is that the application is something veterinarians themselves can embrace as a tool to help improve the efficiency of their operations and provide the highest quality of service to their patients.

Not only will the project help veterinary clinics, but it will also provide important insights into the benefits and challenges of using UCD for mobile app development. Another aim of the project is to describe the process and outcomes of putting UCD to work. The final product will focus on the development of a management application, which we hope will become an everyday tool for getting through the workday. The hope is to demonstrate, in context, how UCD works and can achieve impactful results.

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Chapter 1: Introduction

1.1 Introduction

In the digital world we live in, mobile applications have become the truly indispensable tools of our modern life. Mobile applications help you accomplish your banking operations; remind you to meet friends; keep up your fitness regimen in shape, plot alternate routes through everyday traffic, and so many other tasks. However, in almost every market sector imaginable, these applications still need to be well-designed to ensure high usability in order to succeed.

The classic software development processes, like the Waterfall model, generally focus on technical specifications and the delivery of functional products. They are linear, with each stage completed before the next one begins. And while these stages might specify what needs to happen during each one, they don't always spell out how well the application will serve its eventual users. That's where UCD comes in. UCD can make the real difference between an application that is usable and an application that fails, even if it serves its purpose technically. It is a relatively new field that has grown up around this rather old idea: that you should design with the user in mind [1].

This project utilizes UCD methodology in the development of a mobile application for a real veterinary clinic in Palestine. Using this setting as a case study, we aim to investigate how can UCD be used in a real-life environment to solve efficiency and fundamental precision issue, which can be shared by many other service businesses. This project details the current experience of veterinarians, highlighting the challenges and obstacles they face. UCD has methods to help with turning around ineffective practices and designing directly for real problems with real end-service businesses [2].

The project aims to show how UCD) can transform the traditional practice of mobile applications development, especially for veterinary care. It does so by focusing on the unique

user experiences of veterinarians, and their interactions among themselves and their pet care clients. UCD also helps normalize a design from the halfway point of a project to the point of its completion. Our vision is to initiate new, more efficient, and more user-friendly software solutions primarily in the services of veterinarians.

Applying the principles of UCD to software development in the veterinary field can help achieve an enhanced level of user engagement and satisfaction. The next chapters will look in depth at the methodologies and processes that make up UCD and how they can be put to use to achieve the ultimate payoff of a more intuitively structured and user-friendly piece of health IT system. [3]

1.2 Aim and Objectives

Developing mobile apps using traditional software development models often falls short in addressing the real needs and expectations of real mobile end users. This can result in mobile apps that are cumbersome to operate by end users, poor user engagement, low satisfaction, and high learning curve. UCD is a pioneer methodology that plays a major role in designing and developing mobile apps that is based on inviting the real users to become the center of the whole design process. Our main aim of this project is to apply UCD in the analysis, design and implementation of a mobile application for real veterinary clinic in Palestine. This can be achieved by employing an intermediate approach to UCD and participatory design through direct and indirect involvement of real app users.

To better understand the unique demands and problems faced by veterinary professionals and their assistant, the project begins with a comprehensive data collection from they without any interference from us except to help clarify some unclear matters to them. The app's

functionality and design, which attempts to simplify clinic operations including appointment scheduling, patient record administration, and internal communications, will be guided by the data provided.

One of our priorities is to make this application with a high level of usability. We want it to have a friendly, accessible interface that even the most technically challenged users can navigate without lots of help. We also need to make sure it's secure. Veterinary practices are full of sensitive information, and we'll be adding all manner of strong security to keep it safe.

The project will conclude by scrutinizing the app's usability and acceptance among veterinary professionals. During our investigations, we will judge how well UCD concepts were integrated into the software. The result should be a clearer picture of how UCD influenced the app's effectiveness and should offer plenty of "lessons learned" in terms of what worked well with UCD methods and what might be improved.

1.3 Overview of UCD

UCD ranks as the most prominent method to comprehend the needs, context, and various environments with which the person who will be using the software truly interacts. Empathy for the end user's requirements, provides the basis for making decisions at key points across the full development lifecycle. Most notably, clear user understanding carries through the concept period and into the development and testing parts of the process. The payoff is a better-appreciated and, hopefully, better-understood environment for the end user.

UCD is different from older software development models because it actively includes users from the very beginning, right through to the end. The design team in a UCD project is typically a mixture of psychologists, engineers, technical writers, artists, and above all: users. These

professionals collaborate, usually in very direct ways, with a small number of end users. The multidisciplinary collaboration is crucial for capturing a broad spectrum of perspectives, which in turn is the best path for ensuring that the final design meets diverse user needs.

UCD's most important aspect is its core principle of iterative design. It requires repeated design, evaluation, and redesign cycles. Every cycle includes feedback from users who are the fit checking for the evolving product architecture and design. Users are involved in the constant feedback that drives the refinement of design and the identification of issues before they become real problems. Two aspects are vital in grasping UCD: the evaluation process throughout the lifecycle and the constant monitoring and improvement immediately after deploying a new product or system.

UCD is successful because it creates software that isn't just technically sound but also works with the natural rhythm of the people who use it, and that makes the users satisfied and more productive. This is the special value of UCD, and it is perhaps even more valuable in complex systems where getting the user interaction right is crucial to the whole thing.

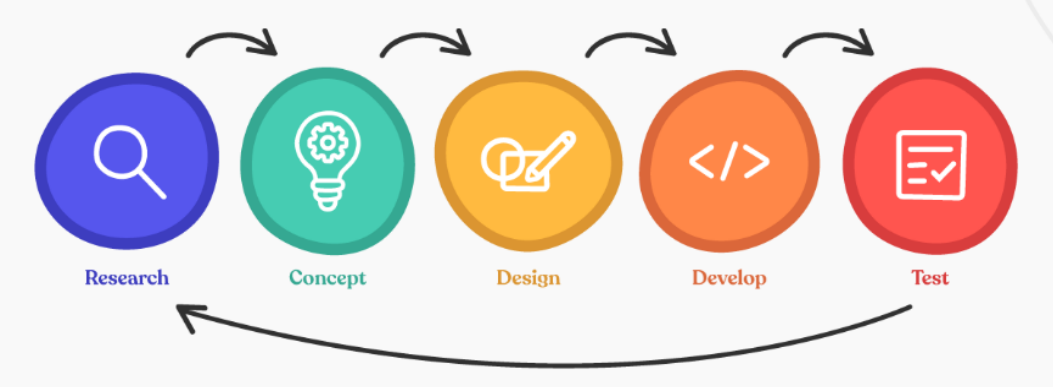

Figure 1: User-Centered Design Process [4]

1.4 Applied Technologies

We will use **Flutter**, a Google-supported versatile and high-performance open-source SDK, for developing our veterinary clinic application. The goal of Flutter is to enable users to write code once and be able to deploy it on multiple platforms like mobile, web, and even desktops, which is crucial for making our application device agnostic [5]. In addition to reducing development time, the ability of this framework to provide live updates sets it apart further, being able to see changes immediately during development, thus reducing greatly the time and feedback loop. Also, a wide variety of tools and widgets included in Flutter helps users create highly functional and visually appealing interfaces. Moreover, its built-in environment enables users to conduct numerous different operations, from network requests to database management, in order to carry out the backend processes needed for our app.

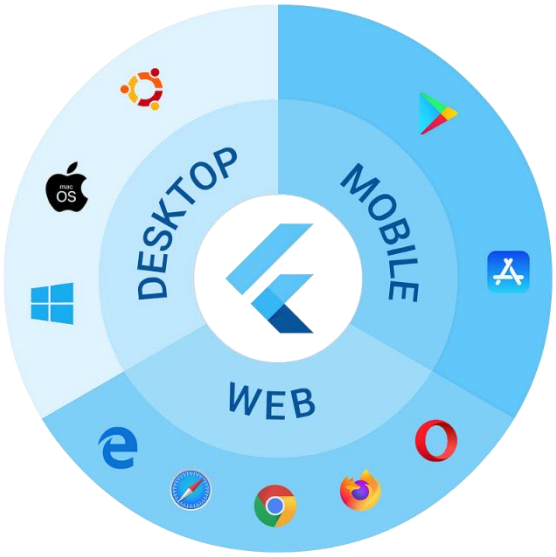

Figure 2: Flutter cross-platform promises mobile, web, and desktop [5]

For our backend service, we are planning to integrate **Firebase**, with its full set of interconnected tools to fulfil the app developing needs such as Analytics, Authentication, Real-time Database and Cloud Storage, with perfect integration. By using Firebase Analytic [6], we can understand more about the behavior of the user for deeper customization to meet the

specific needs of veterinary professionals. Firebase Authentication supplied us with a strong authentication system to make sure that the user can securely access the app. Firebase Storage will help us a lot in managing files getting uploaded to the app securely contains medical images and documents.

Figure 3: Firebase Authentication [6]

Figma will be the design tool we use to create our app's initial prototypes. This powerful design tool allows entire teams to collaborate on a design simultaneously. By designing from different locations at different times while viewers see the changes made during the design and implementation process. Figma is equipped with all the typical functionality we expect from tools like Adobe XD, things like Components & States, but Figma also offers groundbreaking features like auto-layout and variant properties, which means creation of our designs can occur more quickly and intuitively. The result of using Figma as our design tool means we can iterate very rapidly on our designs, produce high fidelity prototypes that can be tested with actual end-users, and keep increasing the consistency and quality of our app as we continue to build screens and features [7].

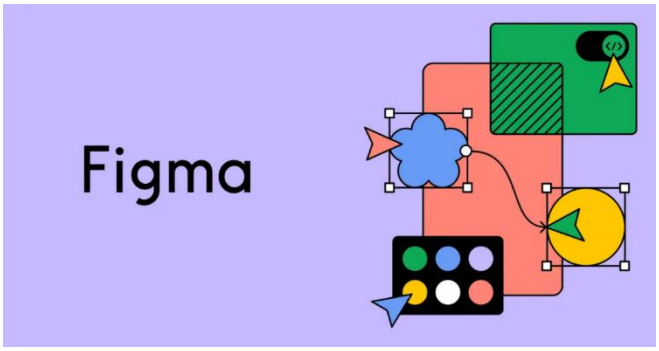

Figure 4: Figma [7]

Using these technologies, our project aims to provide a high level of functionality and usability for veterinary clinics, optimizing workflows and improving patient care. Additionally, the integration of these advanced tools will give us the utmost confidence that our application will not only perform excellently, but also be secure, reliable, and user-friendly.

1.5 Overview of the report

The report's second chapter concerns itself with UCD and the methods and ideologies ideally associated with it. This chapter serves as UCD's theoretical methodology, underlining its import for the design process.

Chapter 3 will represent the literature review of the project, that highlights numerous important UCD-related research. This chapter presents a range of UCD implementations in various scenarios, showing how it has been successfully applied to improve user pleasure and engagement in a variety of software settings.

In Chapter 4, the report will present the analysis of the focus groups sessions that were done with the veterinary professionals and their assistants. So, this chapter will contain the Software Requirements Specification and the main features of the application, also it will define the stakeholders and it will utilize the important diagrams to demonstrate the design and operation of the system.

Chapter 5 will handle the design phase, including UML models and wireframe designs. This chapter demonstrates the process of turning user feedback from previous iterations into tangible designs that support clear user interfaces and useful system architecture.

Chapter 6 concludes the report by providing an overview of the results and a discussion of the general implications of UCD concepts. It explains how the project effectively accomplished its goals, identifying the roadblocks and suggesting directions for further exploration. The text emphasizes the importance of UCD in creating user-centered software solutions.

Chapter 2: Background

2.1 UCD Methodology

In the first semester of our project, we applied focus group discussions with end users, followed by two parts of designing activities: part 1 and part 2. With each part consists of a set of activities done to have a “Demo” decision to be taken regarding the design and the requirement specifications [8]:

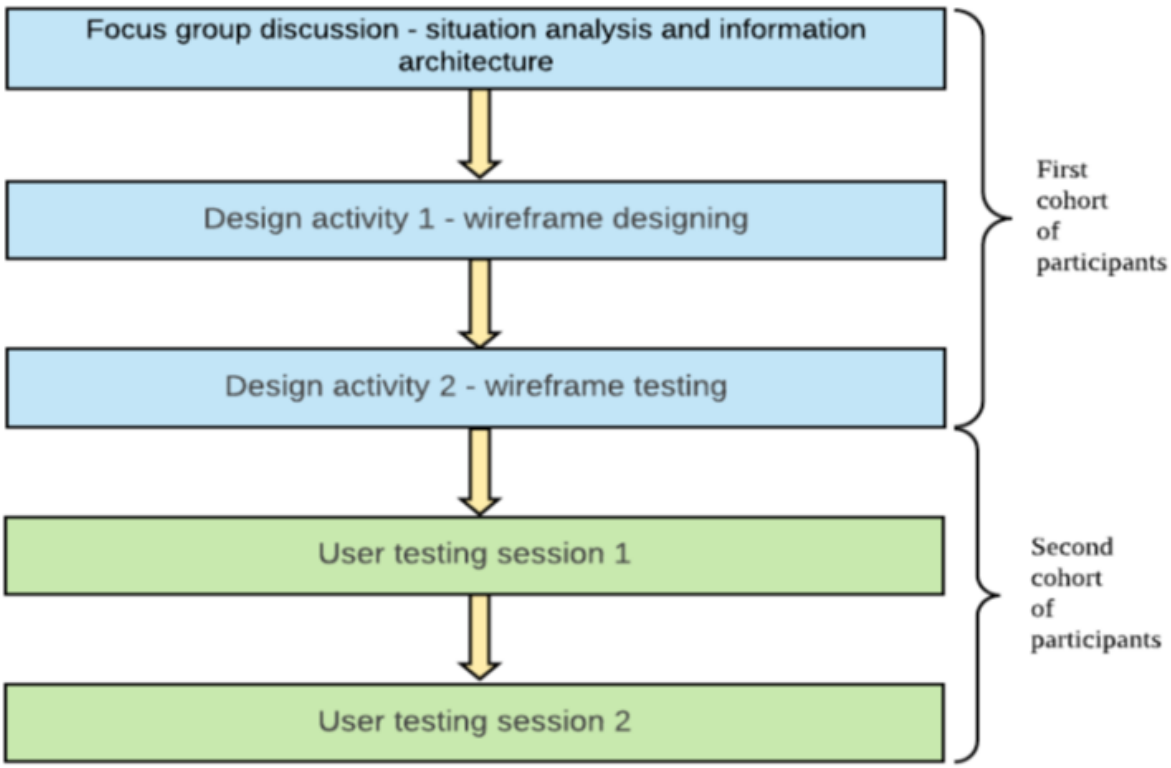

Figure 5: Sequence of design activities and sessions

As UCD focuses mainly on the end users as also the people we are making the project for, there must be some differentiations between the type of people to be dealing with each part or each stage that will be built and tested. In fact, we need to categorize the people depending on each part of the process, so we can fulfill the suitable needs for all the parts.

Here as told, each consists of several stages as the following: -

Let’s start with the first part, which mainly concentrates on the design process and writing down the specifications needed from the first focus group meeting, also knowing the behavior of the users and the practices related to laboratory information usage to specify the inputs of the product and to know how the structure of the information should be built [9] . While our project will be built for a veterinary clinic so we should ask the doctor to write down on a sticky note how can he deal with specific patient in a specific scenario. And how an application can help him doing the suitable treatment for his patient in the clinic. Secondly, he was asked to draw a flow chart for what are the laboratory tests to be taken for the patients as an initial procedure to be taken into consideration for each patient treatment, next a prioritizing process is needed for knowing how to handle such scenarios based on specific information like the patient’s status. If a patient needs to stay in the clinic more time or if the patient needs to come back for another appointment [9].

After the first two scenarios provided, now it is our job to prioritize the information based on the scenario responses provided by the doctor and the user. This meeting is more about how the developers deal with the people or the industry there are going to build the product based on their type of responses that were written down, and what are the main requirements for the product to be ready for purchasing. And what are the part to be invoked with the end users for testability. As it is important to work in a process structure that helps us to easily test each unit of the overall work, keeping in mind that there will be no specific technique to be followed for writing the specifications it’s more about that the members of the clinics should just write any idea they get so main focus on each topic will be specified by the incoming discussion, summing the has been said in the following two design activities:

Design activity 1: wireframe designing, this part mainly focuses on how the information will be structured by providing the doctor and the employees with several clinical related topics. So, each member of the group should speak with the others about the specification he or she set for the topic and answer the questions if the others asked any questions, also each member should be asked to write down four keywords. So that we can reference each keyword with its purpose of use and to envision how the application should start and how the home page would look like [10].

Design activity 2: wireframe testing, in this part inputs and data should be discussed and analyzed by the members and how these data should interact with each other by giving the feedback on each part so we can start going through the relations between each part of the application, and how each part will be categorized based on the specifications provided. Also to know how to provide suitable unit testing models to mockup our functionalities that we will be designing. And after that they will be asked to draw what their envision is about for the home page so the design can be more efficient than it was in the previous part. [10]

In the first part after we gathered the user's inputs and the first prototype is ready, several tests by using the product in a period of time, as each member should use Android as it is the system that we will be working on building the product based on (if no changes in our development process). Since we are working with more than one member, any challenges we might face regarding the privacy instructions for each device, if any of them cannot purchase the product due to the fact that the device doesn't allow that because the app is initially considered to be an external unknown formal app. This might not be a challenge for us, each member should be asked to handle a specific usage technique, so al functionalities of the app can be tested in the right way. Also to make each member gives feedback specified for the task given based on each of their job. [10]

In the second part, where tests on each part should be more specific and efficient, based on the output of the tests of the previous session, the second prototype of the app should be ready. And the members should be asked to download the latest version of the product that for about three months the members are expected to give a deeper and more detailed feedbacks so we can enhance the usability of the product and to provide what is suitable on the functionality side for the workers of the veterinary clinic. [10] [11]

2.2 Why UCD?

By following the pre-defined stages and processes of the software development process, the resulting application can still not be well-designed considering the final user. In particular, the unique features of rolling out the implemented technology can be forgotten because all the interaction with the end-users is believed to be covered by the requirements document. The collection of requirements cannot substitute this work, though. Different groups will have different requirements; therefore, the UCD needs to integrate them into the application from the very beginning, this is the paradigm. Indeed, UCD helps developers become able to develop custom-made applications that not only serve their function per se, as shown in the case of the student management system in the provided scenario, but are intuitive and user-friendly as well. Therefore, by including UCD, the developers will have instructions that allow them to be sure the user will not misuse the application for which it was originally developed.

Chapter 3: Literature Review

3.1 Introduction to Literature Review

This chapter presents a targeted review of the literature on UCD focusing on its principles, methodologies, and its use in various domains, specifically in software development. UCD is a design approach that centers on the end-user, ensuring that final product is bespoke to meet their needs and enhance their experience. The review will highlight nine important studies that have very importantly added to the field and discuss their relevance to the current project.

3.2 Summary of Key Papers

3.2.1 Paper 1: " A Survey of User-Centered Design Practice"

This research by Karel, Ji-Ye, Paul W Smith, and Tom Carey [12] documented the survey results from a comprehensive questionnaire on the use of UCD methods in industrial environments. The goals of this investigation were to gain insight into the frequency of UCD method usage and the distribution of UCD methods with industrial organizations, where “industrial” is broadly defined as in [12]: covering any organization that is a commercial organization (for-profit or not-for-profit), has more than 50 people, and has an IS department.

Gathered through a web-survey, this Survey yielded data about the number and range of methods being employed in organizations today, and their effectiveness. All the contacts were of members of the Usability Professionals Association. Giving the numbers of respondents for each survey indicates how many of the members of the national and local chapters of the 2000 USPA survey received the email.

Measure	Frequency
External (customer) satisfaction	*33*
Enhanced ease of use	*20*
Impact on Sales	*19*
Reduced helpdesk calls	*18*
Pre-release user testing/feedback	*16*
External (customer) critical feedback	*15*
Error/success rate in user testing	*14*
Users' ability to complete required tasks	10
Internal (company) critical feedback	6
Savings in development time/costs	5
No UCD measures in place	15
No useful response	20

Table 1: Top 10 Cited Measures of UCD Effectiveness [12]

as shown in table 1, ways of measuring the UCD's effectiveness were quite peculiar and sometimes don't impress one as being measures at all. Yet, this is how the corporate world responds when asked for UCD performance metrics. The table shows responses from 103 businesspeople for whom UCD was a relevant part of their jobs. They were asked to name up to three indicators that might be seen as relevant to the UCD process effectiveness in their organizations. The result: A rather random scattering of indicators without any sign of a consensus emerging.

Two statements can be made about how UCD methods are adopted and applied in practice. First, informal usability testing and low-fidelity prototyping are the most popular UCD methods. Second, these methods are typically not used to their full potential. The Learning from You survey data places this in context informal usability testing was the most frequently used method by 36% of the respondents, low-fidelity prototyping by 33%, and all other methods by much smaller percentages. Their prominence is due primarily to their accessibility and ease of use for those without extensive training in UCD methods. As many respondents say, we realize that more elaborate techniques would facilitate more reliable and replicable results; many say they want or must introduce more systematic practices into their work. So, why don't we?

The significant variance in the adoption and application of UCD methods reflects a broader pattern in the industry, in which method selection is influenced by cost-benefit trade-offs. Reverse-engineered design criteria haven't kept pace with the choices that methods afford when they're applied, if they're applied or with the new design challenges that face us.

The Survey examines the main problems that prevent UCD from being implemented in organizations. These reasons why UCD has sometimes failed to gain ground include limited resources; a lack of clear, pre-established metrics through which to gauge the success of UCD; and internal resistance to UCD. The Survey makes a case for the development of practical, standardized UCD guidelines based on both empirical evidence and real-world success stories and calls for the establishment of best practices to promote more effective UCD methodologies.

The Survey recognizes the growing acceptance of UCD across industries and reinforces the important role that robust UCD practices can play in helping companies and other entities improve their product development strategies. The effective use of UCD can help organizations better address the many needs of their users, improve the quality of their products, achieve higher customer satisfaction, and facilitate the necessary performance in their markets. All of this can translate into an actual business advantage.

3.2.2 Paper 2: "Understanding the Context of Design – Towards Tactical User Centered Design " [13]

The context of use is a crucial factor in UCD and serves as the basis for designing effective products, systems, and services. Yet this vital aspect of UCD is often overlooked or underrepresented in both theory and practice, especially in large-scale projects in industrial, practical, and governmental sectors. In such projects, determining the contextual factors (e.g., through ethnographic methods) and representing them graphically (in various forms ranging from classic user scenarios to more sophisticated behavioral diagrams) are critical for ensuring that the designer's understanding of the problem space is adequate. the risk of producing solutions that fit poorly with how people work, think, and feel in their everyday lives remains high.

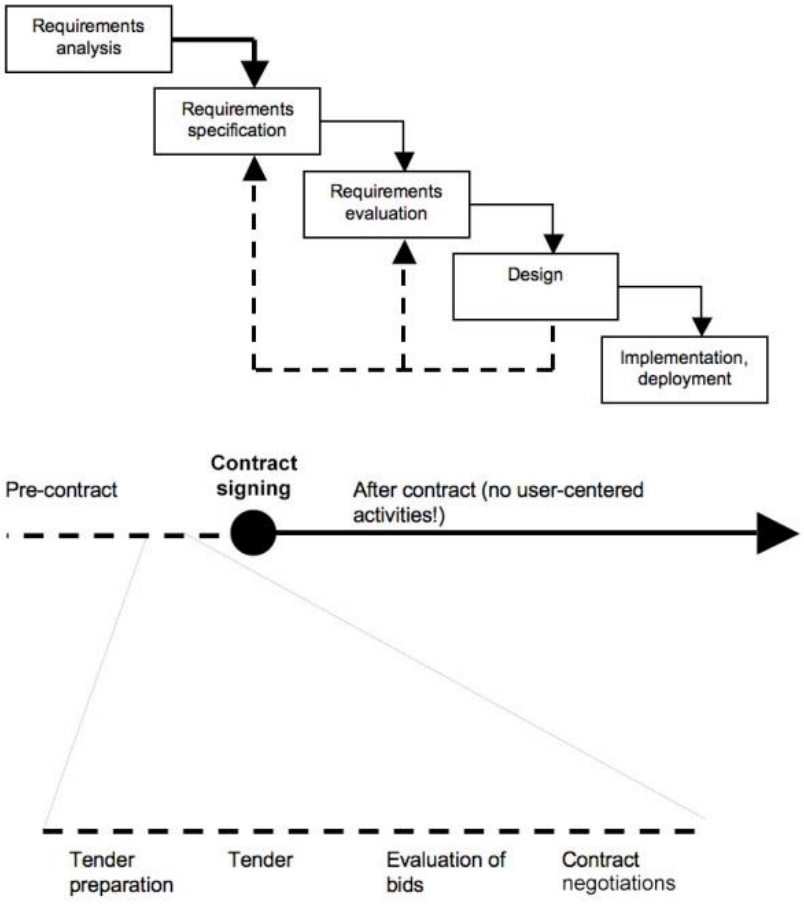

Figure 6: User-centered design vs. tender process [13]

As shown in Figure 1 the general stages of a project life cycle, revealing the holes of UCD activities inside current contractual frameworks. It demonstrates how activities as requirements analysis, specification and design are accomplished earlier than contract signing, without any user-centered activities planned afterwards. This exposes one of the common issues in project conduct that user-centered practices are not integrated to the rest of the activities, e.g. implementation and deployment, in a later stage especially after contracts are ratified and the project comes to the operational phase. This diagram will constantly remind us of the continuous integration of UCD practices cross the project phases and how important that addresses end-user needs and user feedback along project activities, not just leaving them disconnected in the classical project time line.

This paper provides a list of limitations to effective UCD implementation: organizational restraints, stakeholder differences, and project structures that have been set up to resist design changes based on user feedback. It then goes on to suggest directions to overcome these limitations. Their solution is proposing a strategic approach to UCD that starts by presenting readers with a clear picture of the project and the context in which the UCD campaign gets performed. By doing this analysis phase, users can hopefully identify any aptitude for usability problems, and then focus UCD efforts to remediate these issues. [13]

The strength of this perspective is illustrated in various case studies that show how neglecting contextual factors can lead to suboptimal results by influences like company policies, contracts, organizational structures, etc. The chapter ends with a call to take broader HCI research and practice seriously. It suggests that for UCD to have the full

impact on software system and design, we need to have a full understanding of project or designs context, user's environment, and design goals. We need to seek achieving a balance between adopting a user-centered approach and a user-focused approach.

3.2.3 Paper 3: "A glossary of user-centered design strategies for implementation experts "

In Alex R. Dopp and co-authors paper [14], the authors tackle the importance of implementing UCD principles in healthcare settings to improve the implementation of Evidence-Based Practices (EBPs). A significant part of this research is the authors' design of a glossary that includes 30 UCD strategies specifically designed for implementation experts. The glossary not only aims to create a common language and understanding among implementation researchers and UCD professionals but also to foster interdisciplinary teamwork.

The researchers showed how traditional implementation strategies have historically sought only to fit healthcare settings with static EBPs, and not to re-imagine the EBPs themselves to better match the needs of users. They argued that UCD can move beyond the gap because it guarantees the development of innovations stimulated designs depend on the understanding related with end-users beside boost the capacity, reasonableness and viability of EBPs in real-world settings. [14]

In their paper, the authors outline UCD strategies, such as considering users through various research methods to better understand the users' requirement, preference, and behavior deeply, which helps harness more precise and prompt reactions from the designing and adaption processes. The paper writes user insight into the design and

adaption of health intervention, technologies and services, the ultimate purpose of which is inspiring us-friendly, efficient and profitable system.

As a whole, this study provides an anchor for the applied implementation researcher interested in using UCD to enhance the real-world impact of health research, emphasizing the importance of future studies exploring how best to bring UCD into a health services setting.

3.2.4 Paper 4: "Mobile Application Design for Ordering Clean Water Using UCD Method in Indonesia " [15]

In Indonesia, especially in the east of this country there is a big problem with the availability of the clean water [16]. The reason for this water scarcity issue is the way that they are distributing the water by using traditional and inadequate method, these methods are centered on the buyer of the clean water, where they must call or sending SMS for the individuals who have the water in trucks. But this way of ordering the water is not effective and customers usually wait for so long to wait for this water.

This paper introduces a mobile application named Go-Water, where designed using the UCD approach [17].Go-Water is created for two types of users, for the customers who order the water and the water vendors who deliver the clean water to the customers. Since the application has a user-friendly platform, customers can easily order the water by selecting the nearby vendors and desired water volume, also this helps the vendors to improve order management and scheduling.

The main reason of using UCD approach to create Go-Water application is to ensure that this application will have the main specific needs of both customers and vendors [[18]. they want to know what they really need in the application. Additionally, the research proposes a distance-based pricing system to optimize vendor profitability.

The conclusion of this paper confirms that Go-Water application has user-friendly interface for both customers and water vendors. Usability testing results yielded an average score of 83%, indicating successful design that meets user needs for clean water access.

3.2.5 Paper 5: "Human-Centered Design of an mHealth App for the Prevention of Burnout Syndrome" [19]

To avoid Burnout Syndrome (BS) suffered by university teachers' and employees', the aim of this work is to develop and evaluate a Mobile Health (mHealth) application. This application emphasizes the significance of taking care of stress-linked diseases to improve mental and physical health and production. This work used a UCD methodology, and descriptive data was collected from the University of Cauca, in Colombia, from 59 academic and administrative members, who answered the Maslach Burnout Inventory (MBI), and technical and demographic questionnaires [20].

Through the use of UCD approach, three iterations of the mHealth app prototypes have been created; at each level of compounding, usability tests took place to ensure the prototype's design made for a simple and easy to use app. The collaboration of the encompassing high skilled developers, app and visual designers, occupational health professionals, usability experts, and end user took part in the all-inclusive design process [21].

Usability testing indicated positive results in the SUS and ISO 9126 metrics; a SUS score of 89.38 demonstrated a high level of user satisfaction [22]. However, the researchers argued that in real-world scenarios, it would be necessary to study the therapeutic effectiveness of the system in reducing Burnout Syndrome. As a result, continual improvement and evaluation are critical.

The authors of this technical article demonstrate their research investigation as “exploratory research”, acquiring the exploratory design. By conducting a UCD leading to the development of a mobile health app that meets the requirements of academic staff and staff of universities to provide advice on Moody's prevention [23]. Because the app has functioned with the end users of the software at the beginning, it has been well accepted and has received unfavorable criticism. Serving as a prelude to later work assessing the therapeutic effect of the app, and the effectiveness of using the app to reduce Burnout Syndrome.

3.2.6 Paper 6: " Development of an mHealth Platform for Adolescent Obesity Prevention: User-Centered Design Approach " [24]

In this paper, we present TeenPower, which is an mHealth intervention program. A "next big thing," as Dr. Caren Cooper of NCCHPP calls TeenPower [25]. Dr. Cooper is the Deputy Director for the Childhood and Adolescence Branch at the Division of Prevention and Population Sciences (DPPS) in the National Cancer Institute (NCI) [25].

Obesity in adolescents is a common, undertreated, and rising health problem. Dr. Cooper's branch at the NCI addresses not only obesity but also the kind of

communication and mental health that go along with an emerging public service and public health problem.

The agile development of TeenPower was led by an emphasis on User-Centered Design, a process of continuous feedback that allowed the team to hear from healthcare professionals and, critically, from adolescents themselves. In this phase, the team set to work creating rapid "paper" prototypes that could be shown and tested at several healthcare facilities. Feedback from those healthcare professionals and teenagers was used to improve and iterate the nascent design, which then went through its own "pre-production" usability testing. "Post-production" usability testing was later used for understanding how participants in that testing engaged with the app.

During the study phase of the design, user needs and preferences were prioritized. The methods used in the prioritization process included techniques like user analysis, storyboarding, and paper prototyping. What made these techniques even more powerful was the validation process the team carried out using real adolescents. They tested the fidelity and imagined experience of the graphical user interfaces using such teenage rules as "Is it cool? Can I blog or tweet with it?" Then, in the pre-production stage, usability tests on the actual application were carried out [25].

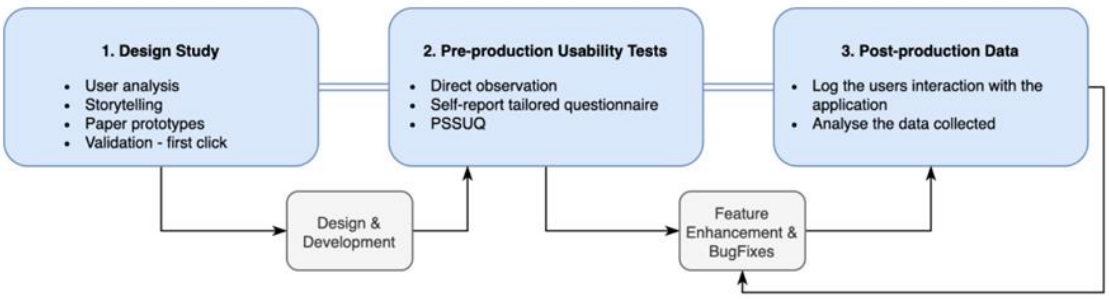

Figure 7: Three-phase user-centered approach model/techniques and method details [24]

Phase three focused on testing the app with actual users. The team used Google Analytics for Firebase to keep an eye on its performance. On the tech side, things looked good: no crashes. But, on the user/motivation side, they detected a problem. Initially, the users showed high engagement. They retained 35% of their numbers after a few weeks. But this metric went down the longer they used the app. This indicated that they were not involved enough in the user experience to stick around. The team needed to up their game, gamification-wise.

To sum up, the TeenPower project demonstrates how user-centered design is crucial in creating successful and captivating mHealth interventions. This project used an effective feedback loop to put system personalization first, in a way that goes beyond just undivided attention touted as an advantage of digital health. The idea was to continually work on the methods of system intelligence so that the system can carry out actions with an appearance of personal interest to the end-user, and continually improve intervention effectiveness.

3.2.7 Paper 7: " Mobile Application Design Emergency Medical Call for the Deaf using UCD Method " [26]

In this article, the important development in the field of deaf accessibility technologies observed by engaging the "Healthy Phone" emergency medical call service as a case study to illustrates of Mobile Application Design for Deaf by UCD principles, this paper addressed that particular designed its empirical focus on hearing impaired people [27].

An important requirement met by the program is answering the question as to how a deaf user may contact emergency medical services (EMS) without a conventional

audio-based communication. Instead of conventional audio-based communication, a visually driven interface that permits choosing symbols to match a user's unique emergency scenarios is provided to the user. Because it is user-friendly and enables prompt and efficient communication, it has a positive impact making the program effective, efficient, and user-friendly. Enhancing the promptness and effectiveness of medical services, the program communicates the locations of the deaf users to the closest hospital automatically [28].

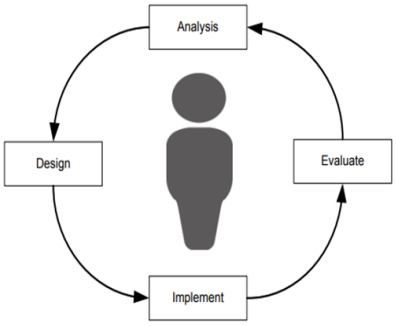

Figure 8: UCD Process [26]

To make certain that the app accommodated their special needs and desires, the design process integrated deaf people in the production and testing phases. The paper discusses iterative improvements and early user input, as well as other stages of app testing, to better the efficacy and user-friendliness of the app.

The user testing results reveal how effective Healthy Phone is and it highlights the importance of employing UCD techniques in developing e-solutions for target groups. Not only does technology become more practically usable with the help of UCD but the overall user experience is also improved, so that even someone who has never used a phone before can get critical services like emergency medical help [29].

3.2.8 Paper 8: “Adapted User-Centered Design: A Strategy for the Higher User Acceptance of Innovative e-Health Services” [30]:

The objective of this paper is to make the usage of a Slovenian e-health health system application services easy and more efficient for elder users, as this project is a collaboration between medicine and health care related students with IT developers, this collaboration forms how the work will be managed.

The app should provide the following functionalities for the elder users, social networking and social services, social and media control center, now a supportive design should be provided to fulfill these services, as the first experimental was the MedReminder, as this is reminding the patients for taking their medicine, as UCD was invoked into this service by the following tasks:

1-Wants and needs analysis, gathering the requirements for the older adults as it is considered to be difficult.

2-Focus group, it is hard to keep elders focused on a several hours long group meeting, to solve such problems, we made participants to take part of the focus groups, these participants may be relatives or friends, and we divided the process into two focus groups.

3-Interview, this method is sued frequently for gathering user

4-questionnaire, another method used to conduct user’s information, the problem in this method is that elders are mor likely to say “do not know” that some questionnaires including technical terminology that elders don’t use in their daily lives.

The overall purpose of this methodology is to provide a good health service environment on the internet and to increase health service efficiency.

3.2.9 Paper 9: “User-Centered Design Groups to Engage Patients and Caregivers with a Personalized Health Information Technology Tool” [31] :

The objective of this paper is to build a tool that could be used daily in the real world, that users, they examined the needs of the users in the design development process of designing the BMT roadmap through UCD.

Families and patients have described their need for more active involvement in the services provided for their health care, in the design process which is consisting of three phases, the first phase where information from both caregivers about the issues and challenges of pediatric HCT patients, and patients where we gather some information about them, like laboratory information and medications.

Second phase, where examples of low-fidelity prototype is provided from the designing group 1, where there was a scenario provided for them as a patient and as a caregiver, also some experts in the field of HCT were invoked in this phase where they cover the usefulness and heuristic of the prototypes, also two members of the group were asked to do the data analysis part where they analyze the data using an open coding method.

Third phase, where examples of the high-fidelity prototype from designing group 2 by using a web app on an iPad and comparing the prototype from the previous phase (phase 2).

As a conclusion, following this type of structure and going through these phases, where both caregivers and patients were invoked for providing a good result of the project, giving the information, instructions, needed to lead the developers to enhance the overall performance of the BMT roadmap application.

Chapter 4: System Analysis

System analysis is a regular approach to discover what a user truly needs and to determine how to go about fulfilling those needs. At this stage of the project, we went into **focus group meetings** with managers, secretaries, and veterinarian assistants. This UCD practice ensures that what gets built is genuinely tied to the actual needs of end users and performs in ways that the typical workflow of the user can adapt to. We had meaningful discussions; we took a plenty of notes.

4.1 Product Description

The OptiVet system strives to enhance the workdays of veterinary managers, secretaries, and assistants. It is both comprehensive and easy to use, and it is quite good at what it was designed to do. The list of what it can do on both the back end and the front end for clinic management and client relations, respectively is quite impressive. It helps the staff to manage all of their (and the clinic's) daily operations more simply and efficiently, and this translates into better experiences for everyone, both the staff and the clients.

4.2 Focus Group’s Analysis

In our UCD process for developing a veterinary clinic app, we hold focus groups with representatives from each department in the clinic. This chapter describes these focus groups and shows how their feedback influences our understanding of the clinic's work processes.

4.2.1 Focus Group One: Comprehensive Clinic Insights

It was crucial to have a clinic manager, a veterinary assistant, and a secretary in our UCD focus group when we developed our veterinary clinic application. We wanted to thoroughly understand their roles and what they did every day and left no stone unturned in our pursuit of this knowledge.

Starting the session with a discussion of the issues they currently face in their roles and how tech could solve/ alleviate those problems helped us understand their current workflows and where they could use improvements. We took a methodical approach to this discussion as we wanted to: capture lots of wide-ranging information. We used a combination of scenario-based, open-ended activities and discussions to help facilitate this effective discussion. We started off by asking participants to think about the broader challenges they face in their roles, and reflective on how technology might solve those issues. We then worked with participants in small groups to get to a pretty detailed level of understanding of their current workflow so by the end of that easing into we got a pretty good high-level picture of what's going on in their organization.

To capture immediate thoughts about specific clinic management and client interaction scenarios, we used sticky notes. This activity was helpful in identifying the most critical features and functions that needed to be in the system. For instance, people mentioned a need for effective scheduling systems and easy access to pet medical records.

After generating ideas we delved into the information architecture, asking participants to categorize hypothetical app features by importance and frequency of use. Using this information, we were able to determine the fundamental features of the system, which in turn guided the draft wireframes.

The foundation for our system's design was laid during this focus group session. Subsequently, the detailed results showed in the System Analysis chapter set because of that. To make the development of the veterinary clinic management system, "OptiVet" to be based on the real needs and preferences of its end users; to exude the spirit of UCD, we approached the focus group session like this.

4.2.2 Focus Group Two: Validation and Specification Refinement

Expanding on the inputs from the previous discussions, the second focus group was held with the purpose of enriching and validating the initial definition of system requirements. This session was important in assuring a correct understanding of operational and functional requirements to proceed to the more detailed system design. After revisiting the system objectives and main functionalities identified in the first focus group, stakeholders, such as the clinic manager, vet assistant, secretary, were involved in this session to assure the alignment between the needs of the real-world operations of a clinic.

Participants had in-depth conversations about the functional requirements that were essential for daily operations and we discussed the real constraints as well as operational environments that the system will need to address. This led to a thorough analysis of the proposed system models, including class diagrams and sequence diagrams, ensuring they accurately represented the clinic workflows and interactions. Through collaborative discussions, we adjusted these models to reflect the true dynamics within the veterinary clinic more accurately.

Additionally, the focus group permitted a detailed exploration of the structure and behavior of the software. Its requirements were studied most carefully. A software application might demand a certain kind of interface with users; that interface must be secure. It doesn't do to have secure users' interface with an application that isn't secure. Preparing the application to perform before an audience is a realm for performance testing, which in turn is a constraint to be worked within during the development phase.

The outcomes of this focus group conversation were instrumental in fleshing out a definitive plan for the project. And what emerged from this Focus Group was not only a reaffirmation of the specifications but also some added insights that resulted from the discussion among focus group members. You can see these play out in Chapter 4, "System Analysis," where these transformed insights become a coherent and actionable plan for how to develop this clinic management system from specification to delivery.

4.3: System Requirements Focus Group’s Diagram (Workflow)

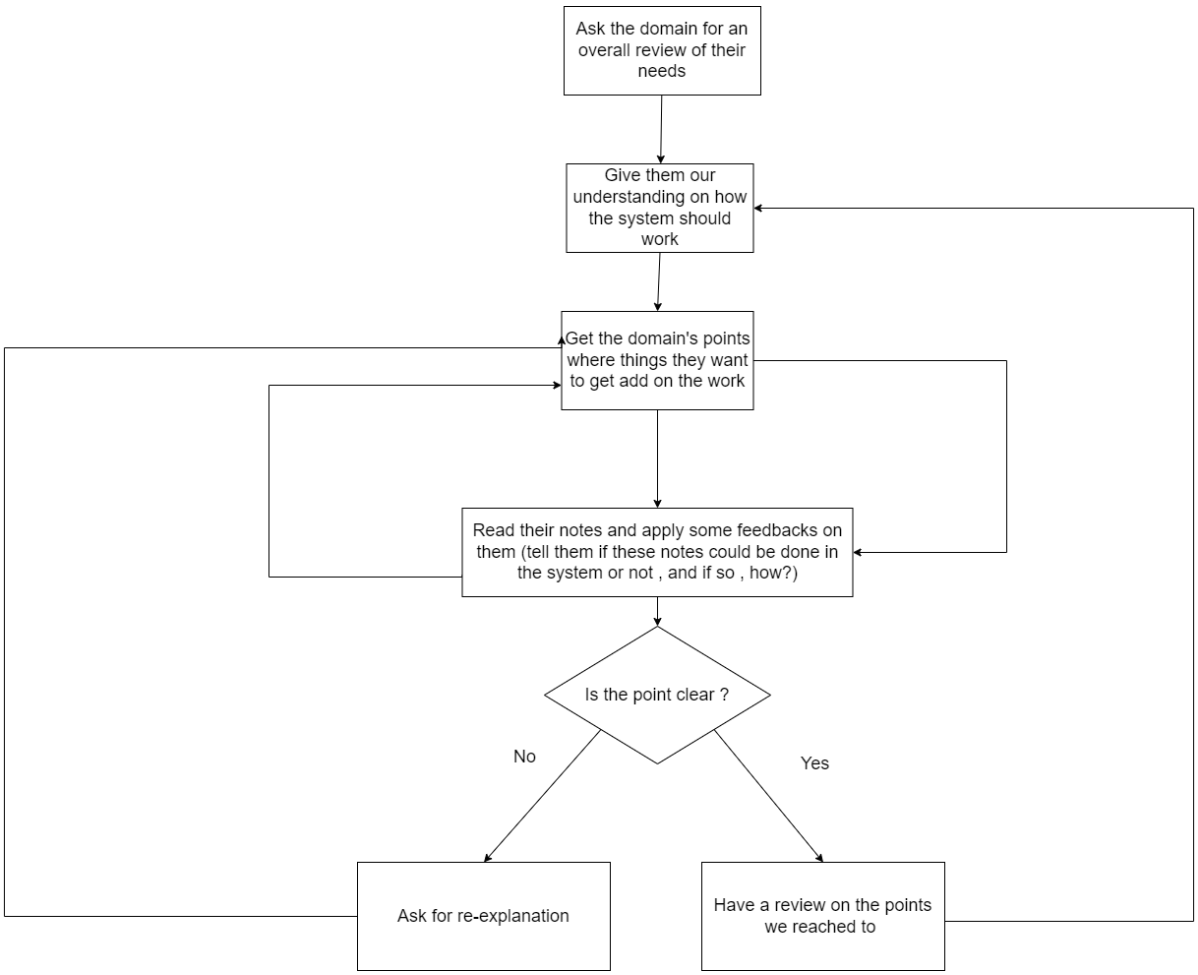

Figure 9: First Focus Group’s Diagram (requirements)

4.4 Focus Group’s Outcomes

After our focus group discussions, this section details the outcomes and how they informed the development of the veterinary clinic app. Here we discuss the defined system objectives, main functions tailored for different clinic roles, the operating environments, constraints, and the functional and non-functional requirements essential for the app's success.

4.4.1 System Objectives

- Simplify veterinary clinic administration.
- Help manager (veterinarian) and veterinarian assistants with their daily responsibilities and appointments.
- Streamline medical profiles, sales data, and checklists.
- Improve the efficiency and organization of clinic management.
- Make sure that data is protected and correct.
- Ensure real-time communication between clinical professionals and clients in a direct and non-delayed way.
- Send timely reminders for tasks and appointments.
- Offer comprehensive reporting tools for better decision-making.

4.4.2 System Main Functions

4.4.2.1 Vet Assistant System Functions:

- User login functionality.
- View list of animals and their details.
- Complete daily checklists for animal health monitoring.
- Send medical critical notes about the animals inside the clinic directly to the Manager (veterinarian).
- Send notes about the needs of animals inside the clinic directly to the Secretary (eg. shortage in Certain type of food, accessories, sand).

4.4.2.2 Secretary System Functions:

- User login functionality.
- Record and manage financial transactions related to clinic services and product sales.

- Add and manage notes for the Manager (veterinarian).
- Create and manage medical profiles for animals.
- View and update appointment schedules for the Manager (veterinarian).

4.4.2.3 Manager (veterinarian) System Functions:

- User login functionality
- View appointment schedules
- Access and respond to notes from Vet Assistants
- Access and respond to notes from Secretaries
- Manage user accounts and permissions
- Generate reports on clinic activities and performance
- Receive alerts for critical animal health issues

4.4.3 Operating Environments

You can access OptiVet from any kind of device. It's even compatible with Apple and Android devices. Also, you can get to OptiVet just by using a web browser. It doesn't matter if you're working in some kind of situation where you can't have a computer for a second. OptiVet just wants to be helpful, after all, and it definitely does its best to accommodate your less traditional and not-so-ideal working spaces.

4.4.4 Constraints

- Making sure OptiVet functions well on all the various devices.
- Keeping data secure and accurate.
- Training staff to use OptiVet effectively.
- Helping staff adjust to using OptiVet instead of old methods

4.4.5 Functional Requirements

User Requirement Number	Description
UR1	All users (Vet Assistants, Secretaries, Managers, and Customers) must be able to log in to the system using secure authentication.
UR2	Secretaries must have the ability to record sales transactions accurately within the system.
UR3	Managers (veterinarian) need access to appointment schedules and the ability to modify them as needed.
UR4	Vet Assistants should be able to view a list of animals and all the relevant information about them.
UR5	Secretaries must be able to create and manage medical profiles for pets, which includes updating and adding new information.

UR6	Managers (veterinarian) should have the capability to view and respond to notes from Vet Assistants.
UR7	Managers (veterinarian) should have the capability to view and respond to notes from Secretaries.
UR8	The system must provide timely reminders for appointments to both Secretaries and Managers (veterinarian).
UR9	Vet Assistants should have the ability to send critical notes directly to Managers (veterinarian) for urgent attention.
UR10	Managers (veterinarian) must be able to manage user accounts and permissions within the system.
UR11	Managers (veterinarian) should have the access to the information and the report for the evaluating the overall performance.
UR12	Vet assistant should work on the checklist and document the pet's healthcare status and any other necessary information to be updated.

Table 2: Functional Requirements

UR1: All users (Vet Assistants, Secretaries, Managers, and Customers) must be able to log in to the system using secure authentication.

SR1.1: Each user should have a unique username and password combination for accessing the system.

SR1.2: The system should authenticate user credentials securely to prevent unauthorized access.

SR1.3: Upon successful login, users should be directed to their respective dashboard or homepage within the system, according to their role and permissions.

SR1.4: System logs should record and inform about any unsuccessful attempts to login.

UR2: Secretaries must have the ability to record sales transactions accurately.

SR2.1: The system should provide a user-friendly interface for Secretaries to input sales transactions, with fields for item type (category), description, quantity, price, and payment method.

SR2.2: Secretaries should have the ability to change or reverse sales transactions, when they have good reason and with permission to track changes.

UR3: Managers (veterinarian) need access to appointment schedules and the ability to modify them as needed.

SR3.1: Managers should be able to view the current appointment schedule for the clinic.

SR3.2: Managers should have the capability to add new appointments to the schedule.

SR3.3: Managers should be able to have the capability to change the timing or to completely eliminate planned appointments if the situation so requires.

UR4: Vet Assistants should be able to view a list of animals and all the relevant information about them.

SR4.1: Vet Assistants should have access to a comprehensive list of all animals currently under the clinic's care, categorized based on pet medical status.

SR4.2: Vet Assistants need to be able to see a whole lot of information all about the patients they're taking care of. From the Patients screen, a Vet Assistant should be able to see (at a minimum) the following fields: Last Name, First Name, Species, Breed, Sex, Neutered/Spayed status, Date of Birth, medical history, and assigned pet owner.

UR5: Secretaries must be able to create and manage medical profiles for pets, which includes updating and adding new information.

SR5.1: Secretaries should have the capability to create new medical profiles for animals entering the clinic for the first time.

SR5.2: Secretaries should be able to update existing medical profiles with new information provided by Vet Assistants or Managers (veterinarian).

SR5.3: The secretary should ensure the profiles of the pet's healthcare statuses and validate the entered.

UR6: Managers (veterinarian) should have the capability to view and respond to notes from Vet Assistants.

SR6.1: Managers should receive notifications for any new notes or messages from Vet Assistants within the system.

SR6.2: Managers should be able to access a centralized dashboard or inbox where they can view all incoming notes and messages from Vet Assistants.

UR7: Managers (veterinarian) should have the capability to view and respond to notes from Secretaries.

SR7.1: Managers should receive notifications for any new notes from Secretaries within the system.

SR7.2: Managers should be able to access a centralized dashboard or inbox where they can view all incoming notes and messages from Secretaries within the system.

UR8: The system must provide timely reminders for appointments to both Secretaries and Managers (veterinarian).

SR8.1: Secretaries should receive notifications for upcoming appointments, allowing them to prepare necessary paperwork or materials.

SR8.2: Managers (veterinarian) should receive reminders for appointments they are scheduled to prepare for and conduct the appointments.

UR9: Vet Assistants should have the ability to send critical notes directly to Managers (veterinarian) for urgent attention.

SR9.1: Vet Assistants should have access to a designated feature or channel within the system for sending urgent notes to Managers.

SR9.2: Critical notes sent by Vet Assistants should trigger immediate notifications to Managers, alerting them to the urgent issue.

UR10: Managers (veterinarian) must be able to manage user accounts and permissions within the system.

SR10.1: Managers (veterinarian) should have administrative privileges to create new user accounts for clinic staff members.

SR10.2: Managers (veterinarian) should have the capability of assigning unique roles and permissions to individual user accounts. They should be able to control access and security in a system.

UR11: Managers (veterinarian) should have the access to the information and the report for the evaluating the overall performance.

SR11.1: Managers should be able to generate various types of reports, such as appointment statistics, and sales trends.

SR11.2: Managers should have the ability to personalize reports. they should be able to choose which parameters and filters by which to organize the data in a report.

UR12: Vet assistant should work on the checklist and document the pet's healthcare status and any other necessary information to be updated.

SR12.1: The system should provide a daily checklist template for Vet Assistants to fill out for each animal, including fields for health status, feeding, grooming, and other observations.

SR12.2: Vet Assistants should be able to send in the completed daily checklist in a secure manner, with the information being stored safely in the animal's medical profile.

4.4.6 Non-Functional Requirements

Security Requirements:

- User data must be encrypted both in transit and at any point it is stored.
- The system should oblige strong rules for password creation, with some level of complexity and expiration.

Usability Requirements:

- The user interface should be designed so that any sort of user can easily navigate its features.
- The comprehensive help section (and any possible user guides) must be easily accessible from within the application itself.

Reliability Requirements:

- Depending on the nature of the business, 99.2% is the expected range during business hours.
- In case of failure, backups should be enough to restore data.

Maintainability Requirements:

- The system must be easy to be updated, that it should be maintainable and updatable for a lower cost.
- The architecture of the system must be well documented as to make it easy for anyone who wants to use the system.

4.5 Functional Decomposition

4.5.1 Actors

We will explain each actor, its description, and the operations that this actor is allowed to perform and display the Use case diagram.

Actor	Summary
Manager (veterinarian)	This actor represents the person that is in charge of the clinic and/or owns the clinic and is the veterinarian
Vet Assistant	This actor represents the person that is required to do the grooming and daily check on pets
Secretory	This actor represents the person that is responsible for making appointments for the veterinarian and is responsible for making sales transactions

Table 3: Use cases Actors

4.5.2 Use Cases

Here is the Use Cases from OptiVet and their respective Summary

Name	Summary
Login	All actors can access the system using unique credentials
View Animals	Vet Assistants can see a list of animals and their respective details.
Complete Daily Checklists	Vet Assistants can fill out and submit daily checklists documenting each animal's health status and any necessary observations
Send Critical Notes	Vet Assistants & Secretory can send urgent notes directly to the Manager (veterinarian) for immediate attention.
Record Sales	Secretaries can enter all the necessary information about a sale into the system. This includes the description of the item sold, the number of items, the price, and the payment method.
Manage Medical Profiles	Secretaries can create medical profiles and update them. They need to make sure that all the information contained within is accurate and complete.
Manage Appointments	Secretaries can schedule, set up, and modify appointments for the Manager (veterinarian).

Table 4: Use Cases

4.5.3 Use Cases Diagram

The use case diagram describes how the users interact with the system, it mostly shows and explains how the system functionalities work.

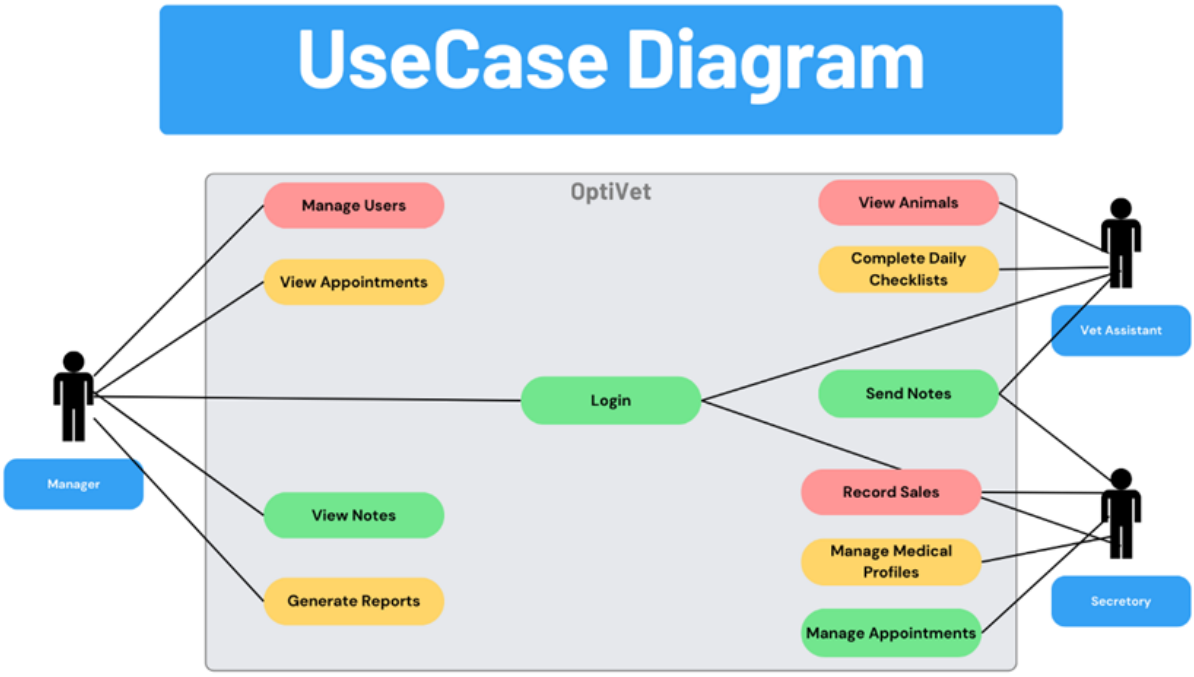

Figure 10: Use case Diagram

4.6: System Models

Describing the flow behavior of the system models and how they are integrated with each other.

4.6.1: Class Diagram

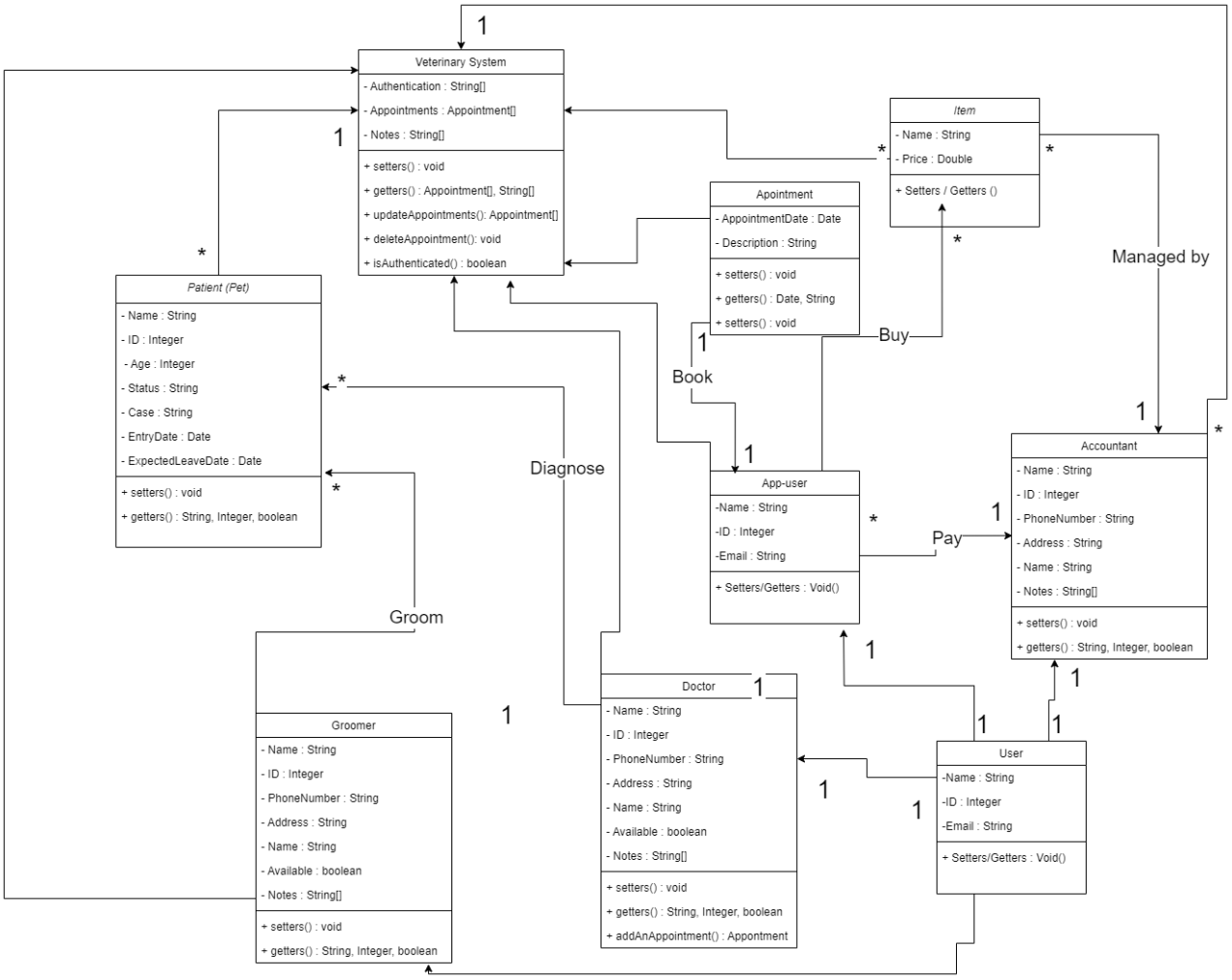

Figure 11: Class Diagram

4.6.2: Sequence Diagrams

4.6.2.1: User-view Sequence Diagram

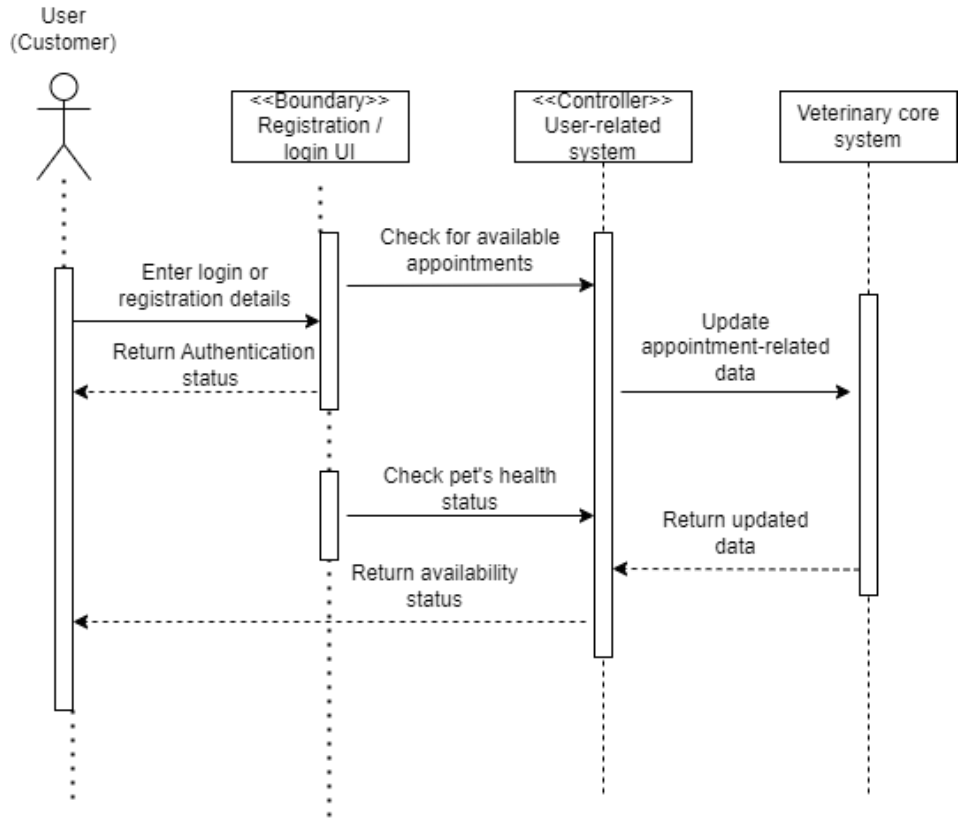

Figure 12: User-related Sequence Diagram

4.6.2.2: Veterinary-view Sequence Diagram

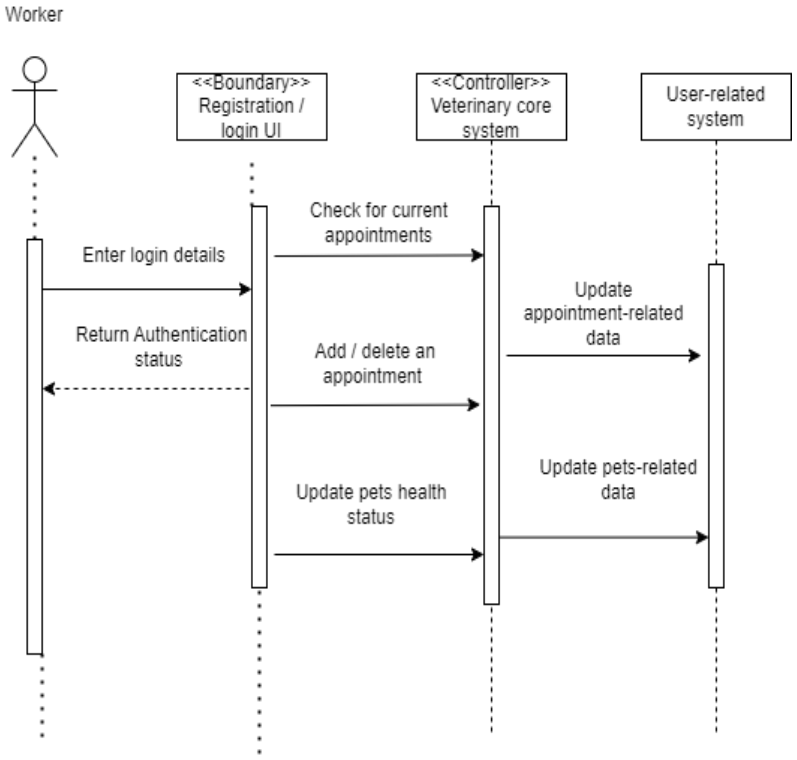

Figure 13: Veterinary-related Sequence Diagram

4.6.3: Activity Diagram

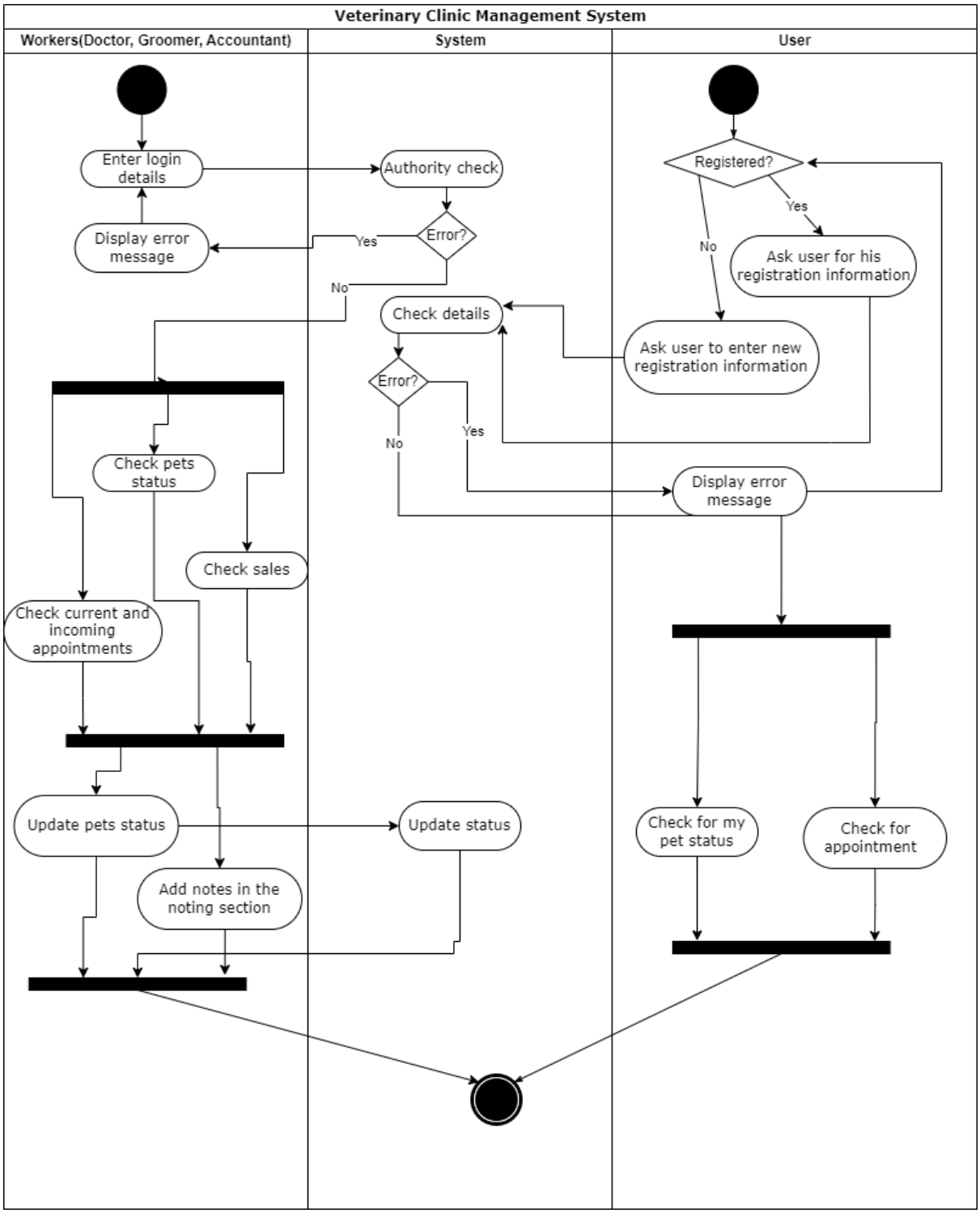

Figure 14: Activity Diagram

4.6.4 State Diagram

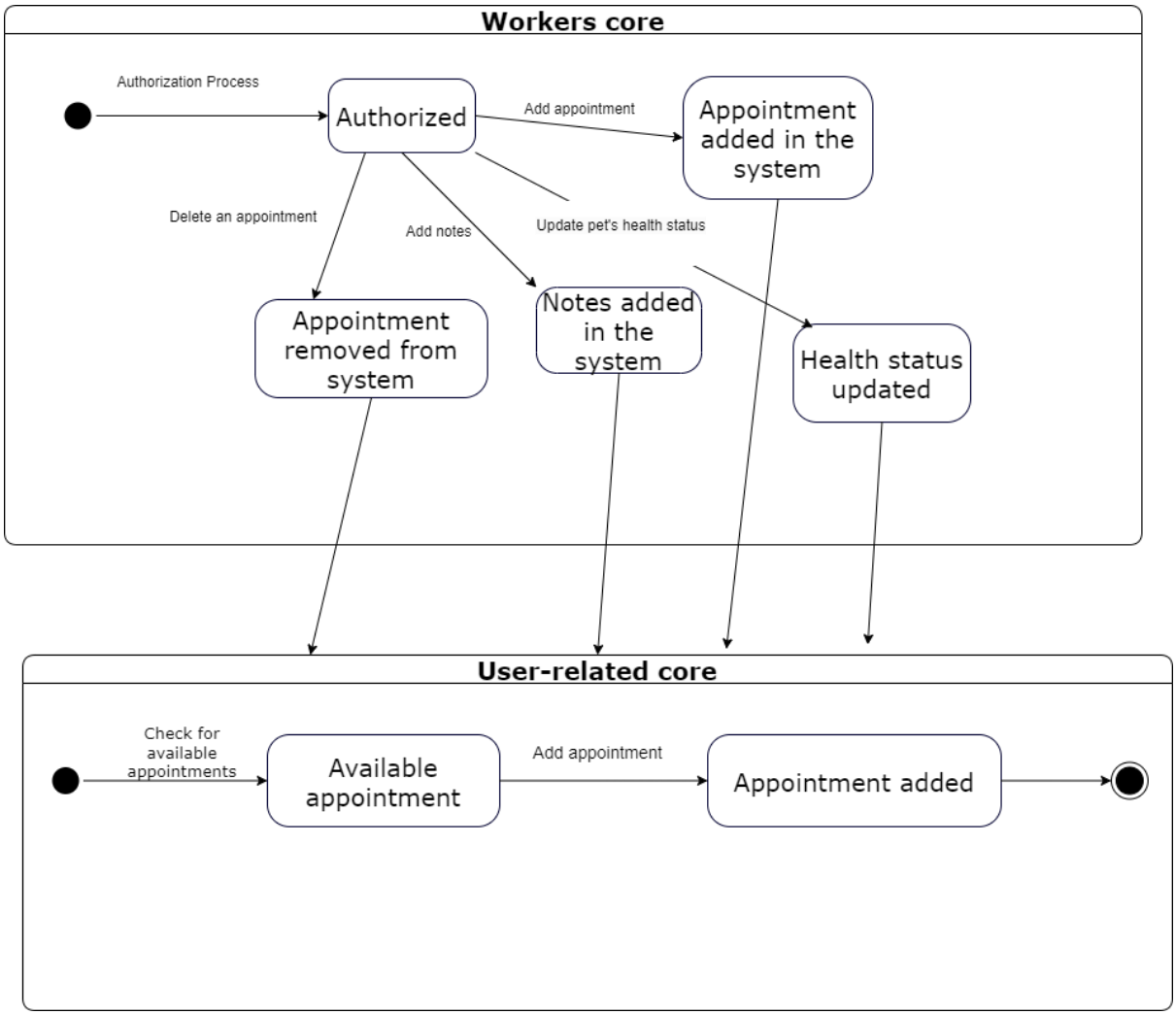

Figure 15: State Diagram

Chapter 5: System Design

5.1 System Architecture

5.1.1 Sub-System

Sub-System	Description
Vet Assistant	This sub-system controls the processes related to the groomer (Vet Assistant), it lets him have a view of the pet's information and the doctor's notes and allows him to send messages for the doctor and the accountant.
Secretary	This subsystem manages secretarial activities, allowing them to keep track of sales transactions, organize appointments, maintain pet medical profiles, and administer user accounts.
Manager (veterinarian)	This subsystem is in charge of the functions related to Managers (veterinarians), such as looking at appointment calendars, going over and replying to staff notes, creating reports, and handling user accounts.

Table 5: Sub-System

5.1.2 Software Architecture

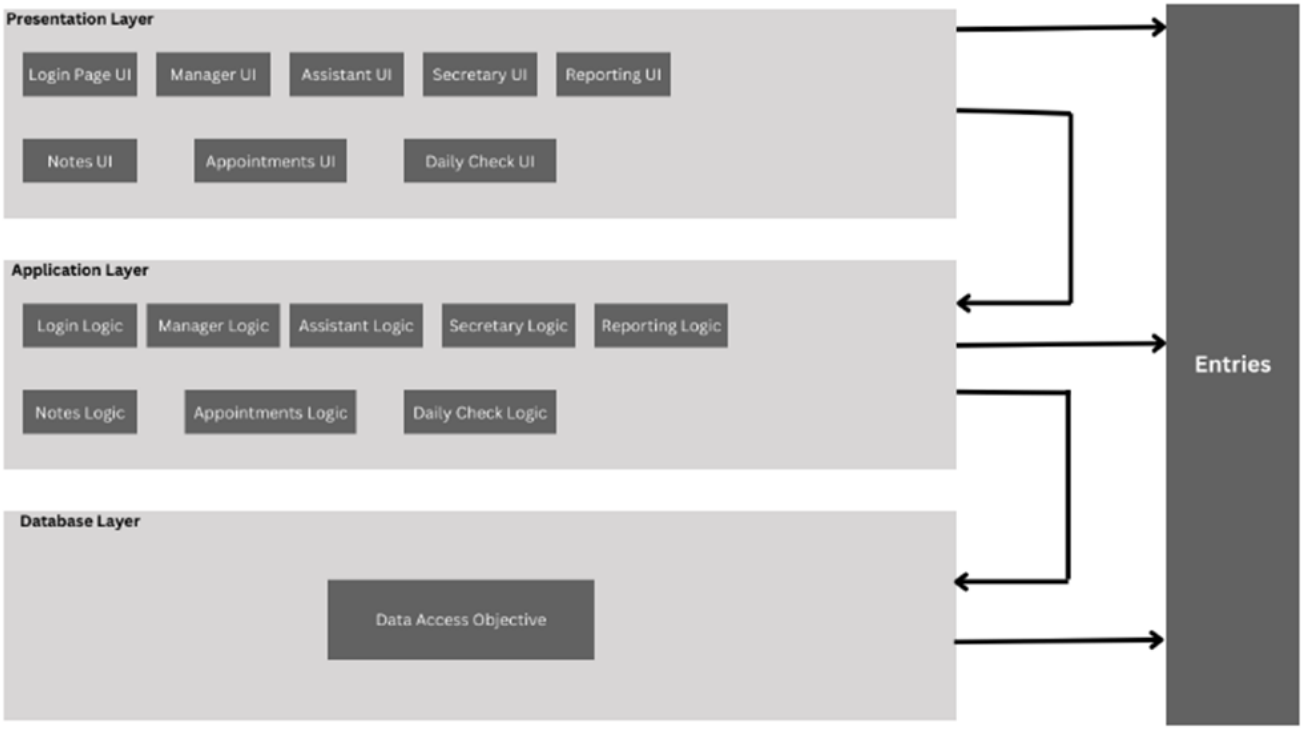

Figure 16: Software Architecture

5.1.3 Deployment Diagram

The diagram shows how the client and server interact. It explains the types of components (like databases and execution environments) that the developers of any client/server system must have in mind when they create an architecture.

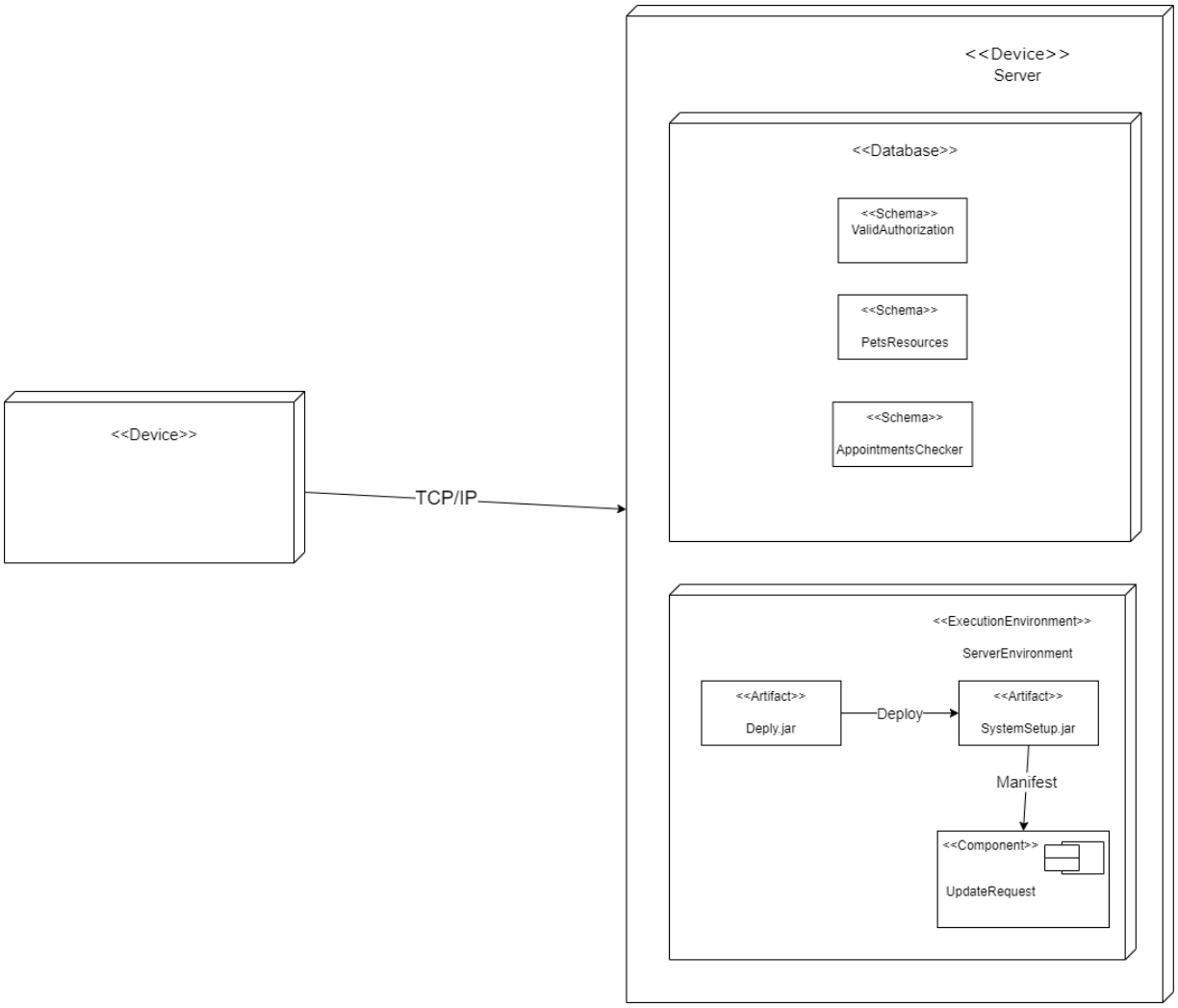

Figure 17: Deployment Diagram

5.2 System Design Analysis

In this part, we collect our points from the first and the second focus groups to determine how the UI is going to be like. As in this process we also make the domain get involved with us for specifying how the application should start and end.

As we firstly provide the domain with the outcomes of the previous sessions, we had together to get their first vision on how the UI should be like and how the user can go through the application with fulfilling both of their sides. After we get their vision, now it is our role to ask them if they think that this design could get any better by letting us deciding a new prototype design. It's like a cycle where we keep updating the design depending on what the domain feels like on how things should work in the veterinary clinic. Also, we should take into consideration our feedbacks on their designing suggestions, so to keep our work with a clear methodology that meets the right system requirements.

5.3: System Design Focus Group's Diagram (Workflow)

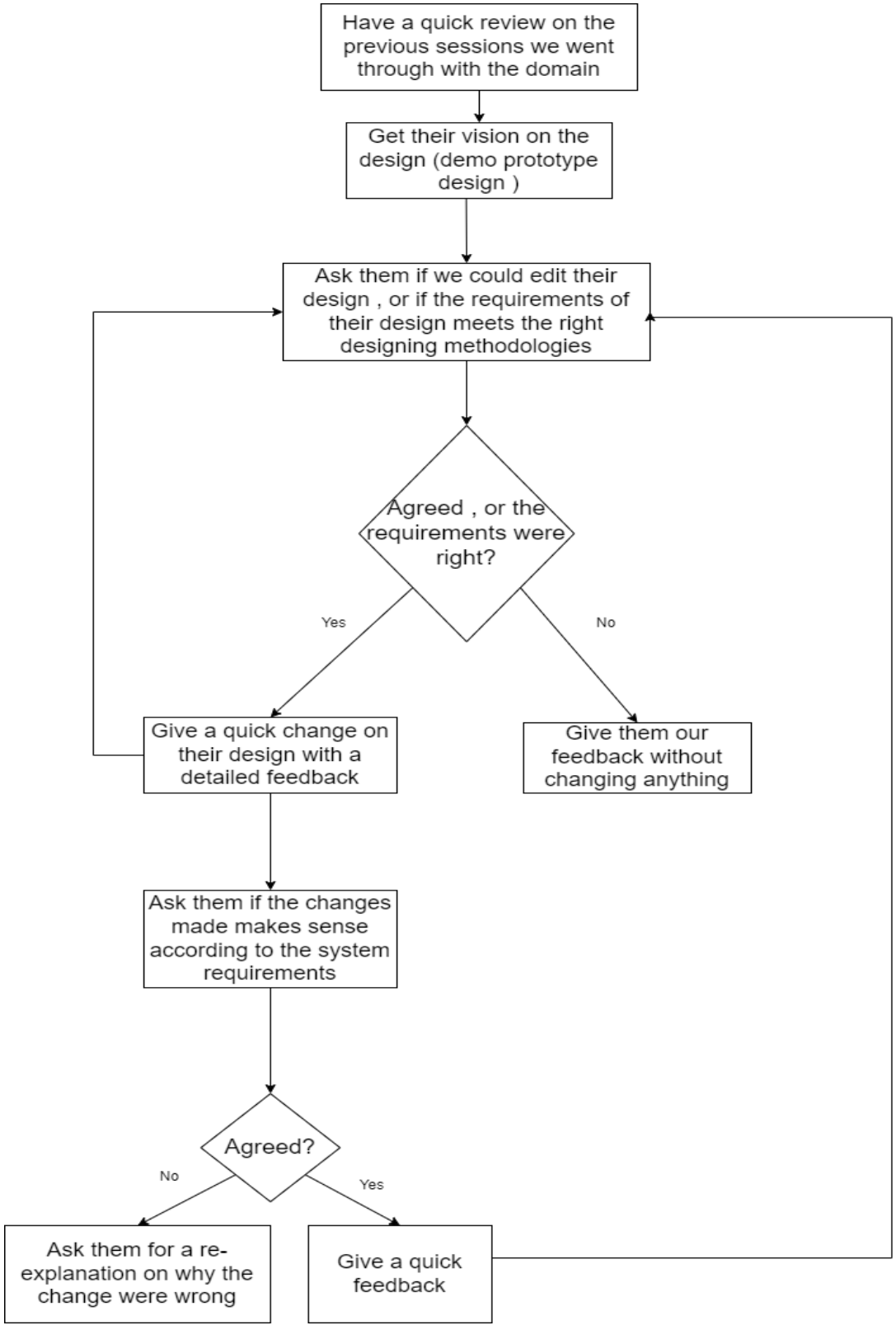

Figure 18: Second Focus Group's Diagram (design)

5.4 Prototypes

In this section, we showcase the prototypes that were created using the iterative feedback loop from our subject matter experts and focus groups. The prototypes demonstrate how the user interface design is developing, integrating recommendations and enhancements to guarantee the program fulfills the real-world requirements and anticipations of veterinary practitioners.

5.4.1 Vet Assistant Prototypes

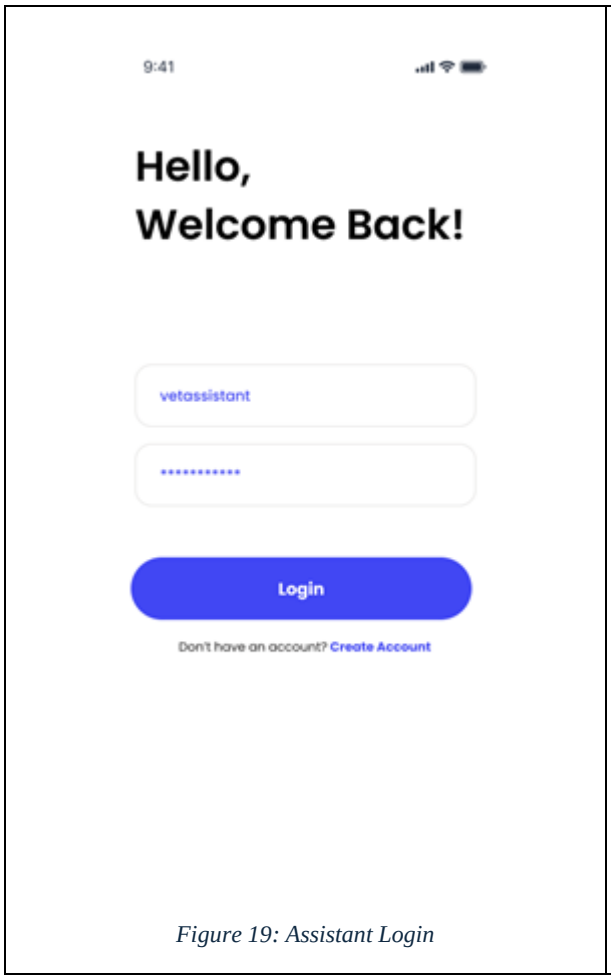

Figure 19: Assistant Login

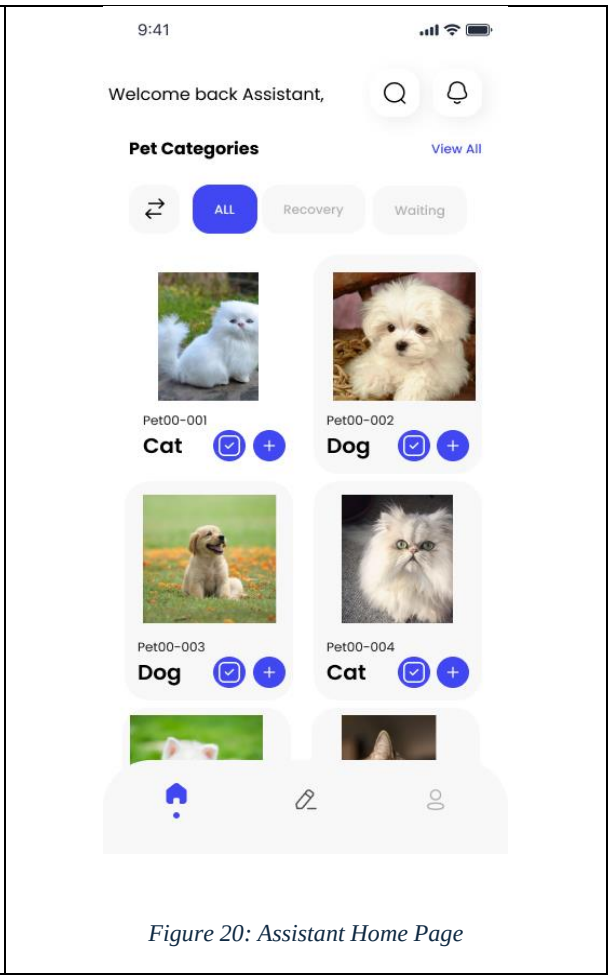

Figure 20: Assistant Home Page

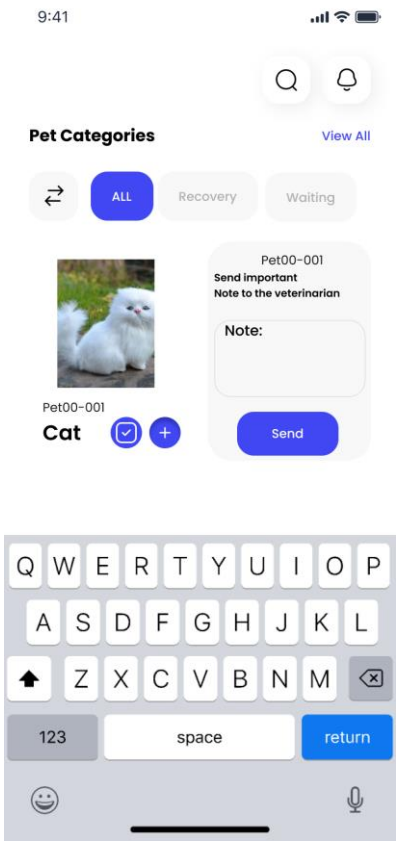

Figure 21: Assistant send important Notes to the vet

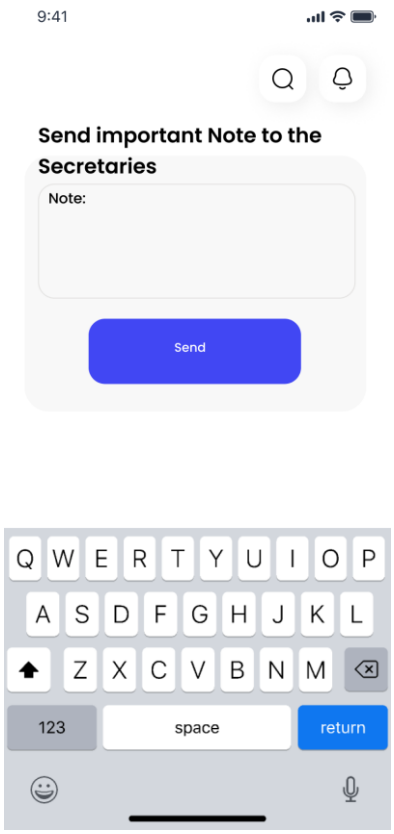

Figure 22: Assistant send important Notes to the Secretaries

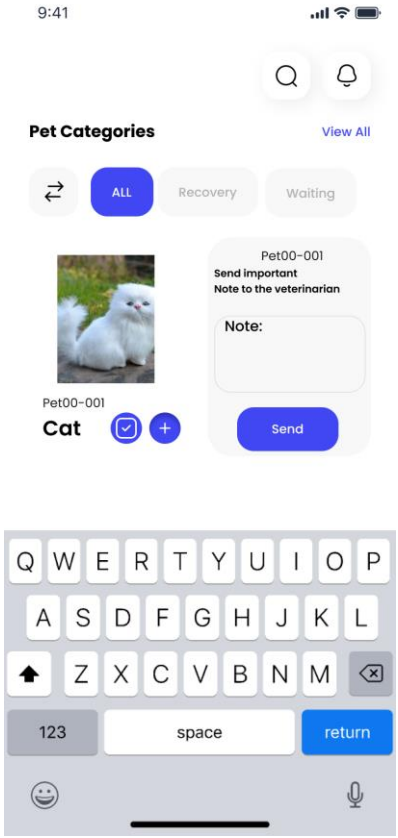

Figure 23: Assistant send important Notes to the vet

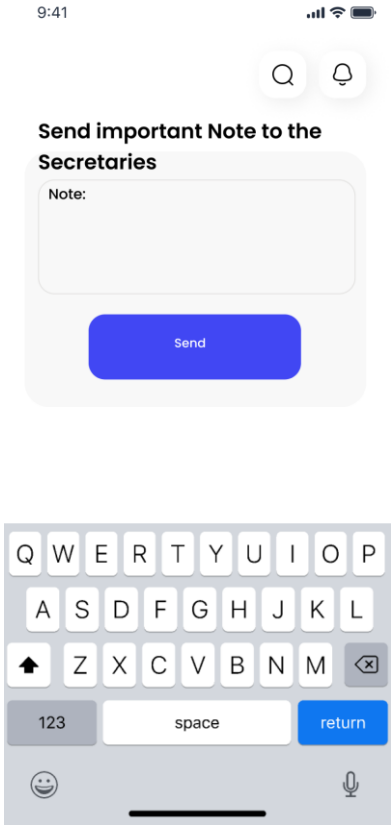

Figure 24: Assistant send important Notes to the Secretaries

5.4.2 Vet Prototypes

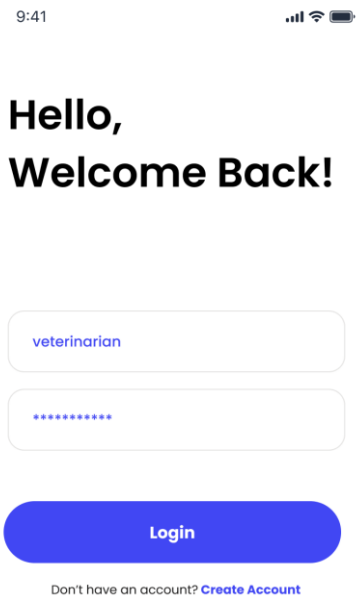

Figure 25: Vet Login

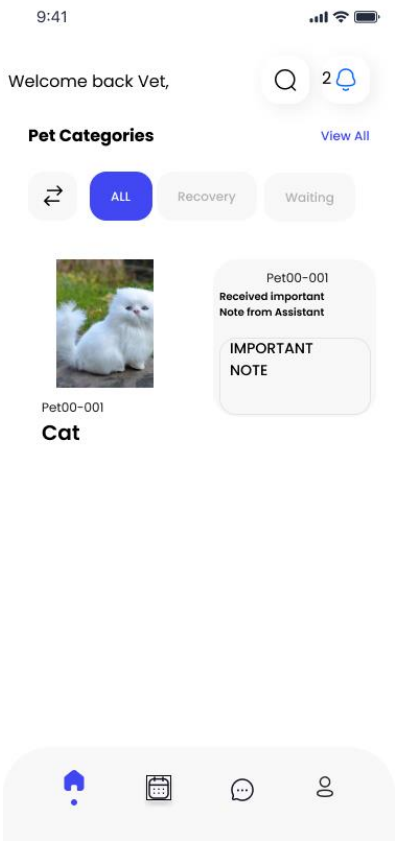

Figure 26: Vet Home Page

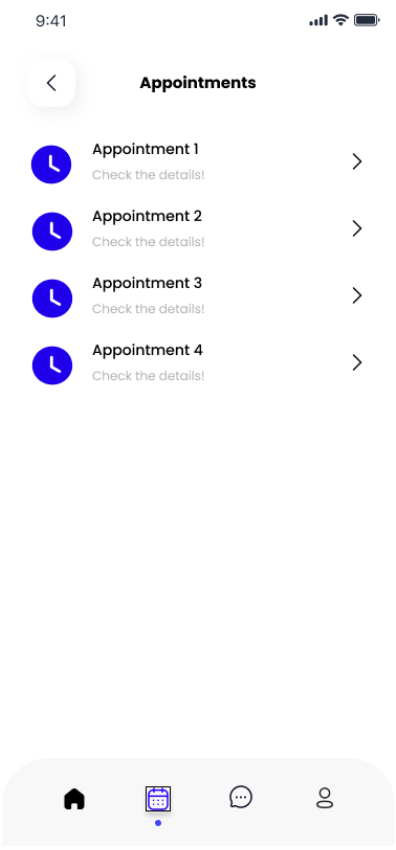

Figure 27: View Appointments

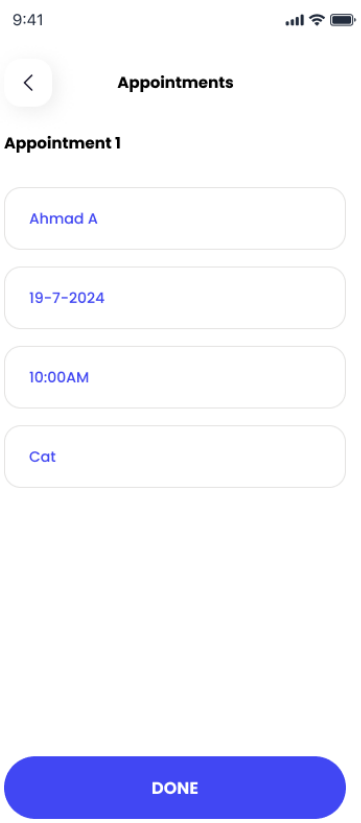

Figure 28: View Specific Appointment

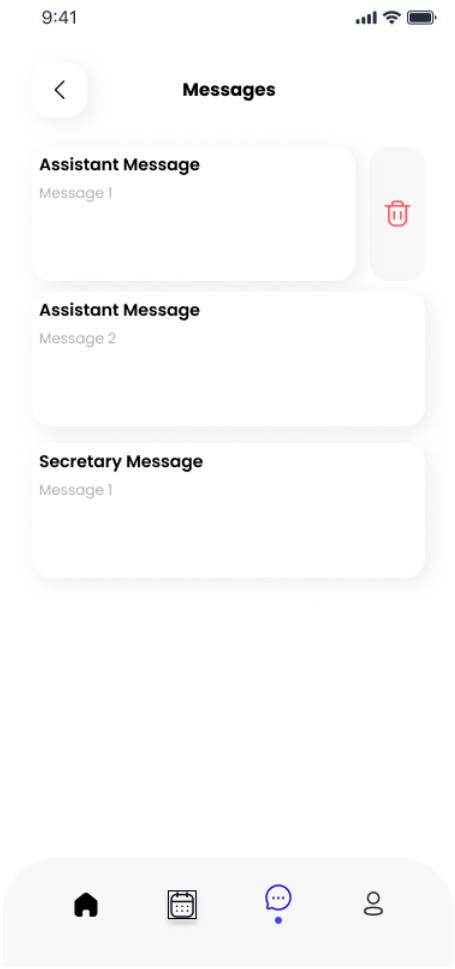

Figure 29: Vet's Messages

5.4.3 Secretaries Prototypes

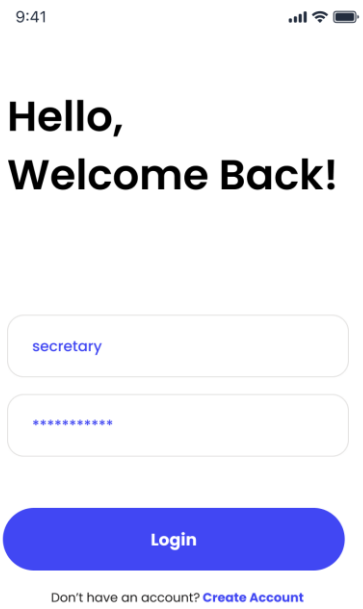

Figure 30: Secretaries Login

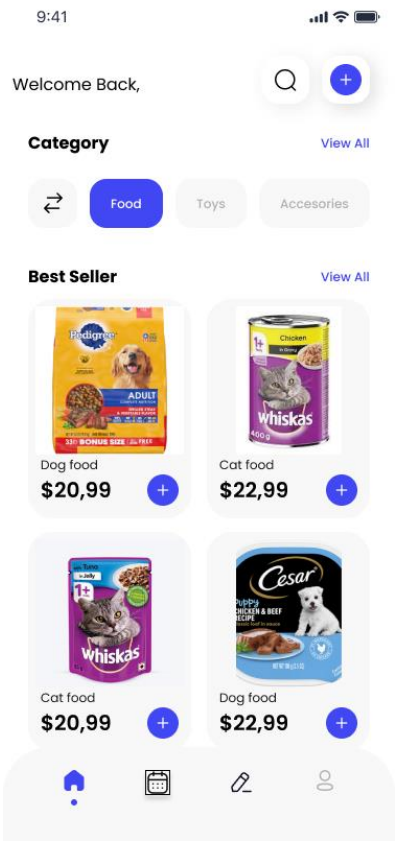

Figure 31: Secretaries Home Page

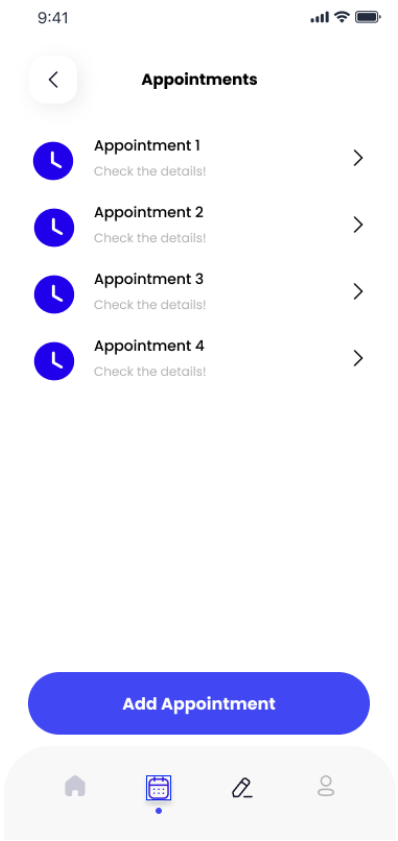

Figure 32: Secretaries View Appointments

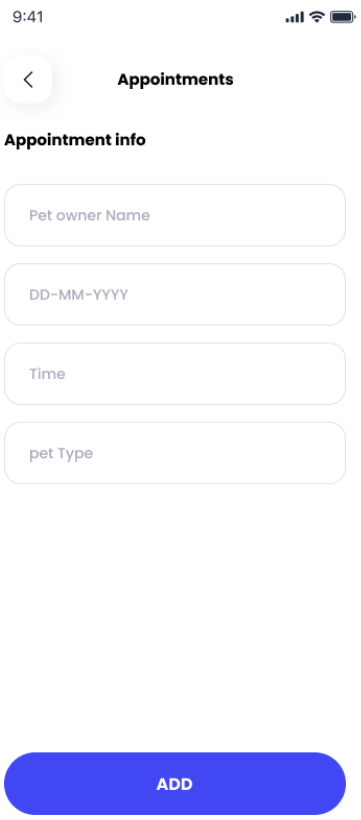

Figure 33: Secretaries Add Appointments

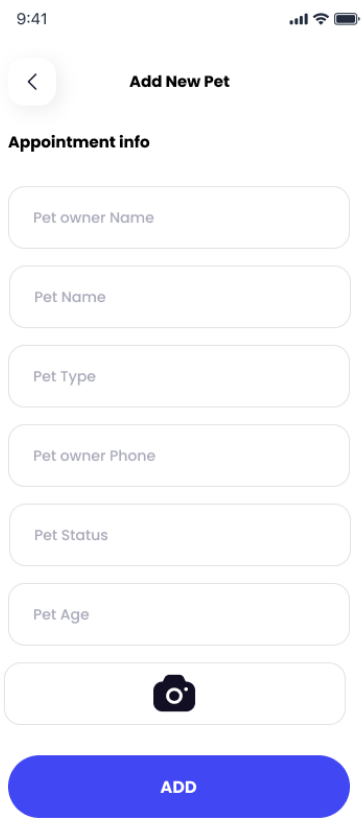

Figure 34: Secretaries add New Pets

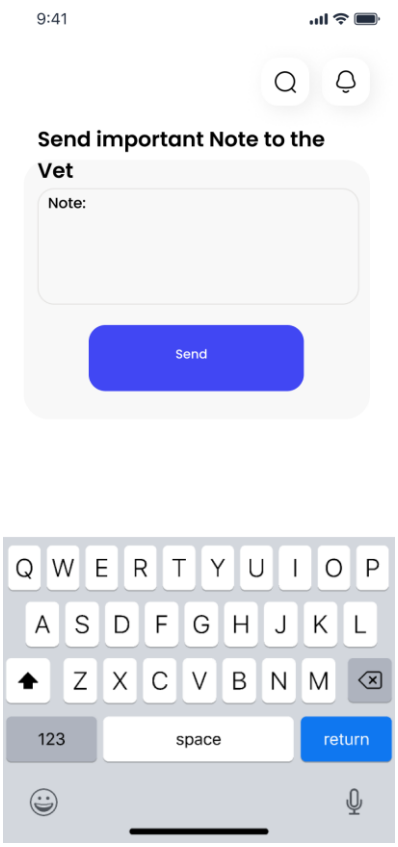

Figure 35: Secretaries send Notes to Vet

Chapter 6: Conclusion

When considering how important is to use such modern approaches like UCD, the first thing that comes to our mind is how we reached this kind of approach and how we can use it in real-world problems. In the software system world, we always consider how the system could be built without having to make so many changes to it after applying it to the customers, we know providing such an efficient design is something that requires a lot of effort, especially when it comes to systems that invoke several parties in it.

As an overall view, when talking about UCD we mean that the people we are working for should be in the middle of each process we make, and this approach is to ensure that the requirements and the designs we built are efficient enough to fulfill their needs. When developers or designers invoke such users, they don't just invest a lot of effort in using the resources in a proper way to find good solutions related to the system design, but it ensures each stage of the design. Also providing an efficient approach reduces the costs for committing any changes in the design for the long term [31].

UCD is considered to be a modern design solution for solving several problems related to the system itself which means that we work on each use-case scenario to manage the problems related to each of them. As UCD considers the whole user experience, going through this type of approach demands a good understanding of how systems work and how each part of the system integrates with the others. The project is based on an explicit understanding of the environment the users and their tasks, as these understandings differs from one system to another [31].

In our use-case, we considered our domain as a main part of the designing process, as we had the doctor, the groomer, and the accountant. Each of the roles provided has a scenario related to it, but they also have some things in common related to the interface part. The customers also have a use-case scenario related to them as they have a specific interface and there are specific private resources that are available only for the employees, not the customers.

We also considered how each element in the system will integrate properly with other elements, as this is a main part of using UCD that we should be careful on how elements will be invoked in the system design properly so we can go through the user experience with better feedback on each demo we come out with.

Lastly, we are grateful for having such an approach like UCD to be used for easily providing the users and the customers with an efficient app experience. This approach will help us to overcome such software design-related problems and to stand out from the rest in the incoming competitive job market.

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